Okun's Law: Fit at 50?

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November 8, 2012

Okun's Law 101

- Okun (1962)

  - *"Levels" version:*
    $$U_t - U_t^* = \beta\,(Y_t - Y_t^*) + \varepsilon_t,\ \beta < 0,$$

  - *"Changes" version*:
    $$\Delta U_t = \alpha + \beta\,\Delta Y_t + \omega_t$$

- Textbooks say U.S. coefficient $\beta = -0.5$.

Accusations Against Okun's Law

- It's unstable
  - "An Unstable Okun's Law, Not the Best Rule of Thumb" (Meyer and Tasci, St. Louis Fed, 2012)

- It's dead
  - "The Demise of Okun's Law" (Robert Gordon, 2011)

- Recoveries have become "jobless"

- It broke down during Great Recession
  - April 2010 WEO ("Okun's Law and Beyond")

Policy Implications

- "***The U.S. jobs challenge*** today stems from a pattern of jobless recovery that does not conform to the classic cyclical view of recession and recovery. So while healthy GDP growth will be essential [for a return to full employment], it will probably not be sufficient.... it ***will require major efforts in education, regulation, and even diplomacy***." (McKinsey Global Institute, 2011)

- *"Why is unemployment remaining high? Because growth is weak — period, full stop, end of story.* Historically, low or negative growth has meant rising unemployment, fast growth falling unemployment (Okun's Law) … what we've been seeing lately is well within the normal range of noise. There's no hint in these data that we've entered new territory in which decent growth fails to create jobs; the problem is that we haven't had decent growth." (Paul Krugman, July 9, 2011.)

What We Do … and What We Find

- We examine fit of Okun's Law:
  - In the U.S. since 1948
  - In 20 advanced economies since 1980

- What we conclude:
  - It ***is*** a law (at least by the standards of macroeconomics)
  - Strong and stable in most countries
  - Exceptions exaggerated and/or quantitatively small

  BUT:
  - substantial variation in coefficient across countries
    - for reasons only partly understood

Deriving Okun's Law

(1) $\quad E_t - E_t^* = \gamma\,(Y_t - Y_t^*) + \eta_t \qquad \gamma > 0$

(2) $\quad U_t - U_t^* = \delta\,(E_t - E_t^*) + \mu_t \qquad \delta < 0$

- We expect $\gamma < 1.5$ (labor as quasi-fixed factor)

- We expect $|\delta| < 1$ (procyclical labor force participation)

(3) $\quad U_t - U_t^* = \beta\,(Y_t - Y_t^*) + \varepsilon_t \qquad \beta < 0$

- $\beta = \gamma\delta$, $|\beta| < 1.5$, and $\varepsilon_t = \mu_t + \delta\,\eta_t$.

Estimating Okun's Law

(3) $\quad U_t - U_t^* = \beta (Y_t - Y_t^*) + \varepsilon_t \qquad \beta < 0$

- We usually measure U_t^* and Y_t^* with HP filter.

- Several tests of robustness
  - With HP
    - Alternate values of HP smoothing parameter
    - Addressing end-point problem

  - Without HP
    - Use of forecast errors
    - Use of CBO measure of U_t^* and Y_t^*
    - Use of "changes" specification

(4) $\quad \Delta U_t = \alpha + \beta \Delta Y_t + \omega_t$, holds if U^* and ΔY^* constant.

U.S. Evidence on Okun's Law

Results: U.S. Annual Data 1948-2011

Levels equation: $U_t - U_t^* = \beta (Y_t - Y_t^*) + \varepsilon_t$,

Changes equation: $\Delta U_t = \alpha + \beta \Delta Y_t + \omega_t$

	Levels		
	$\lambda = 100$	$\lambda = 1{,}000$	Changes
β	-0.411***	-0.383***	-0.405***
	(0.024)	(0.023)	(0.029)
α			1.349***
			(0.116)
Obs	64	64	63
Adjusted R^2	0.817	0.813	0.752

Note: OLS standard errors. ***, **, and *: sig. at the 1, 5, and 10 percent level.

Results for U.S., 1948-2011
(SUR, joint estimation of equations 1-3, annual data, $\lambda = 100$)

Okun's Law for Employment	Estimate	Adjusted R^2
γ	0.543***	0.610
Unemployment-Employment Relation		
δ	-0.728***	0.798
Okun's Law for Unemployment		
β	-0.405***	0.820

Obs	64
p-value for H_0: $\beta = \gamma\delta$	0.378

Note: Standard errors in parentheses. ***, **, and *: sig. at the 1, 5, and 10 percent level.
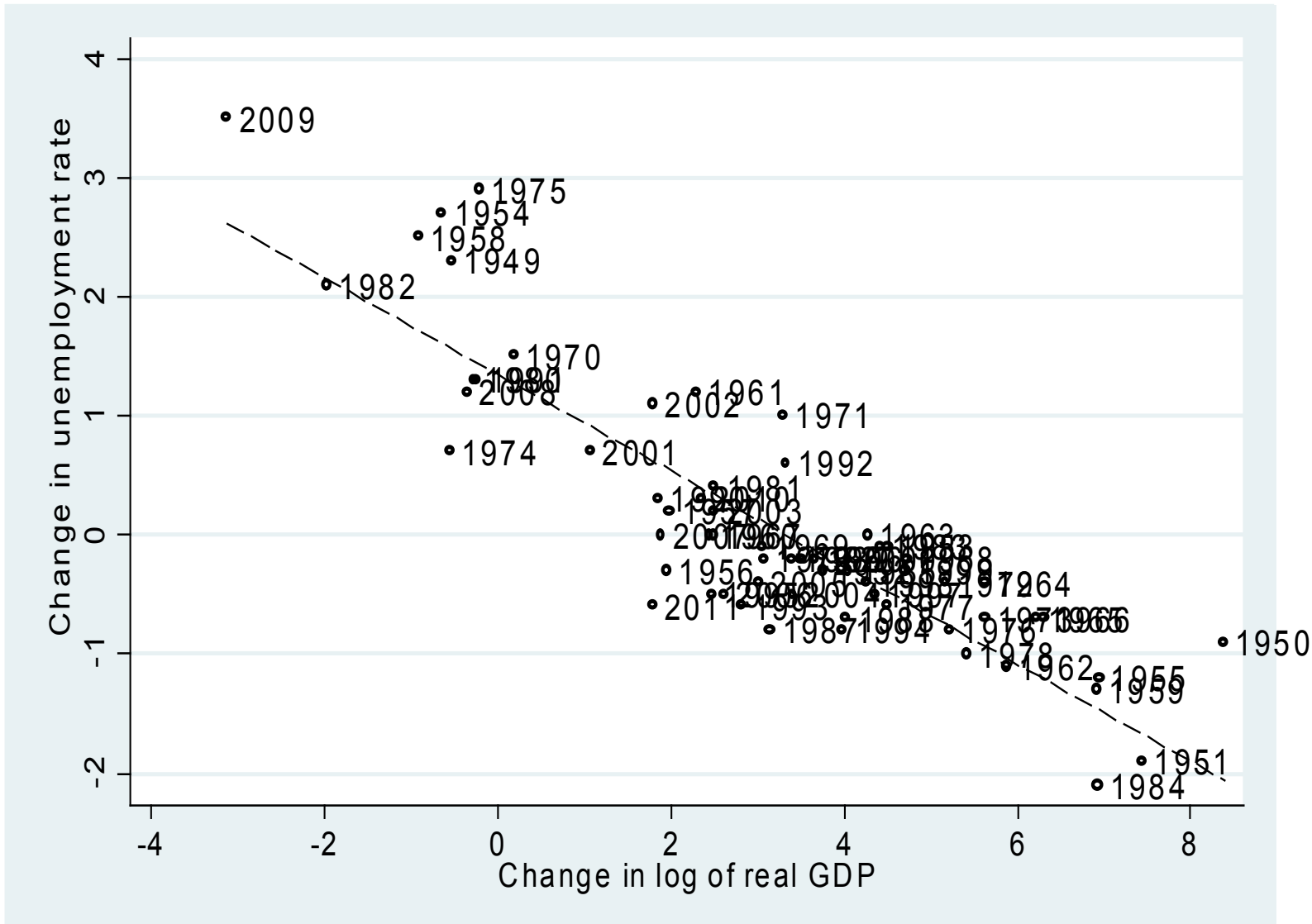
Okun's Law: U.S. Fit

