The Evolution of Okun's Law and of Cyclical Productivity Fluctuations in the United States vs. Europe

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Themes of Paper with Broader Implications

- Procyclical productivity shocks are not a fundamental object in macroeconomics; they are residual artifacts of lags of hours behind output
  - Productivity lead is definitional and does not prove causation
  - Productivity residual varies across time and places (US vs EU) as a result in part of labor-market institutions, not differences in technology shocks.
  - Procyclical productivity fluctuations have nothing to do with technology, and the phrase "technology shocks" should be banished from business-cycle macroeconomics

Documenting and Explaining Contrasting Changes in Cyclical Labor-market Behavior

- Point of Departure: Okun's Law as proposed in 1962
  - In response to a 1% change in the output gap, procyclical responses of hours 2/3, of which employment 1/3, LFPR 1/6, hours/employee 1/6
  - Procyclical productivity fluctuations make up remaining 1/3
- Okun ignored lag of hours. In quarterly data with lags, employment response implied by Okun for pre-1986 interval rises from 1/3 to ½, and productivity response falls to 0.2.

Where do the Changes in the Output Gap Come From?

- This paper is about the response of hours and productivity to changes in the output gap. Where do these changes in output gap come from? Anything that shifts the AD or AS curve horizontally

- AD shifts include IS and LM shocks: Wealth effects, credit market tightness, financial market shocks, investment cycles of overbuilding, changes in government spending and taxes, monetary policy, changes in demand for money, shocks to net exports from foreign demand and exchange rates

- AS shifts: relative price of oil, food, imports, medium-term productivity trends, Nixon price controls

Contrast with Modern Dynamic Macro-Labor Models

- Standard paradigm of modern dynamic macro-labor models takes high-frequency output changes caused by this long list and *forces* them to be misinterpreted as high frequency technology shocks and/or consumption-leisure preference shocks.
    - It is not a flaw that my list of changes of the output gap is exogenous, so are technology shocks and preference shocks
    - The difference is that the modern paradigm arbitrarily excludes *all* the items on my list from being relevant. The issue is not exogeneity but arbitrary exclusion

- Modern paradigm also ignores lags of changes in hours behind changes in output. This fact implies by definition that productivity changes (the residual) lead output changes.
    - We find that productivity leads output by ~2 quarters, hours lag by ~1.5 quarters. That's >3 quarters of dynamic adjustment that the standard paradigm misinterprets as high frequency technology shocks

Other New Findings: Unconventional US Data and Extension of EU-15 Quarterly Data

- For US only: a new approach to data
  - US: Total Economy not NFPB Sector
  - US: Conventional vs. Unconventional Productivity Measures
- For EU-15, a first attempt to create quarterly data for EU-15 that duplicate those long available for US
  - Quarterly data series back to 1975 on employment and output with consistent aggregation across countries
  - So far, no hours series available over this time span

- Main finding: in the US, productivity no longer exhibits procyclical fluctuations. But in the EU, productivity has actually become more responsive to output changes.
  - Key qualification: productivity is defined as output per employee. Future research will extend this to output per hour.

Preview of Substantive Hypotheses to Explain Changes

- Joint explanation of US and EU behavior based on "American Exceptionalism"
- US shift toward greater labor input response is explained by the "Disposable Worker" hypothesis
  - Increased managerial power, new emphasis on maximizing shareholder value, decreased power of labor groups and employees
  - Explanations at top and bottom mirror those for increased US inequality

Preview of Substantive Hypotheses (Continued)

- Europe has not experienced a parallel shift in market power between labor and management

- Also, several major EU countries have developed institutions and policies that explicitly or implicitly restrict the responsiveness of labor to output changes, e.g. "work sharing"

  – These policies shift the impact of output changes from employment level onto hours per employee and consequently output per employee

The Output Identity: Simple Version and Conventional Version for the Total Economy

$$Y \equiv \frac{Y}{H} \cdot \frac{H}{E} \cdot \frac{E}{L} \cdot \frac{L}{N} \cdot N$$

$$Y^P \equiv \frac{Y^P}{H^P} \cdot \frac{H^P}{E^P} \cdot \frac{E^P}{E^H} \cdot \frac{E^H}{L} \cdot \frac{L}{N} \cdot N$$

