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Potential Growth and Structural Unemployment in Spain, EMU and the US

Rafael Doménech
Chief Economist for Developed Economies

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Motivation

Whenever unemployment stays high for an extended period, it is common to see analyses, statements, and rebuttals about the extent to which the high unemployment is structural, not cyclical.

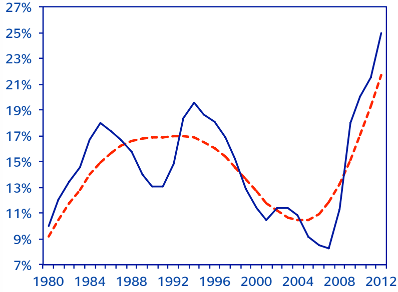
Peter Diamond, 2013

Motivation

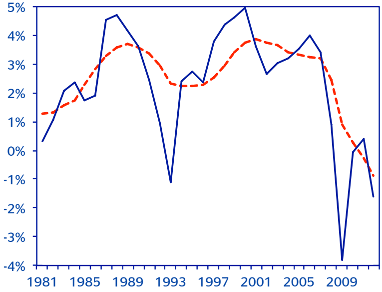
- Many estimates of structural unemployment are very procyclical
- In most cases, these procyclicality of structural unemployment is the main cause of the procyclicality of potential growth
- On this respect, the evidence for the Spanish structural unemployment rate estimated by European Commission is a clear example
- This procyclicality affects the estimation of important gaps in policy making as, for example, the cyclical component of budget balance

Motivation

Unemployment rate and its structural component, Spain 1980-2012
Source: European Commission

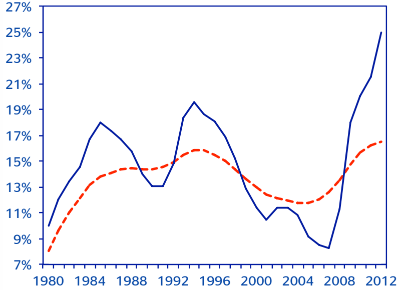


Growth of GDP and potential growth, Spain 1981-2012
Source: European Commission



Motivation

Unemployment rate and its structural component, Spain 1980-2012
Source: OECD



OECD estimate also procyclical, but less than in the case of the EC

NAIRU increase: 4.7pp (OECD) vs 11.2 (EC)

Debate about the interactions between shocks and institutions

A useful decomposition of GDP

- GDP can be decomposed in terms of the working-age population, L_t^{15-64}:

$$GDP_t = \frac{GDP_t}{L_t^{15-64}} L_t^{15-64}$$

or, in growth of rates

$$\Delta \ln GDP_t = \Delta \ln \left(\frac{GDP_t}{L_t^{15-64}} \right) + \Delta \ln L_t^{15-64}$$

- Additionally, GDP per working-age population can be decomposed as

$$\frac{GDP_t}{L_t^{15-64}} = \frac{GDP_t}{H_t} \frac{H_t}{L_t^d} (1 - u_t) \frac{L_t^s}{L_t^{15-64}}$$

where H is the total numbers of hours worked, L^d is total employment and L^s is labour supply.

A useful decomposition of GDP

- The decomposition of GDP per hour using the production function approach implies usually the specification of a Cobb-Douglas production function such as

$$\ln \frac{GDP_t}{H_t} = \ln A_t + \alpha \ln \left(\frac{K_t}{H_t} \right)$$

where capital is, in some cases, corrected by capacity utilization.

A useful decomposition of GDP

- Here, we use an alternative approach decomposing the log of GDP (gdp) in terms of the trend and cyclical components of the log of GDP per working-age population ($y \equiv \ln(GDP/L^{15-64})$) and of the latter variable ($l = \ln L^{15-64}$). Since
$$gdp_t \equiv y_t + l_t$$
then
$$gdp_t = \overline{gdp}_t + gdp_t^c = \bar{y}_t + \bar{l}_t + y_t^c + l_t^c$$
where, as usual, the bar over the variables represents the trend components and the superscript c denotes the cyclical component.
- The variable that we use to identify the cycle is the unemployment rate.
- Two reasons for the choice of this variable:
  - The economic relevance of the unemployment rate
  - Its correlation with other components in the decomposition of GDP (capacity utilization, activity rate, growth of working-age population, etc.)