(Levels specification, natural rates based on HP filter, annual data)
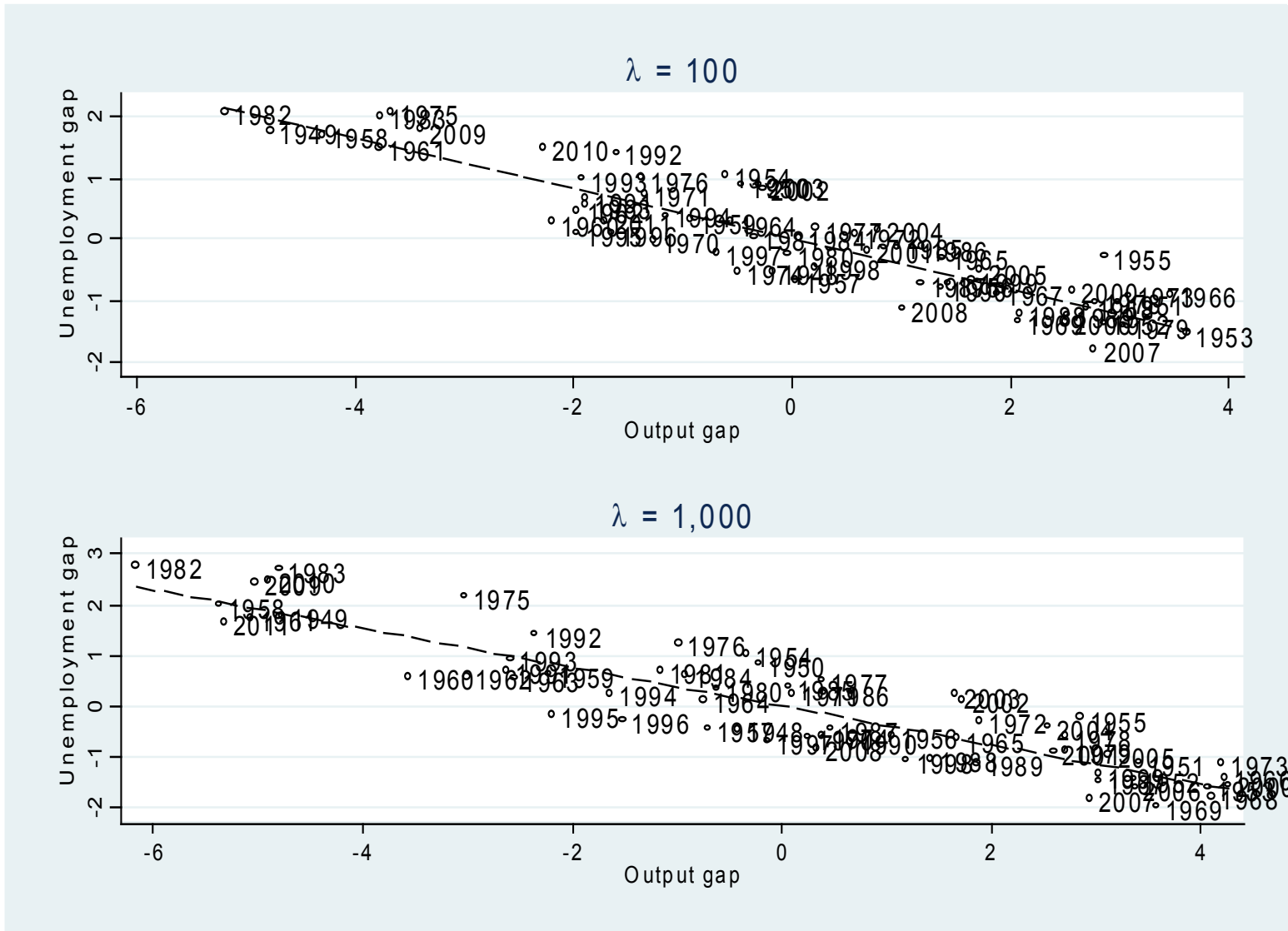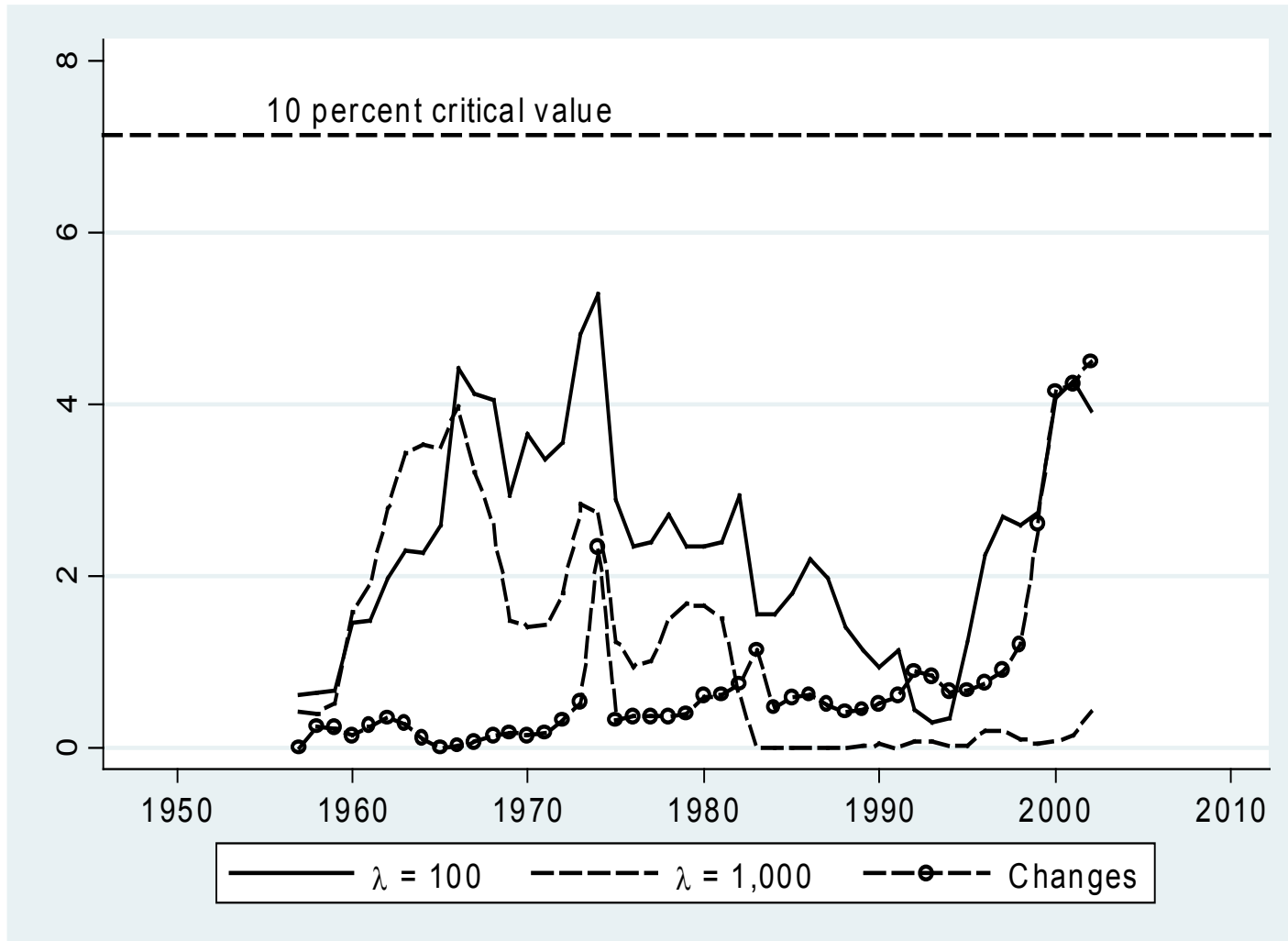
Okun's Law: U.S. Fit