Introducing the Alternative "Unconventional" Identity

- Nalewaik's 2010 Brookings Paper:
  - GDP and GDI are conceptually identical
  - But they differ (statistical discrepancy)
  - GDI is more procyclical
  - When GDP is revised, it tends to be revised toward what GDI already shows
- Hours
  - All existing work uses hours based on payroll employment
  - There is a little-known series on hours based on the household survey
- In principle 2 numerators, 2 denominators = 4 possible productivity measures, here we simplify by comparing only two combinations, Conventional and Unconventional

Conventional Compared to Unconventional Identity

$$Y^P \equiv \frac{Y^P}{H^P} \cdot \frac{H^P}{E^P} \cdot \frac{E^P}{E^H} \cdot \frac{E^H}{L} \cdot \frac{L}{N} \cdot N$$

$$Y^I \equiv \frac{Y^I}{H^H} \cdot \frac{H^H}{E^H} \cdot \frac{E^H}{L} \cdot \frac{L}{N} \cdot N$$

Detrending the Full-Period US Data

- Uses Kalman detrending, which allows use of an outside feedback variable.
    - Avoids excessive cyclicality of H-P trends
    - For this outside information, turn to a technique for estimating the unemployment gap from inflation data. The unemployment gap provides outside information on the business cycle
    - Study of US vs. EU uses H-P filter as a stopgap prior to further data study to locate outside cyclical variable
- We avoid making judgments on 2008-10 cycle by constraining all growth trends as equal to 2007:Q4 values throughout 2008-10
    - Thus the paper "dodges" the hot current (as yet unanswerable) topic of the *new normal*

Graphs Start with the US: What We Learn from Cyclical Deviations from Trend

- The most interesting results
  - Okun's 2/3 hours vs. 1/3 productivity result worked perfectly in late 1960s and early 1980s but at almost no other time
- Most important, the 2008-09 cycle has been bigger for hours than for output, while 1980-82 was the reverse
- Correlation of productivity gap with output gap changes timing and disappears after mid-1980s

US: Gaps for C & U Average: Output, Hours, Productivity

Figure 5a. Log Percent Gaps of Actual Relative to Trend for Output, Aggregate Hours, and Labor Productivity, Average Identity, 1955:Q1 – 2010:Q2
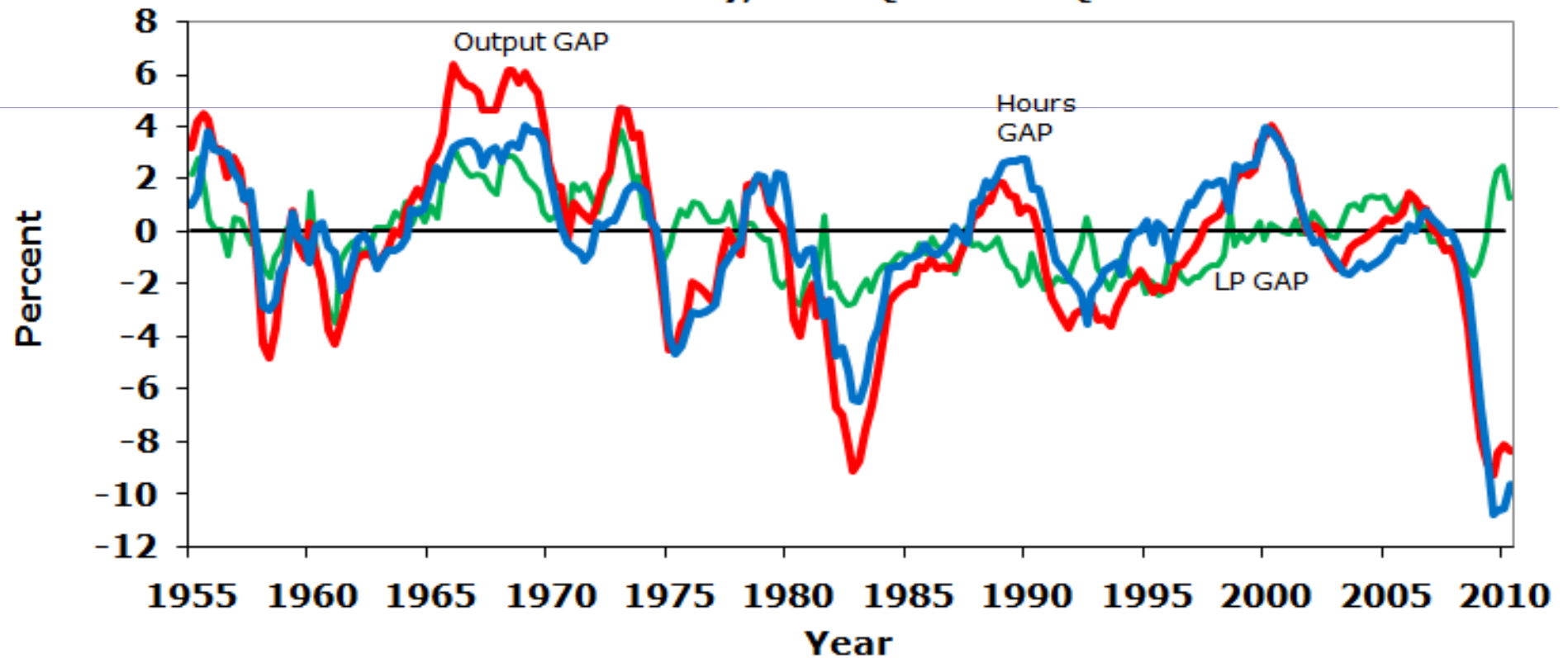
Regression Analysis Begins for US-Only 1955-86 vs. 1986-2010