The Okun's law

- Our identification scheme is based on the Okun's law (e.g., Ball et al., 2013) and its usefullness to identify the trend component of GDP and the unemployment rate (e.g., Doménech and Gómez, 2006):

$$u_t - \overline{u}_t = \beta \left(gdp_t - \overline{gdp}_t \right) + \varepsilon_t$$

- An alternative to the preceding equation is to use GDP per working age population (y) instead of GDP:

$$u_t - \overline{u}_t = \beta \left(y_t - \overline{y}_t \right) + \varepsilon_t$$

The Okun's law

- In both specifications, the problem is that the trend components of u, gdp, and y are not observed.
- The usual approach is to estimate these trend components using the Hodrick-Prescott filter.
- With annual data, most researchers have used a smoothing parameter between 100 (e.g., Backus and Kehoe, 1992) and 400 (e.g., Correia, Neves and Rebelo, 1992, or Cooley and Ohanian, 1991).
- These values are above 6.25, which corresponds to the standard value of 1600 used with quarterly data (Ravn and Uhligh, 2002).

Preliminary evidence

$$u_t - \overline{u}_t = \beta \left(y_t - \overline{y}_t \right) + \varepsilon_t$$

Estimates of the Okun's Law, 1980-2012

		GDP			*y*		
		(1)	(2)	(3)	(4)	(5)	(6)
USA	β	-0.52 (12.8)	-0.51 (13.6)	-0.48 (11.4)	-0.53 (12.4)	-0.51 (12.6)	-0.50 (11.9)
	R^2	0.84	0.85	0.80	0.83	0.83	0.81
	DW	1.61	0.91	0.53	1.54	0.81	0.58
EMU	β	-0.41 (10.9)	-0.48 (14.5)	-0.48 (16.6)	-0.49 (11.1)	-0.45 (13.5)	-0.41 (13.4)
	R^2	0.79	0.87	0.90	0.79	0.85	0.85
	DW	1.24	1.05	0.98	1.22	0.83	0.58
Spain	β	-0.98 (11.9)	-0.96 (15.1)	-0.91 (13.6)	-0.97 (11.1)	-1.07 (17.3)	-1.07 (20.2)
	R^2	0.82	0.88	0.85	0.79	0.90	0.93
	DW	1.59	0.63	0.35	1.63	1.05	0.89
λ		6.25	100	400	6.25	100	400

λ is the smoothing parameter of the HP filter

Preliminary evidence

- Similar values of β for the USA and EMU, clearly higher (in absolute terms) for Spain
- The estimated values of β are very statistically significant and robust to changes in λ
- High R^2
- High autocorrelation of residuals (low DW), particularly for high values of λ
- Similar results for GDP and GDP per working-age population

An unobserved component model

- We asumme that GDP per working-age population can be decomposed as:

$$y_t \equiv \bar{y}_t + y_t^c$$

$$\begin{aligned} \bar{y}_t &= \gamma_{yt} + \bar{y}_{t-1} \\ \gamma_{yt} &= \gamma_{yt-1} + \omega_{\gamma t}, \end{aligned}$$

where $\omega_{\gamma t}$ is i.i.d.

- Therefore, we assume stochastic growth for the trend component, that is, that trend GDP is $I(2)$

An unobserved component model

- In the same vein, the unemployment rate can be decomposed as:

$$u_t \equiv \overline{u}_t + u_t^c$$

$$\overline{u}_t = \overline{u}_{t-1} + \omega_{ut}$$

where ω_{ut} is i.i.d.