("Changes" specification, annual data)

Okun Stability Test, 1948-2011
(Test for stability of Okun coefficient, β, at unknown date, annual data)

Note: *F*-statistic, inner 70 percent of sample. Critical value from Andrews (2003).

Results for U.S.: Quarterly Data

(OLS, levels specification: $U_t - U_t^* = \beta(L)\,(Y_t - Y_t^*) + \varepsilon_t$, 1948Q2-2011Q4)

	Hodrick-Prescott filter λ			
	1,600	1,600	16,000	16,000
β_0	-0.428***	-0.245***	-0.411***	-0.213***
	(0.015)	(0.0230)	(0.013)	(0.0286)
$\beta1$		-0.133***		-0.153***
		(0.0345)		(0.0447)
$\beta2$		-0.116***		-0.0794***
		(0.0230)		(0.0286)
$\beta_0 + \beta_1 + \beta_2$		-0.494***		-0.445***
		(0.0126)		(0.0119)
α				
Obs	256	256	256	256
Adjusted R^2	0.767	0.865	0.795	0.852

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Note: Standard errors in parentheses. ***, **, and *: sig. at the 1, 5, and 10 percent level.

Replication of Okun (1962) and More

(OLS, changes specification: $\Delta U_t = \alpha + \beta(L) \Delta Y_t + \varepsilon_t$)

Sample	1948Q2-1960Q4		1948Q2-2011Q4	
Data	Vintage data		Current data	
β_0	-0.307***	-0.233***	-0.286***	-0.218***
	(0.036)	(0.0303)	(0.018)	(0.0160)
β_1		-0.168***		-0.137***
		(0.0327)		(0.0168)
β_2		-0.0394		-0.0767***
		(0.0307)		(0.0160)
$\beta_0 + \beta_1 + \beta_2$		-0.441***		-0.432***
		(0.0380)		(0.0200)
α	0.305***	0.424***	0.244***	0.359***
	(0.061)	(0.0524)	(0.023)	(0.0215)
Obs	51	51	255	255
Adjusted R^2	0.584	0.758	0.494	0.663

Note: Standard errors in parentheses. ***, **, and *: sig. at the 1, 5, and 10 percent level.
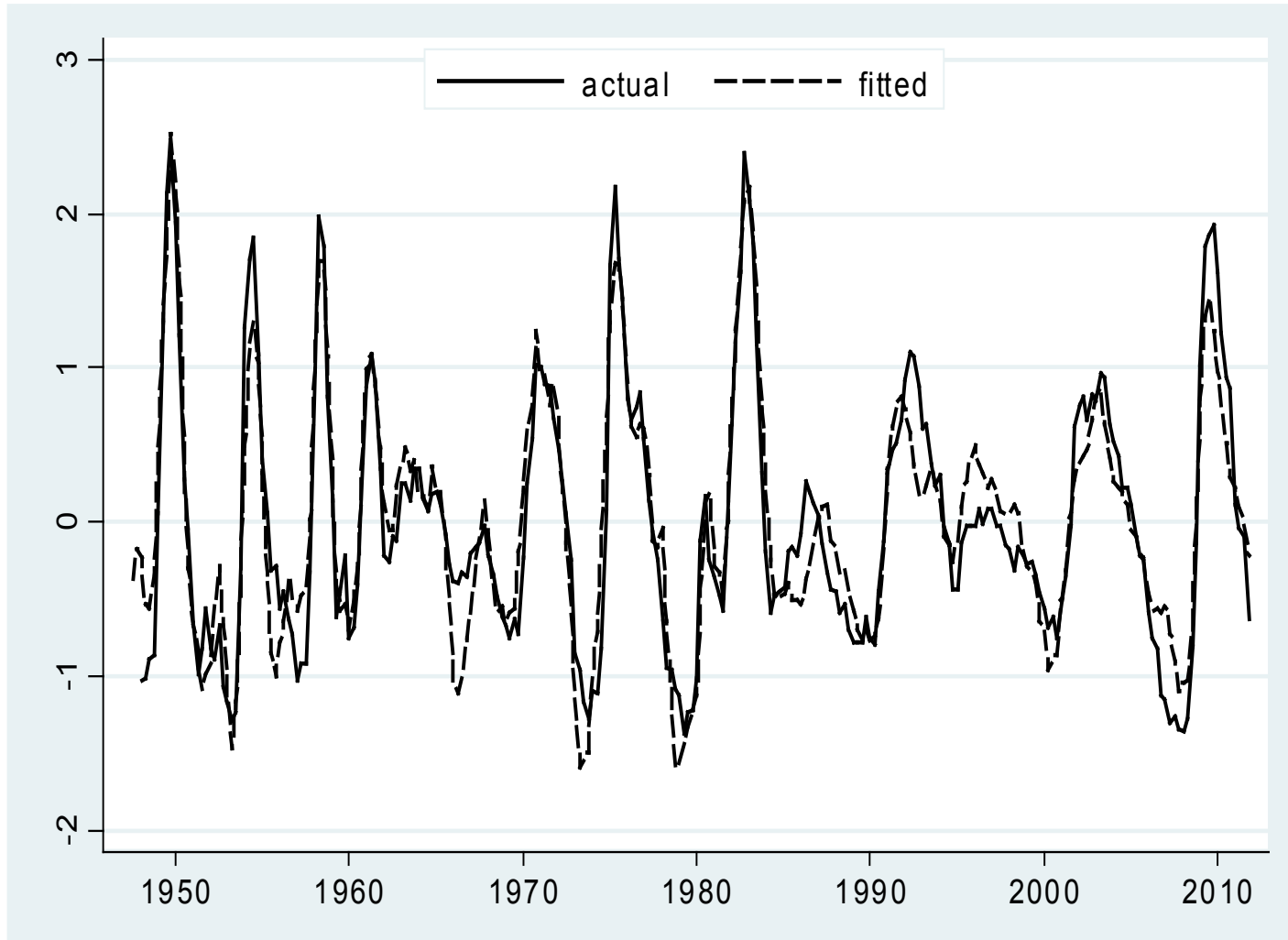
Okun's Law: U.S. Fit, Quarterly Data