- All variables expressed as *FIRST DIFFERENCES OF DEVIATION FROM TREND, i.e. Δ log gap in X*

- Changes in gaps for identity components (Y/H, H/N) explained by
  - Changes in output gap (with lags for hours & leads for LP)
  - Lagged dependent variable (lags 1-4)
  - Error correction term
  - End-of-expansion dummies
    - Not 0,1 dummies. They enter in the form 1/M, -1/N
    - These sum to zero
    - Productivity slows late in expansion
    - Constrained to be completely offset by faster productivity growth early in recovery ("Early Recovery Productivity Bubble")

Regression Results for US-Only, Table 2, 1955-86 vs. 1986-2010

- Hours gap lags output by roughly one quarter
- Productivity leads output by roughly two quarters
- End-of-expansion dummies (8 recessions)
  - To simplify tables, constrained to be equal within subsample
  - Significant in LP equations pre and post 1986
  - Not significant in hours equation post 1986
- Split sample: 1954-86 vs 1986-2010
  - Big change in long-run responses
- To simplify paper, regressions are presented only for conventional concept of hours & LP
 - Unconventional data are noisier due to HH

Table 2. Regressions Explaining Cyclical Deviations from Trend in Conventional Output Identity Components[a], 2007:4 Trend End

| Independent Variable	Dependent variable, 1954:1 - 1986:1				Dependent variable, 1986:1 - 2010:2			
	Hours		Output per Hour[b,g]		Hours		Output per Hour[b,g]	
Lagged dependent variable[c]	-0.55	**	-0.72	**	0.02		-0.54	**
Output deviation from trend[d]	1.18	**	0.37	**	1.18	**	0.13	
Error correction term[e]	-0.12		-0.18		-0.25	**	-0.40	*
End-of-expansion (EOE) dummy variable[f]	1.88	**	-2.16	**	0.67		-2.49	**
Adjusted R^2	0.71		0.65		0.66		0.41	
Standard error of estimate	1.81		1.76		1.45		1.62	
Sum of squared residuals	388.34		367.52		182.18		228.93	
Chow Test[h]					1.50		0.38	
Mean Lag/Lead Response to Output Changes	0.90		-2.19		1.40		-1.70	
Long Run Response to Output Changes[i]	0.76		0.21		1.20		0.09	