- Therefore, we assume that the unobserved component of the unemployment rate is $I(1)$
- Additionally:

$$u_t - \overline{u}_t - \rho\overline{u}_{t-1} = \beta\left(y_t - \overline{y}_t\right) - \rho\beta\left(y_{t-1} - \overline{y}_{t-1}\right) + \varepsilon_t$$

- Previous equation is a more general case (allowing for autocorrelation), which collapses to the standard specification when $\rho = 0$

An unobserved component model

- We can write all previous equations in state-space form:

$$\begin{bmatrix} \bar{y}_t \\ \bar{y}_{t-1} \\ \bar{u}_t \\ \bar{u}_{t-1} \end{bmatrix} = \begin{bmatrix} 2 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} \bar{y}_{t-1} \\ \bar{y}_{t-2} \\ \bar{u}_{t-1} \\ \bar{u}_{t-2} \end{bmatrix} + \begin{bmatrix} \omega_{yt} \\ 0 \\ \omega_{ut} \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} y_t \\ u_t \\ u_t - \beta y_t - \rho(u_{t-1} - \beta y_{t-1}) \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -\beta & \rho\beta & 1 & -\rho \end{bmatrix} \begin{bmatrix} \bar{y}_t \\ \bar{y}_{t-1} \\ \bar{u}_t \\ \bar{u}_{t-1} \end{bmatrix} + \begin{bmatrix} y_t^c \\ u_t^c \\ v_{ut} \end{bmatrix}$$

where

$$\sigma^2_{y^c} = \lambda\sigma^2_{\omega_y}, \qquad \sigma^2_{u^c} = \lambda\sigma^2_{\omega_u} = \mu\lambda\sigma^2_{\omega_y}, \qquad \sigma^2_{v_u} = \gamma\lambda\sigma^2_{\omega_y}$$

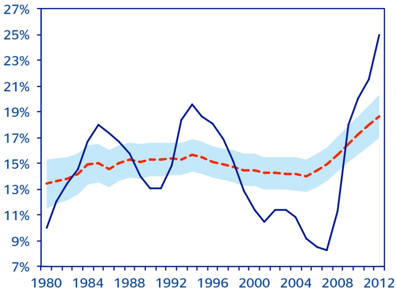
Results

Parameters estimates, 1980-2012

	γ	μ	σ_{ω_y}	λ	β	ρ
USA	2.49 (3.17)	0.56 (4.05)	0.002 (13.9)	61.6 (4.91)	−0.50 (11.3)	0.82 (8.18)
EMU	1.19 (2.57)	0.36 (4.05)	0.002 (13.9)	67.6 (4.93)	−0.41 (11.0)	0.81 (10.3)
Spain	4.09 (2.21)	1.94 (4.07)	0.003 (13.9)	65.3 (4.49)	−1.10 (11.0)	0.81 (6.61)

Results

Unemployment rate and its structural component, Spain 1980-2012
Source: BBVA Research



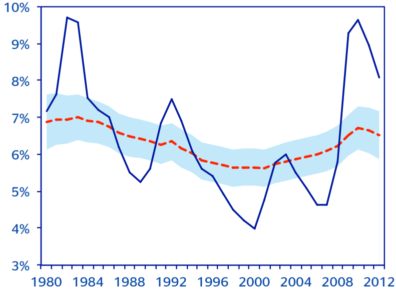
Structural unemployment rate relatively stable from 1980

Consistent with the absence of structural reforms in the labour market

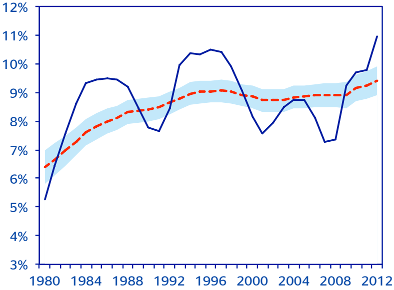
Structural unemployment has increased 4 pp during the latest crisis

Results

Unemployment rate and its structural component, USA 1980-2012
Source: BBVA Research