(Actual and fitted values of unemployment rate, 1948Q2-2011Q4)
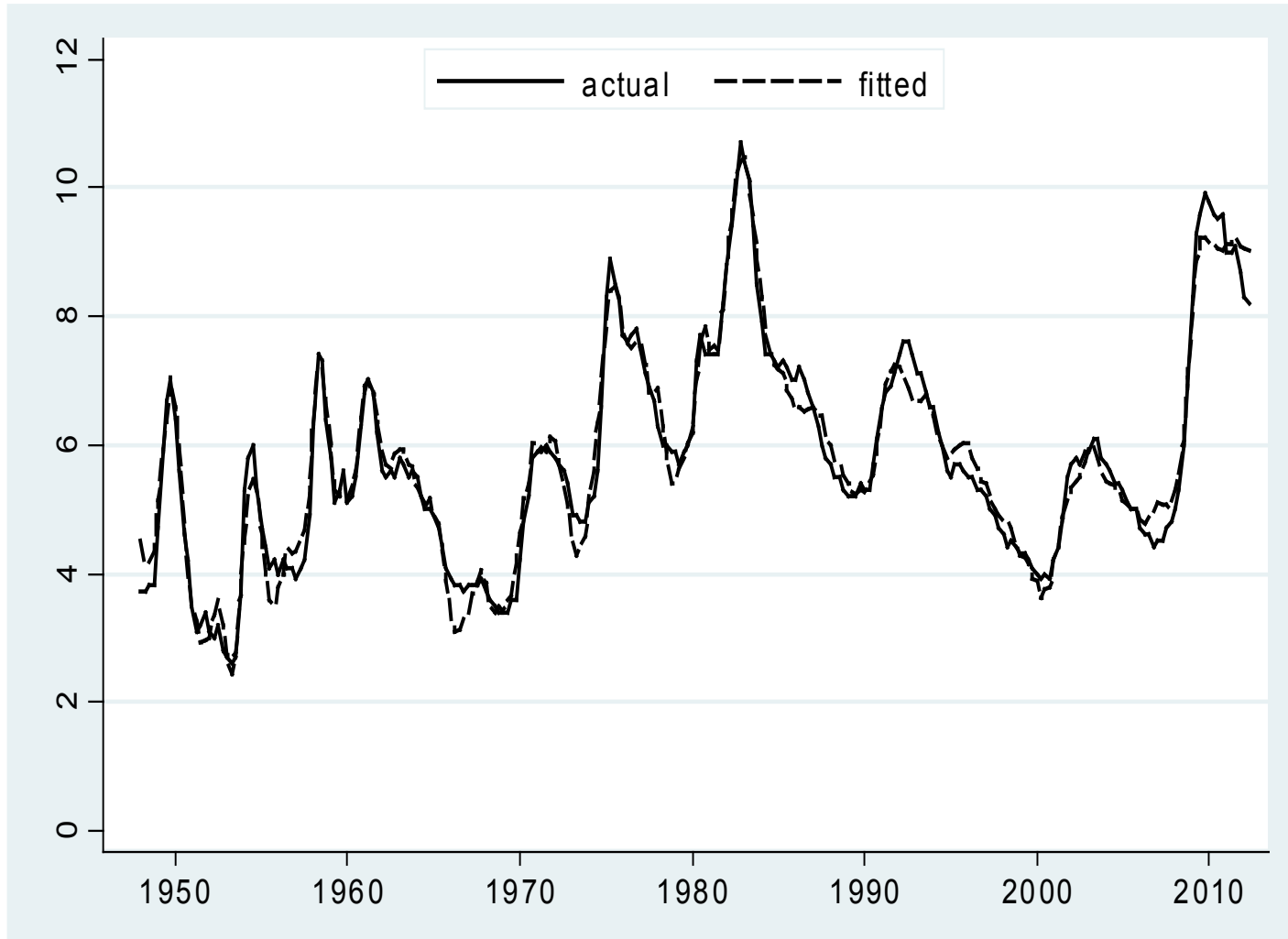
Note: Fitted value of U_t based estimate of $U_t - U_t^* = \beta (Y_t - Y_t^*) + \varepsilon_t$ with $\lambda = 1,600$.

Okun's Law: U.S. Fit, Quarterly Data

(Actual and fitted values of unemployment rate *gap*, 1948Q2-2011Q4)

Note: Fitted value of $\underline{U}_t - U_t^*$ based estimate of $U_t - U_t^* = \beta\,(Y_t - Y_t^*) + \varepsilon_t$ with $\lambda = 1{,}600$.

Jobless Recoveries?