US: Long-Run Responses, Before and After 1986

Figure 6. Long Run Response of Labor Productivity and Aggregate Hours by Conventional Definitions using 1954:Q1 – 1986:Q1 vs 1986:Q1 – 2010:Q2 Coefficients
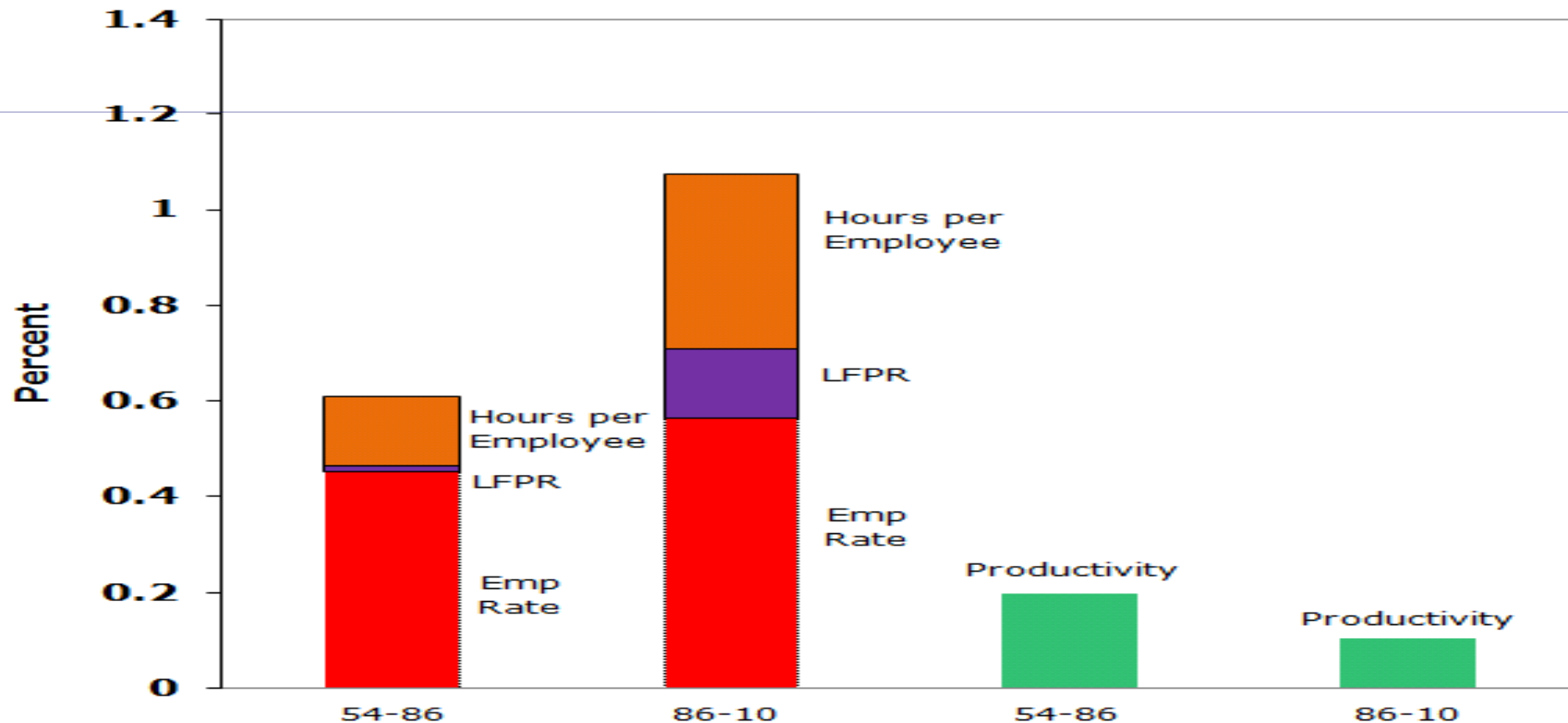
Actual and Fitted, 4-qtr Changes, Early and Late Equations for Hours