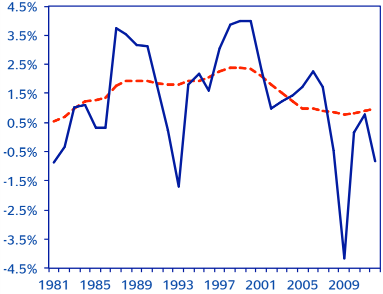


Unemployment rate and its structural component, EMU 1980-2012
Source: BBVA Research



Results

Growth of GDP per working-age population, Spain 1981-2012
Source: BBVA Research



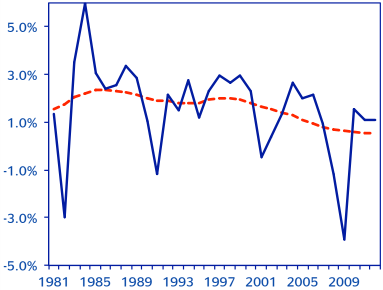
Significant reduction of GDP per wap growth in the years of the housing and financial bubbles

Potential growth similar to the crisis in the second half of the 70s and first 80s ...

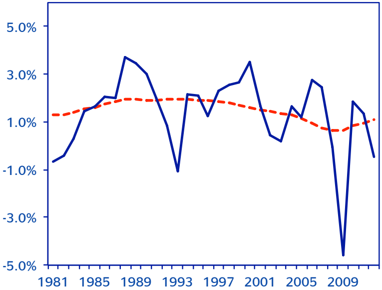
... but not negative: close to 1% and very similar to the potential growth observed in the USA and EMU

Results

Growth of GDP per working-age population, USA 1981-2012
Source: BBVA Research

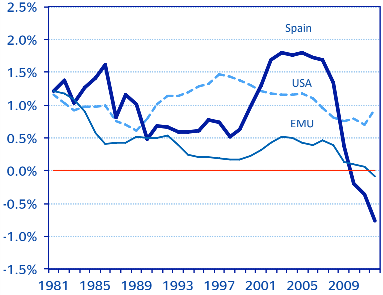


Growth of GDP per working-age population, EMU 1980-2012
Source: BBVA Research



Results

Growth of working-age population, Spain, EMU and USA 1981-2012
Source: BBVA Research



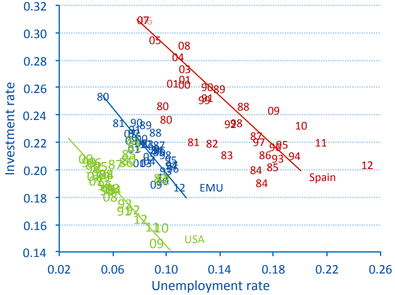
USA: stable growth of WAP around 1%

EMU: slightly negative trend, growth around 0.3%

Spain: (1) very volatile growth, (2) immigration, and (3) negative growth since 2010

Extension I: investment and unemployment rates

Investment and unemployment rates, Spain, EMU and USA 1981-2012
Source: BBVA Research



Significant and relatively stable negative correlation (-0.79)%

USA: stable correlation since mid 80s

Spain: stable correlation since 1985, with a shift of 4 pp in the unemployment rate since 2009.

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Extension I: investment and unemployment rates

- We extend the UCM with a new state for the investment rate:

$$\begin{bmatrix} \overline{y}_t \\ \overline{y}_{t-1} \\ \overline{u}_t \\ \overline{u}_{t-1} \\ \overline{ir}_t \\ \overline{ir}_{t-1} \end{bmatrix} = \begin{bmatrix} 2 & -1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} \overline{y}_{t-1} \\ \overline{y}_{t-2} \\ \overline{u}_{t-1} \\ \overline{u}_{t-2} \\ \overline{ir}_{t-1} \\ \overline{ir}_{t-2} \end{bmatrix} + \begin{bmatrix} \omega_{yt} \\ 0 \\ \omega_{ut} \\ 0 \\ \omega_{irt} \\ 0 \end{bmatrix}$$