Okun's Law vs. "Jobless Recoveries"

- Popular view:
  - "Output Came Back, Employment Didn't" (NPR, 2011)

- Our view:
  - Okun's Law holds (as shown in previous slides)
  - Confusion because recent output recoveries have been slow.
  - Point is recognized by some observers
    - o Krugman (2011)
    - o Gali et al. (2012)
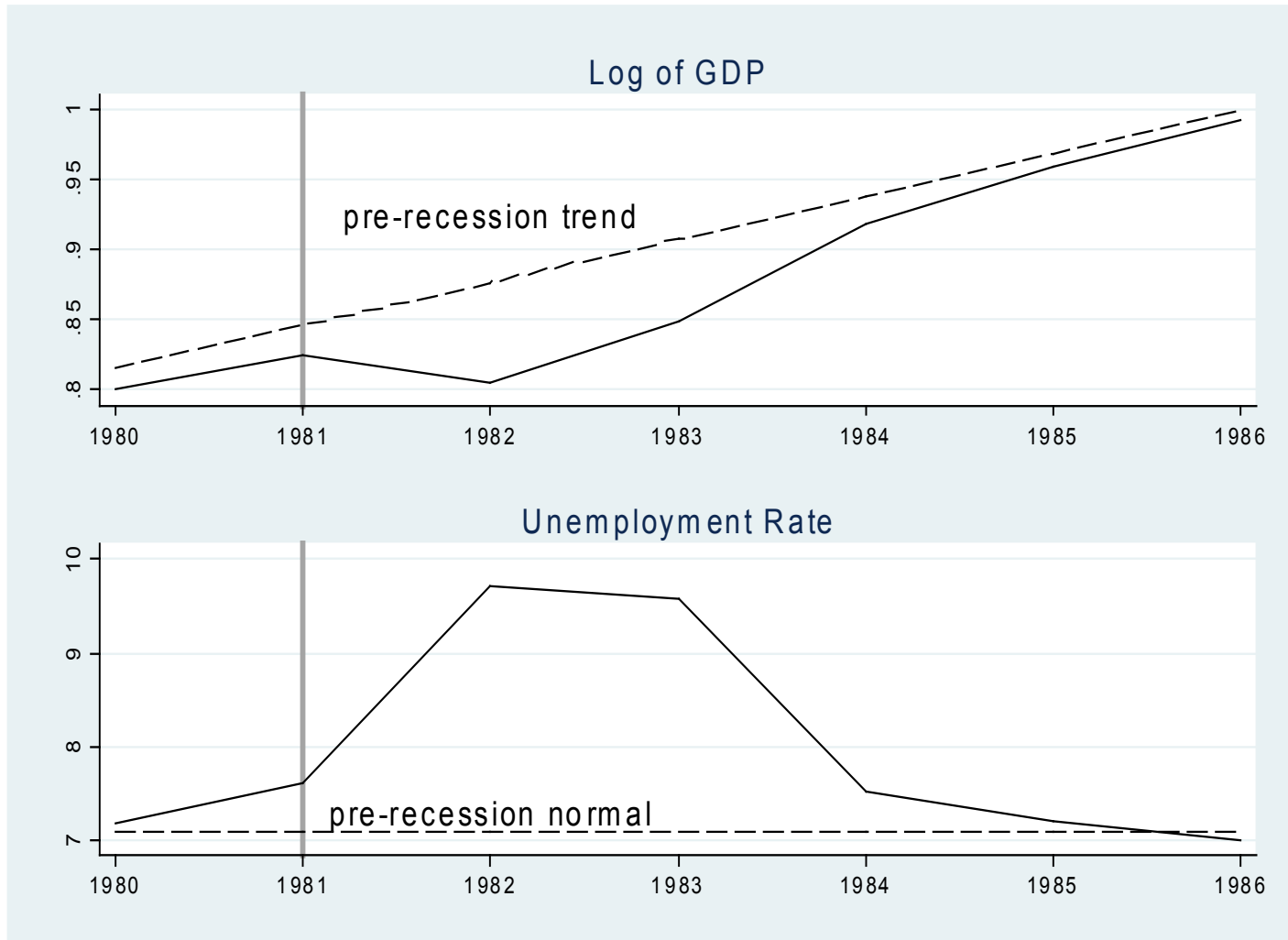
A Recovery that Looks Jobless
(U.S. during the Great Recession)

Log of GDP

pre-recession trend

Unemployment Rate

pre-recession normal
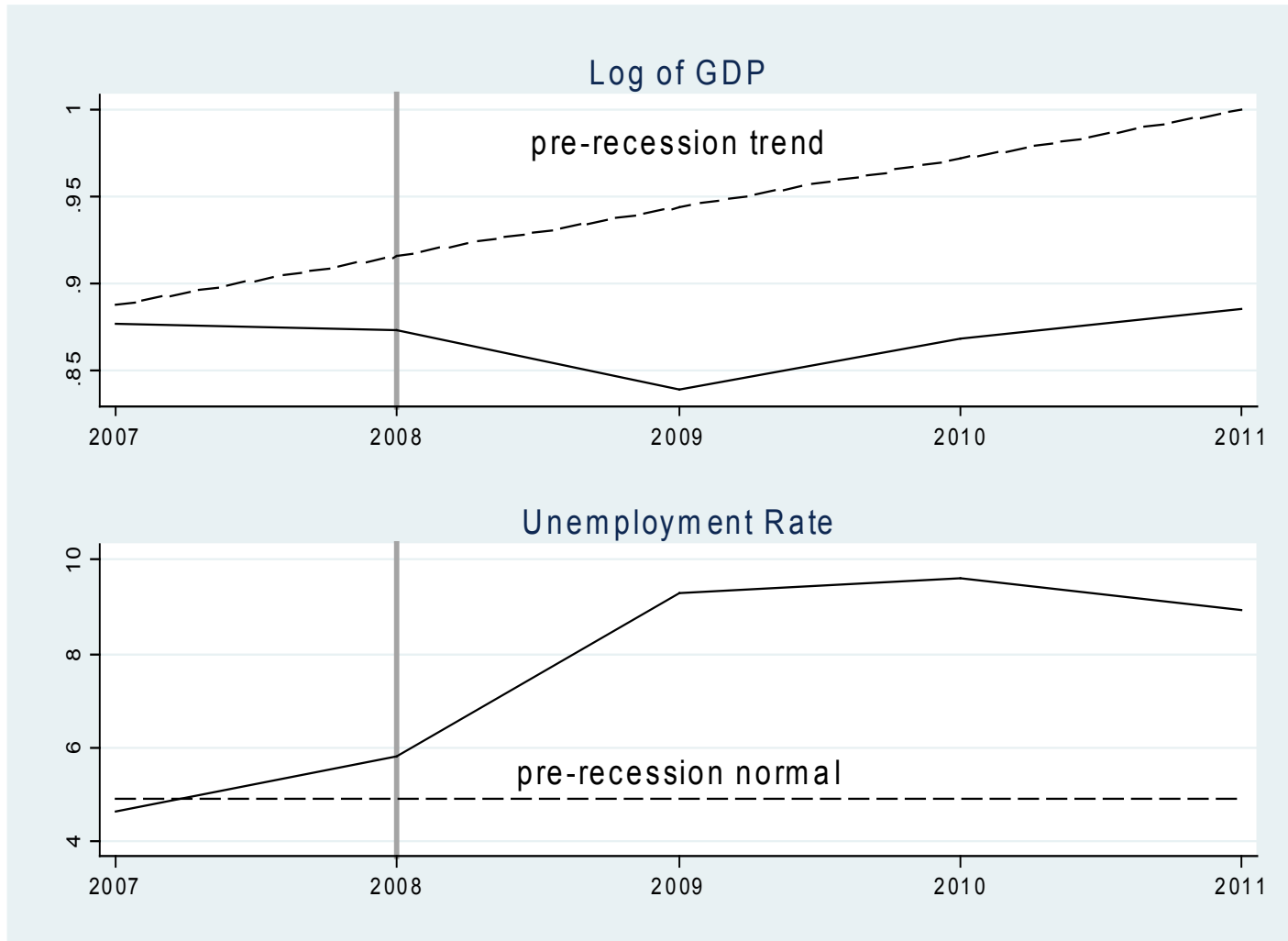
Note: HP filter trends through 2007. Assumption: U_t^* and ΔY_t^* constant thereafter.