Figure 7a. Annual Growth Rates of Actual, Fitted, and Trend Aggregate Hours, Early and Late Coefficients, Conventional Identity
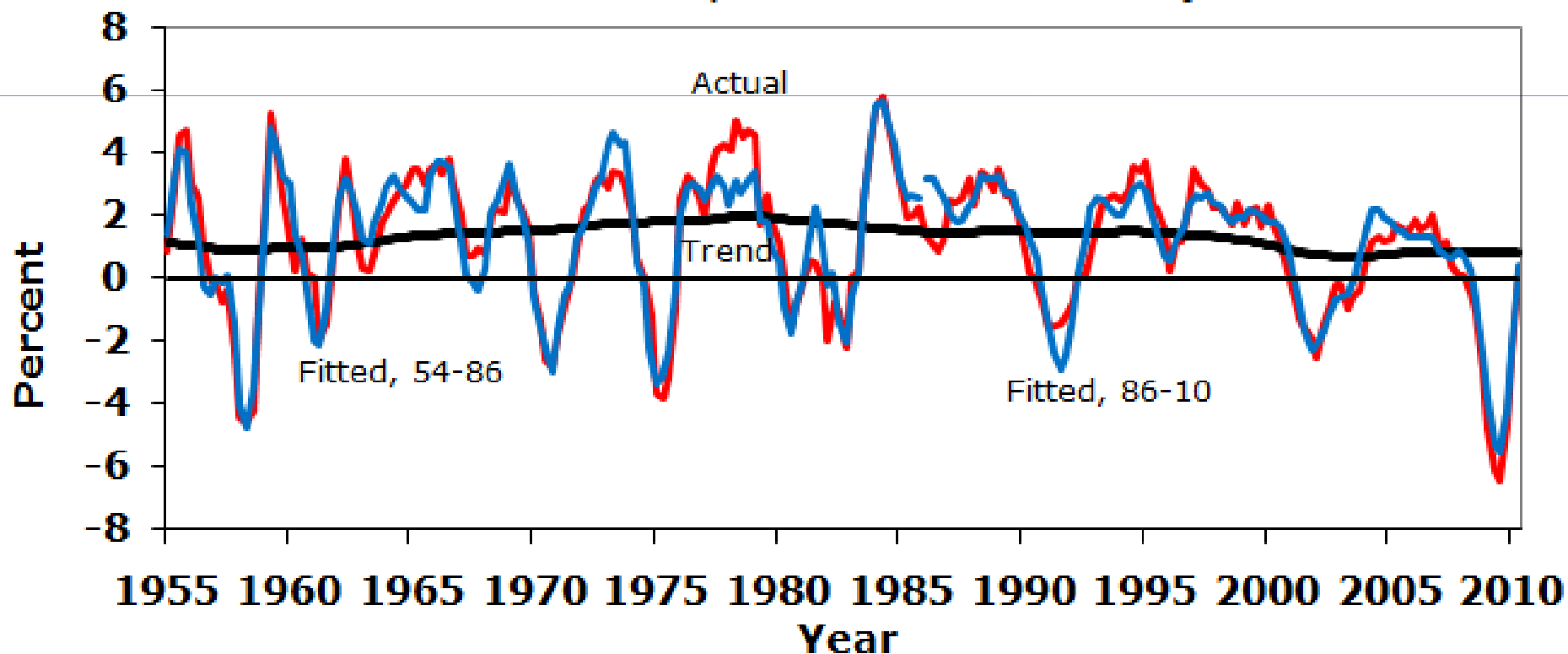
Actual and Implied Fitted for LP, Backed Out of Hours Equation