Extension I: investment and unemployment rates

- We also change the UCM with a new measurement equation:

$$\begin{bmatrix} y_t \\ u_t \\ ir_t \\ u_t - \beta_u y_t - \rho_u(u_{t-1} - \beta_u y_{t-1}) \\ u_t - \beta_{ir} ir_t - \rho_{ir}(u_{t-1} - \beta_{ir} ir_{t-1}) \end{bmatrix} = A \begin{bmatrix} \bar{y}_t \\ \bar{y}_{t-1} \\ \bar{u}_t \\ \bar{u}_{t-1} \\ \bar{ir}_t \\ \bar{ir}_{t-1} \end{bmatrix} + \begin{bmatrix} y_t^c \\ u_t^c \\ ir_t^c \\ v_{ut} \\ v_{irt} \end{bmatrix}$$

where

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ -\beta_y & \rho_y \beta_y & 1 & -\rho_y & 0 & 0 \\ 0 & 0 & 1 & -\rho_{ir} & -\beta_{ir} & \rho_{ir}\beta_i r \end{bmatrix}$$

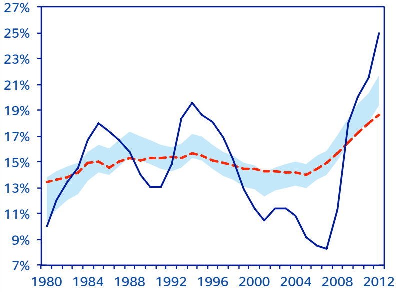
Extension I: results

Parameters estimates, 1980-2012

	γ_y	μ_y	σ_{ω_y}	λ	β_y	ρ_y	γ_{ir}	μ_{ir}	β_{ir}	ρ_{ir}
USA	1.87	0.67	0.002	54.6	−0.49	0.79	3.35	0.63	−0.72	0.86
	(3.40)	(3.92)	(17.8)	(5.91)	(12.1)	(7.26)	(3.57)	(4.08)	(9.13)	(9.22)
EMU	0.75	0.36	0.002	66.6	−0.40	0.80	1.64	0.36	−0.64	0.74
	(2.54)	(4.05)	(13.9)	(6.04)	(12.8)	(11.8)	(3.41)	(4.01)	(8.84)	(9.00)
Spain	3.10	2.37	0.003	55.7	−1.00	0.81	0.94	1.02	−1.16	0.71
	(2.45)	(4.46)	(17.8)	(5.59)	(11.5)	(7.12)	(1.27)	(4.32)	(14.3)	(9.39)

Extension I: results

Spain: structural unemployment rate, 1980-2012
Source: BBVA Research



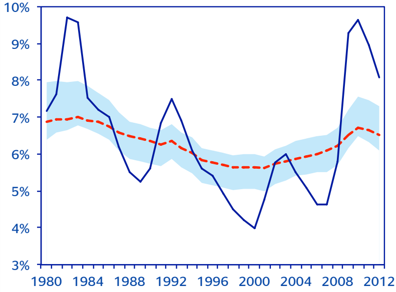
When the investment rate is taken into account, the structural unemployment rate is similar to the previous estimate

In most of the years, the previous estimate is inside the new confidence interval

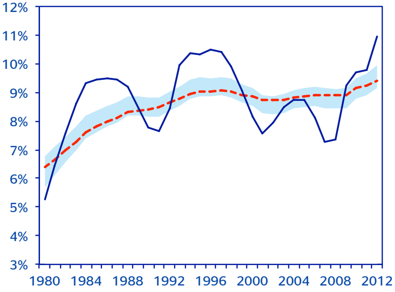
Nevertheless, the structural unemployment rate increases slightly more in the latest years

Extension I: results

Unemployment rate and its structural component, USA 1980-2012
Source: BBVA Research



Unemployment rate and its structural component, EMU 1980-2012
Source: BBVA Research



Extension II: assuming that u is I(2)