A Recovery that Looks Job-full
(U.S. During the 1981 Recession)

Log of GDP

pre-recession trend

Unemployment Rate

pre-recession normal

Note: HP filter trends through 1980. Assumption: U_t^* and ΔY_t^* constant thereafter.

Cross-Country Evidence on Okun's Law

Cross-country Estimates, 1980-2011

(OLS, levels specification: $U_t - U_t^* = \beta (Y_t - Y_t^*) + \varepsilon_t$, $\lambda = 100$, annual data)

	β	Obs	Adj. R^2		β	Obs	Adj. R^2
Australia	-0.536***	32	0.80	Japan	-0.152***	32	0.65
Austria	-0.136***	32	0.21	Netherlands	-0.511***	32	0.62
Belgium	-0.511***	32	0.54	New Zealand	-0.341***	32	0.59
Canada	-0.432***	32	0.81	Norway	-0.294***	32	0.62
Denmark	-0.434***	32	0.72	Portugal	-0.268***	32	0.62
Finland	-0.504***	32	0.77	Spain	-0.852***	32	0.90
France	-0.367***	32	0.68	Sweden	-0.524***	32	0.62
Germany	-0.367***	32	0.51	Switzerland	-0.234***	32	0.44
Ireland	-0.406***	32	0.77	UK	-0.343***	32	0.60
Italy	-0.254***	32	0.29	USA	-0.454***	32	0.82

Note: Standard errors in parentheses. ***, **, and *: sig. at the 1, 5, and 10 percent level.

Cross-country Sub-sample Stability

(OLS, levels specification, $\lambda = 100$, annual data, 1980-2011)

|	$\beta_{\text{pre-95}}$	$\beta_{\text{post-95}}$	p-value		$\beta_{\text{pre-95}}$	$\beta_{\text{post-95}}$	p-value
Australia	-0.552***	-0.433***	0.405	Japan	-0.109***	-0.209***	0.008
Austria	-0.134*	-0.137**	0.974	Netherlands	-0.713***	-0.336***	0.006
Belgium	-0.634***	-0.310**	0.053	New Zealand	-0.317***	-0.426***	0.363
Canada	-0.500***	-0.287***	0.006	Norway	-0.319***	-0.247***	0.410
Denmark	-0.490***	-0.369***	0.205	Portugal	-0.221***	-0.463***	0.007
Finland	-0.610***	-0.297***	0.001	Spain	-0.793***	-0.923***	0.205
France	-0.400***	-0.335***	0.470	Sweden	-0.648***	-0.362***	0.046
Germany	-0.427***	-0.270**	0.232	Switzerland	-0.211***	-0.274***	0.516
Ireland	-0.462***	-0.382***	0.359	UK	-0.419***	-0.215***	0.045
Italy	-0.142	-0.358***	0.110	USA	-0.447***	-0.464***	0.829

Note: Standard errors in parentheses. ***, **, and *: sig. at the 1, 5, and 10 percent level.

Summary of Cross-country Estimates

- Strong relationship in most countries.

- Coefficient β falls significantly at 5 percent level in 5 countries, rises significantly in 2.

- Average β is –0.43 in first sample, –0.35 in second.

- Correlation of countries' βs across periods = 0.50.