Figure 8a. Actual, Fitted, and Trend Growth Rates for Labor Productivity, Early and Late Coefficients, Conventional Identity, 1955:Q1 – 2010:Q2
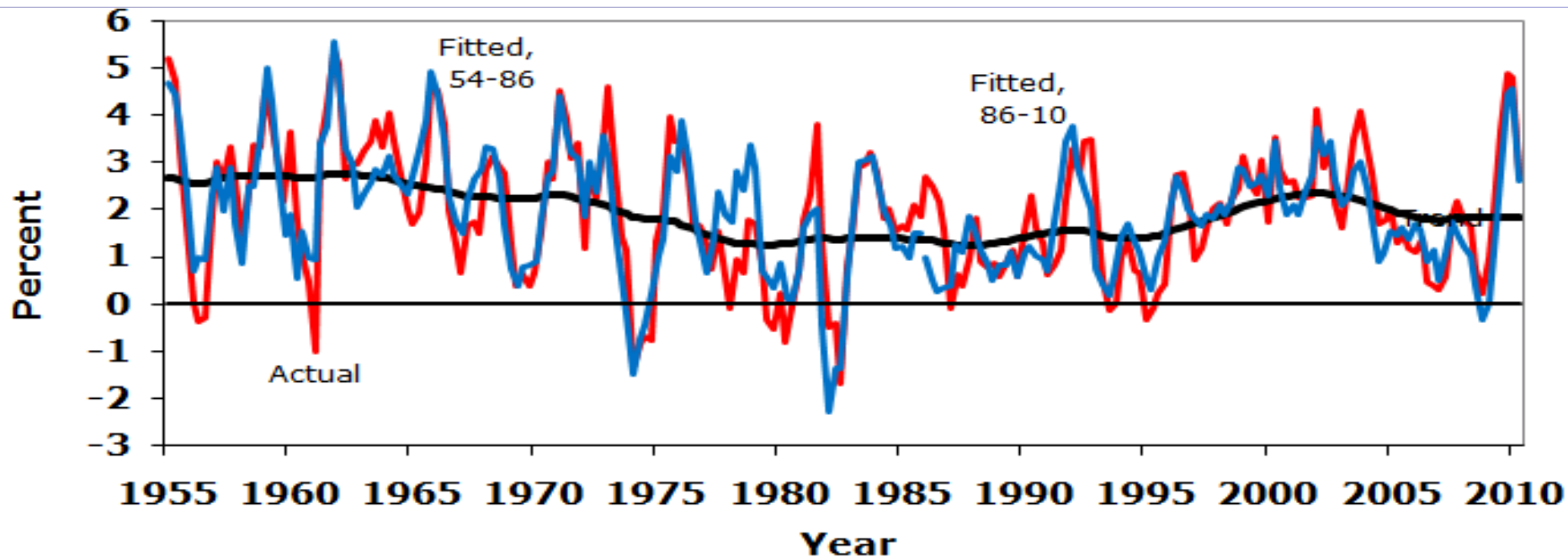
Stripped Down Identity for Comparing US and European Data

$$Y \equiv \cdot \frac{Y}{E} \cdot \frac{E}{N} \cdot N$$

- No suitable data for the EU on aggregate hours, LFPR
  - Y/E: Output per Employee, the Productivity Measure
  - E/N: Employment per Capita, the Labor Input Measure

# Comparing the US and the EU, Graphs and Regressions

- Uses stripped down output identity: output per capita as the productivity measure and employment per capita as the labor input
- Other differences from full US regression
  - No EOE variable (not available for Europe)
  - Shorter time period, 1977:Q1 – 2010:Q4
    - Early = 1977-1993, Late = 1994-2010
  - No outside cyclical variable, instead we use Hodrick-Prescott filter with a parameter of 6400, running the trends to 2007:Q4 and extending the trend growth rates to 2010:Q4

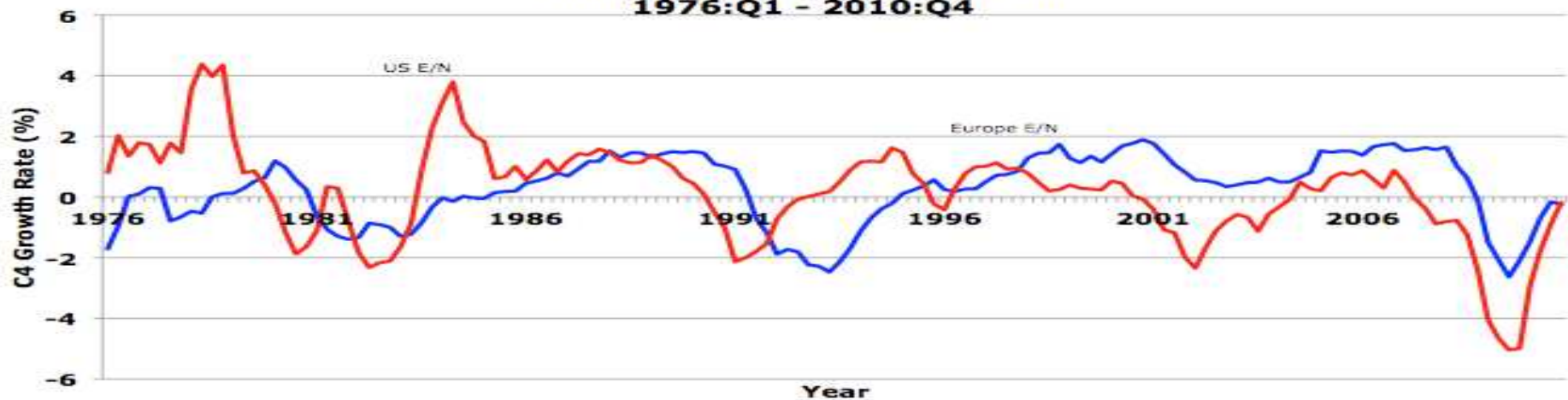# Observations on the Actual Growth Rates in US and EU