- Now we assume that in the UCM the structural unemployment rate is I(2):

$$\begin{bmatrix} \overline{y}_t \\ \overline{y}_{t-1} \\ \overline{u}_t \\ \overline{u}_{t-1} \\ \overline{ir}_t \\ \overline{ir}_{t-1} \end{bmatrix} = \begin{bmatrix} 2 & -1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2 & -1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} \overline{y}_{t-1} \\ \overline{y}_{t-2} \\ \overline{u}_{t-1} \\ \overline{u}_{t-2} \\ \overline{ir}_{t-1} \\ \overline{ir}_{t-2} \end{bmatrix} + \begin{bmatrix} \omega_{yt} \\ 0 \\ \omega_{ut} \\ 0 \\ \omega_{irt} \\ 0 \end{bmatrix}$$

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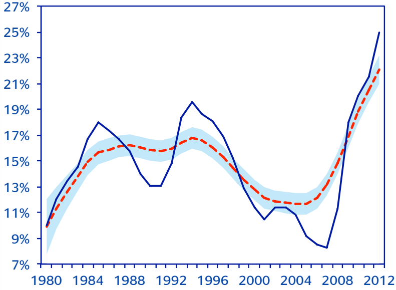
Extension II: assuming that u is I(2)

Spain: structural unemployment rate, 1980-2012
Source: BBVA Research



Similar $\overline{u}$ to the one estimated by the EC

Better results for Okun's law and investment equation when $\overline{u}$ is assumed to be I(1)

I(2) assumption not supported by unit root tests

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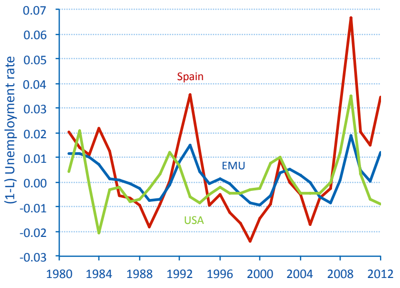
Extension II: assuming that u is I(2)

First difference of the unemployment rate: Spain, USA and EMU, 1980-2012
Source: BBVA Research



The first difference of u seems to be stationary

Higher volatility in Spain

High correlation of Δu

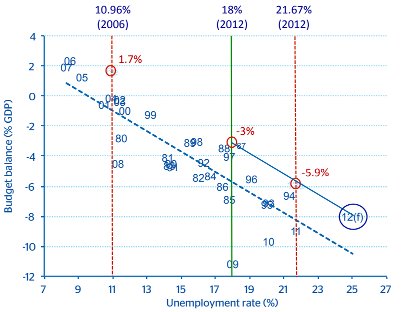
Extension II: assuming that u is I(2)

Dickey-Fuller Unit Root Test

		t-statistic	5% critical value	
USA	u	-2.97	-2.96	Reject I(1)
	Δu	-4.21	-1.95	Reject I(2)
EMU	u	-3.20	-2.95	Reject I(1)
	Δu	-3.61	-1.95	Reject I(2)
Spain	u	-2.09	-2.95	Accept I(1)
	Δu	-2.66	-1.95	Reject I(2)

Implications for the structural budget deficit

Unemployment and budget balance, Spain 1980-2012
Source: BBVA Research



The structural budget deficit estimated by the EC is also prcyclical

With our estimates of structural employment the structural deficit is less procyclical

Larger structural deficits in the boom and smaller in the crisis

Extensions (work in progress)

- Inclusion of financial variables (as in Borio et al., 2013)
- Labour market variables (vacancies and the Beveridge curve)
- Unemployment gap and wage inflation. Is inflation helpful for estimating the unemployment gap? Globalization, composition effects, etc.

Conclusions

- Estimates of structural unemployment based only in the information content of wages or price inflation are often very procyclical
- Other economic variables (such as the GDP, investment rates, etc.) contain useful information about the cyclical and structural components of unemployment rates
- Based on this information, our estimates show a more stable behaviour of the structural unemployment rate
- The unemployment rate and its structural component also contains very useful information to asses the fiscal stance of budget balances