Okun's Law and the Great Recession
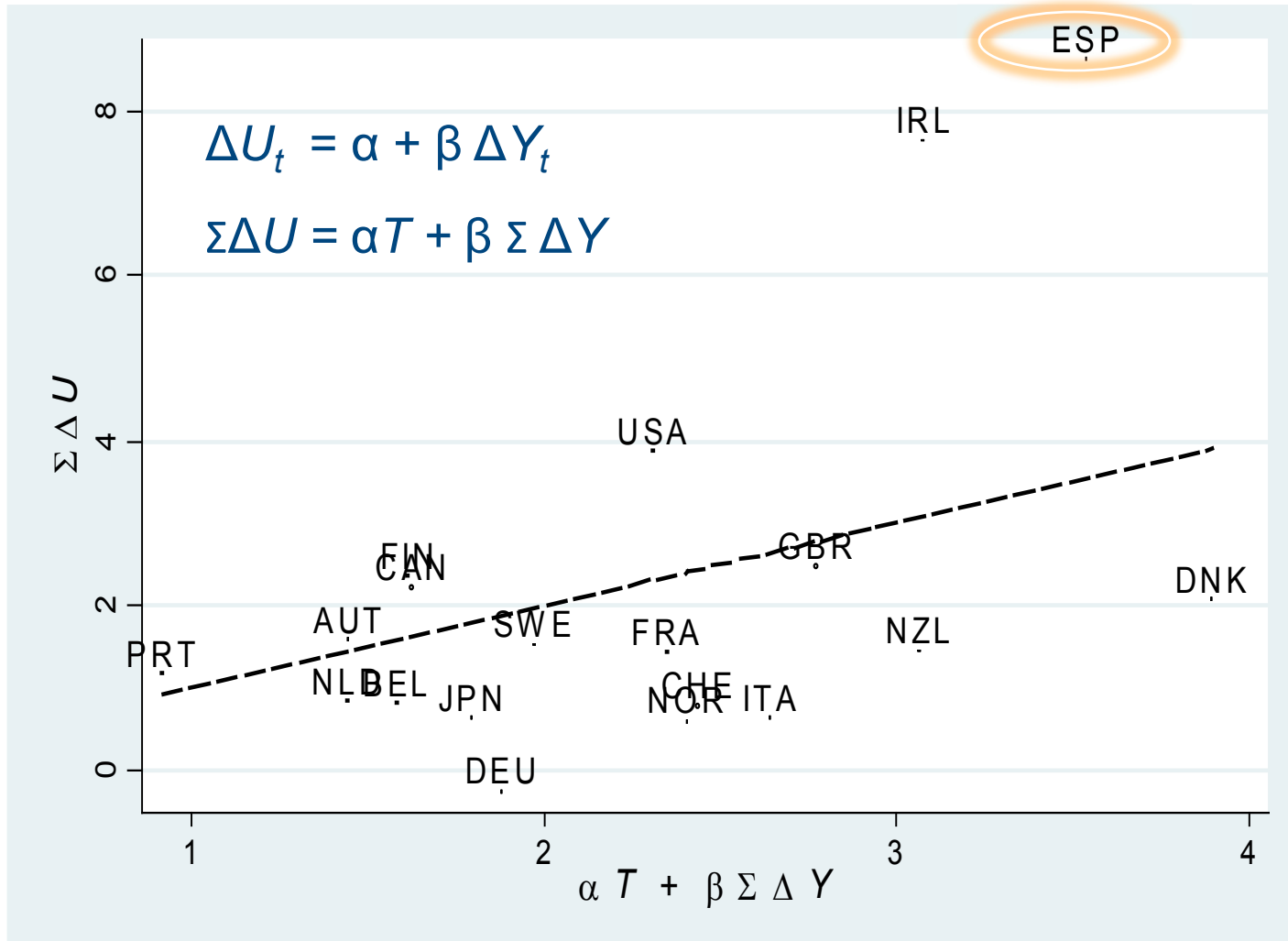(Peak-to-trough output and unemployment changes)
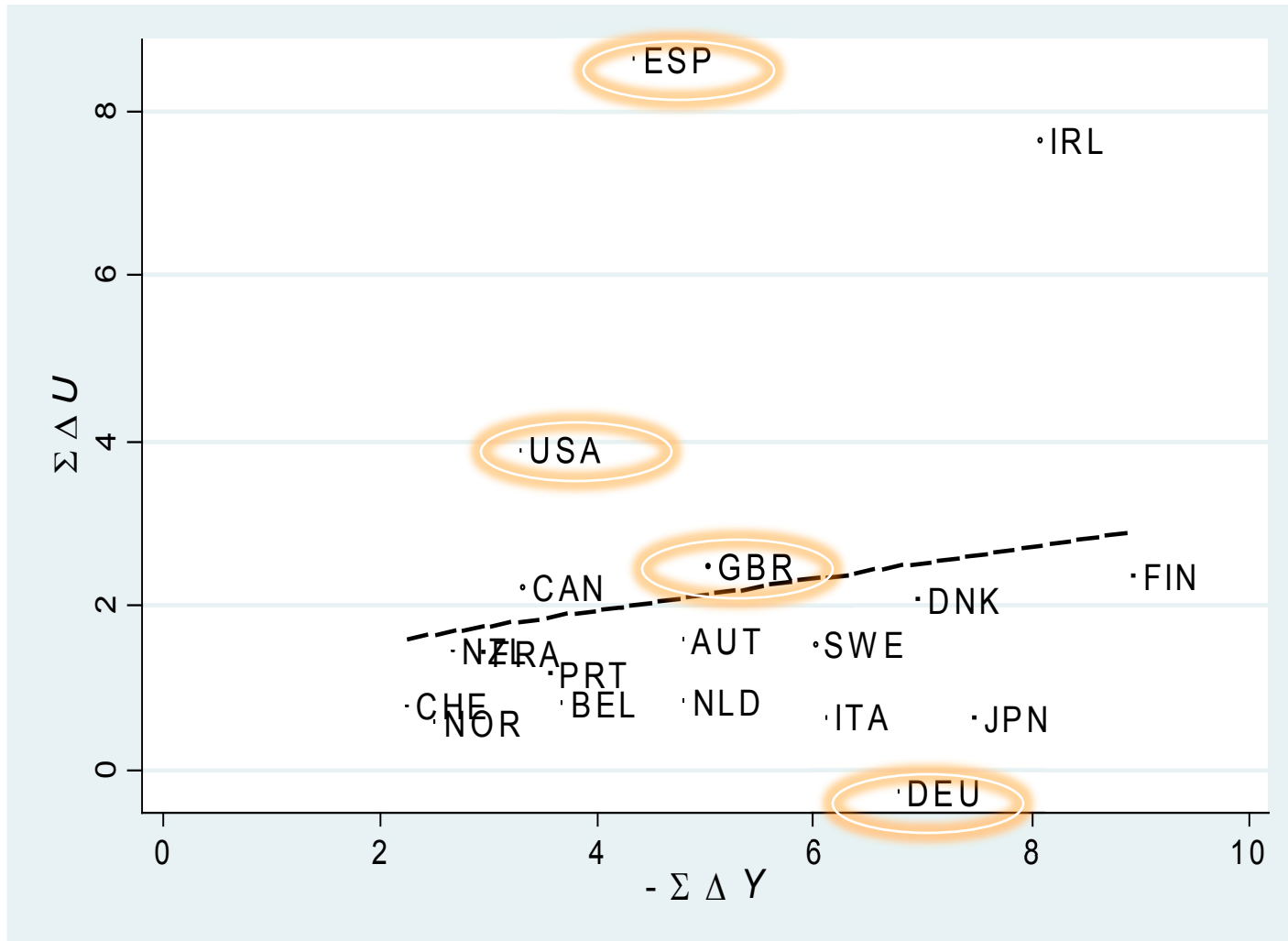
Notes: Similar to Figure 3.1 in April 2010 WEO.
$\Sigma\Delta U$ and $\Sigma\Delta Y$ = cumulative peak-trough changes. Adjusted R^2 = –0.03.

Okun's Law and the Great Recession

(Peak-to-trough changes, adjustment for recession duration, T)

$$\Delta U_t = \alpha + \beta \, \Delta Y_t$$

$$\Sigma \Delta U = \alpha T + \beta \, \Sigma \, \Delta Y$$

y-axis: $\Sigma \Delta U$

x-axis: $\alpha \, T + \beta \, \Sigma \, \Delta \, Y$

ESP IRL USA FIN CAN GBR DNK AUT SWE FRA NZL PRT NLD BEL JPN CHE NOR ITA DEU

Note: Adjusted R^2 = 0.54.

Okun's Law and the Great Recession

(Adjustment for recession duration and country-specific Okun coefficients)
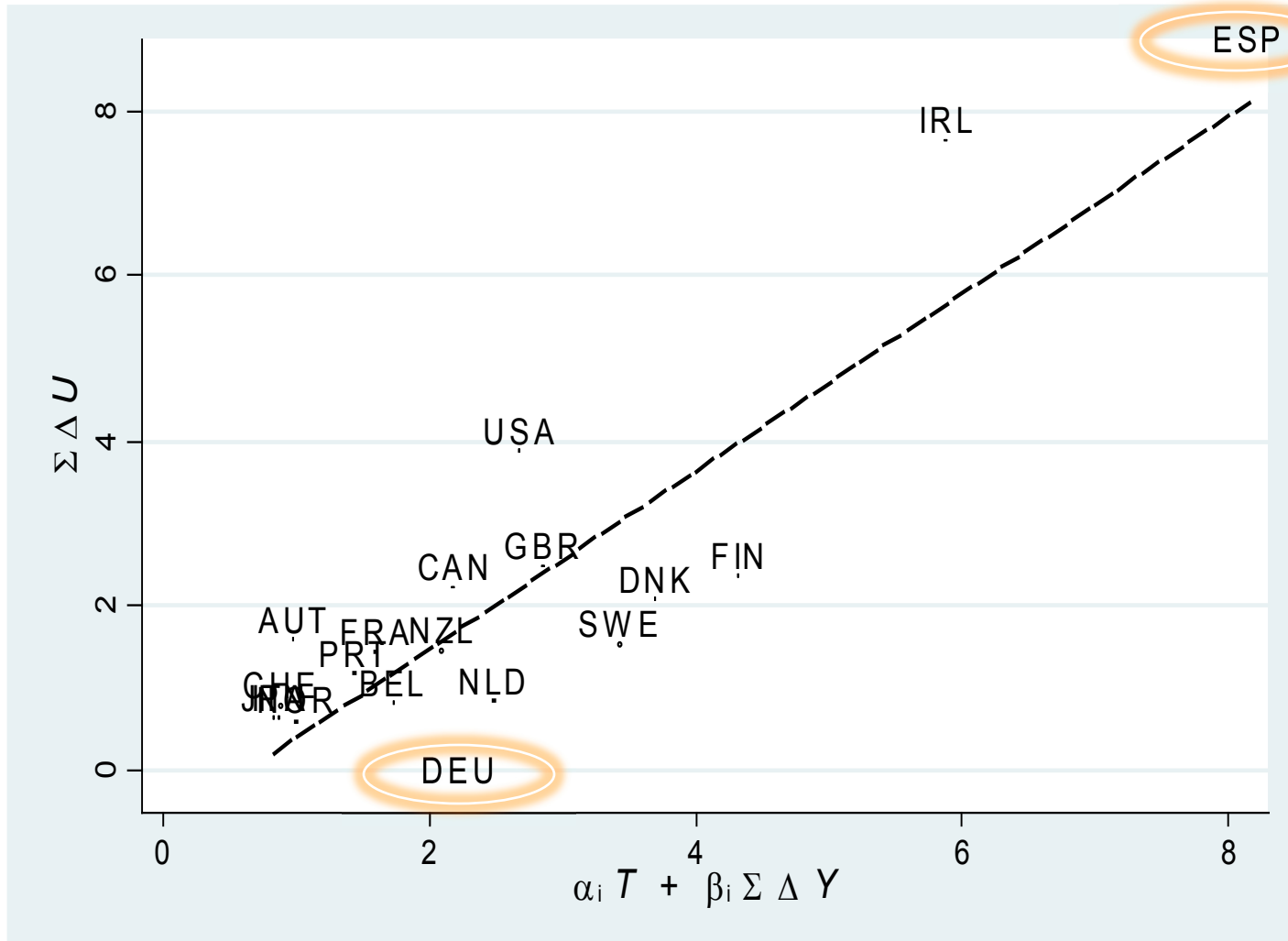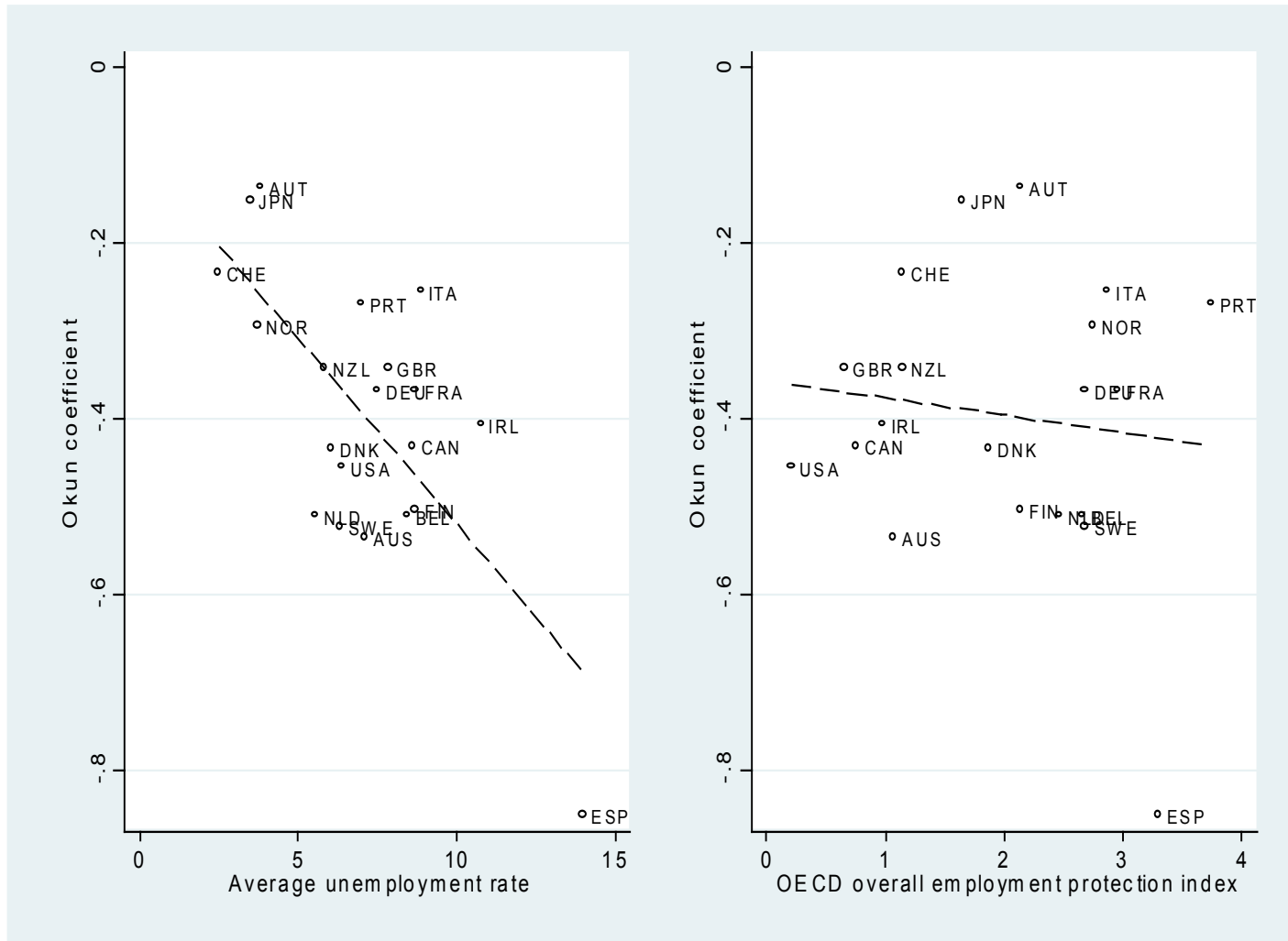

Note: α_i and β_i = country-specific Okun coefficients, T = duration. Adjusted R^2 = 0.76.

Sources of Variation in Okun's Law Coefficients

- Two Avenues:

  - Cross-country variables

  - Individual stories

Cross-Country Variables
(Okun coefficient vs. candidate variable)

Note: Average unemployment rate denotes 1980-2011 mean.
OECD overall employment protection index: 1985-2011 mean based on available data.

Individual Stories

- Large coefficient in Spain: temporary labor contracts

- Three smallest coefficients:

  - Japan: lifetime employment tradition

  - Switzerland: migrant labor

  - Austria: a puzzle

Conclusions

- Strong, stable relationship in most countries.

  - Little evidence of jobless recoveries or breakdown in the Great Recession.

- Substantial cross-country variation only partly understood.