- Change in output growth from 2008-2010 is nearly identical for EU and US

- 1997-2007, average growth of E/N ratio was substantially faster in the EU.

- Decline in European E/N ratio in 2008 - 2009 is only about half of US decline

- It follows that labor productivity must have grown more slowly in the EU after 1997, as shown in the graph of Y/E

US vs EU: Actual Four-Quarter Growth of Output, Labor

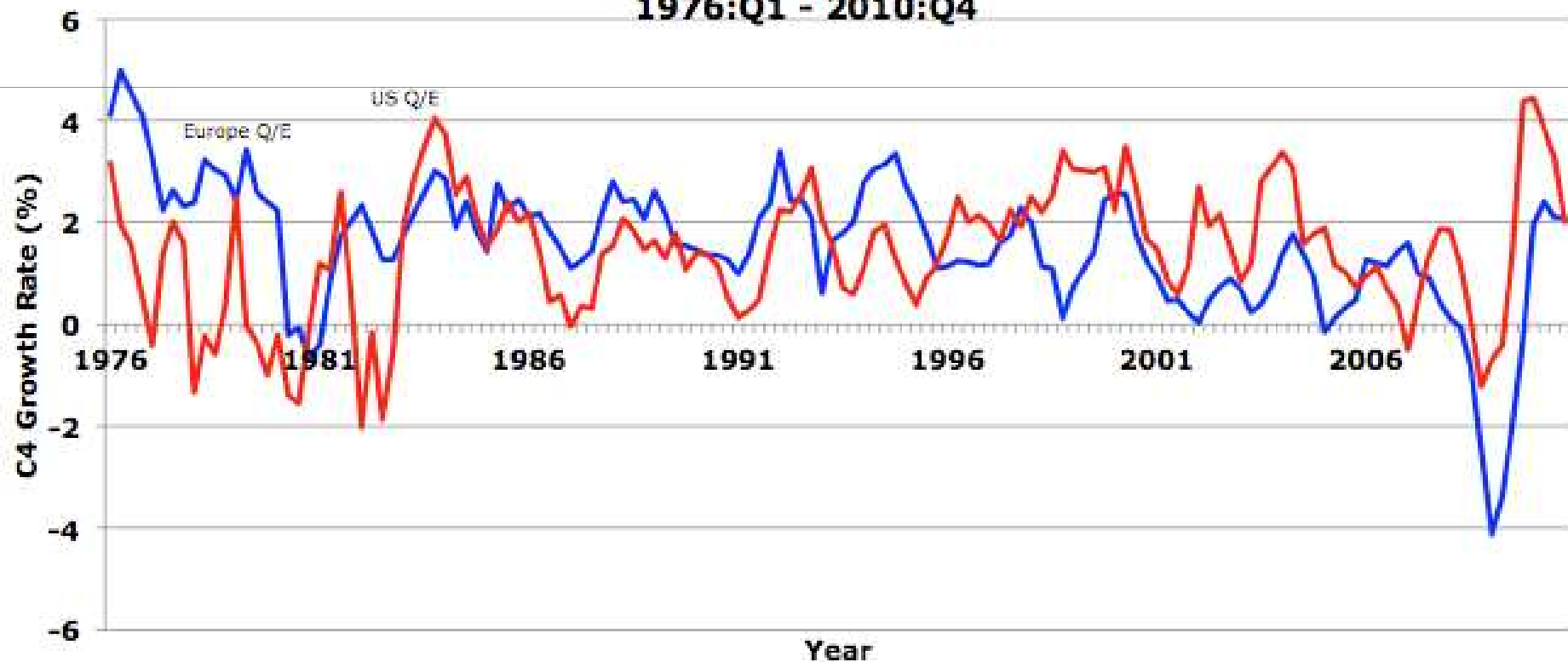Figure 8a. US vs. Europe Four-Quarter Actual Growth Rates of Output per Capita 1976:Q1 – 2010:Q4
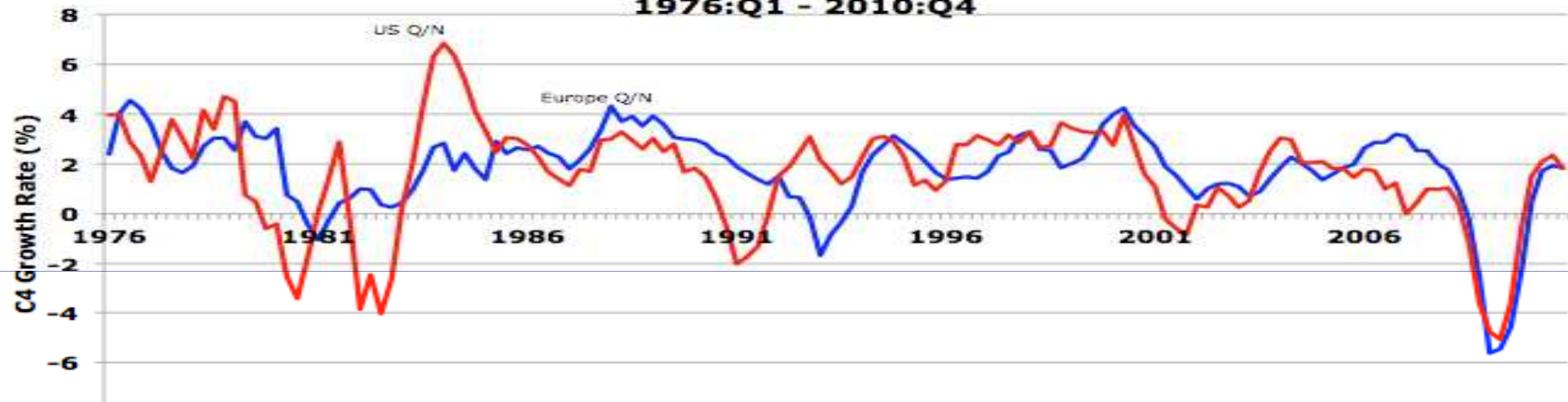
Figure 8b. US vs. Europe Four-Quarter Actual Growth Rates of Employment over Population 1976:Q1 – 2010:Q4

US vs EU: Actual Four-Quarter Growth of Output per Employee (Productivity)

Figure 8c. US vs. Europe Four-Quarter Actual Growth Rates of Output per Employee
1976:Q1 - 2010:Q4

Observations on Gaps in US and EU

- The gap for a variable is the percent log ratio between actual and trend
- Can see that the depth of the 2008-2009 recession was virtually identical in US vs. EU
- E/N gap in 2008-2009 declines less in the EU than in the US, but the difference is smaller than for actuals b/c the faster E/N trend in the EU is subtracted out

Observations on Gaps in US and EU (cont.)

- Two facts:
  - 1) EU employment growth in 2008-2009 dropped only about half as much as in the US
  - 2) Relative to trends, decline in EU employment was only modestly less severe than in the US
- Productivity Gaps: US had an earlier and shorter lived drop in productivity in the recent recession, with a more complete recovery: productivity gap in 2010:Q4 was -0.1 for US, -3.4 for Europe

US vs EU: Gaps for Output, Labor

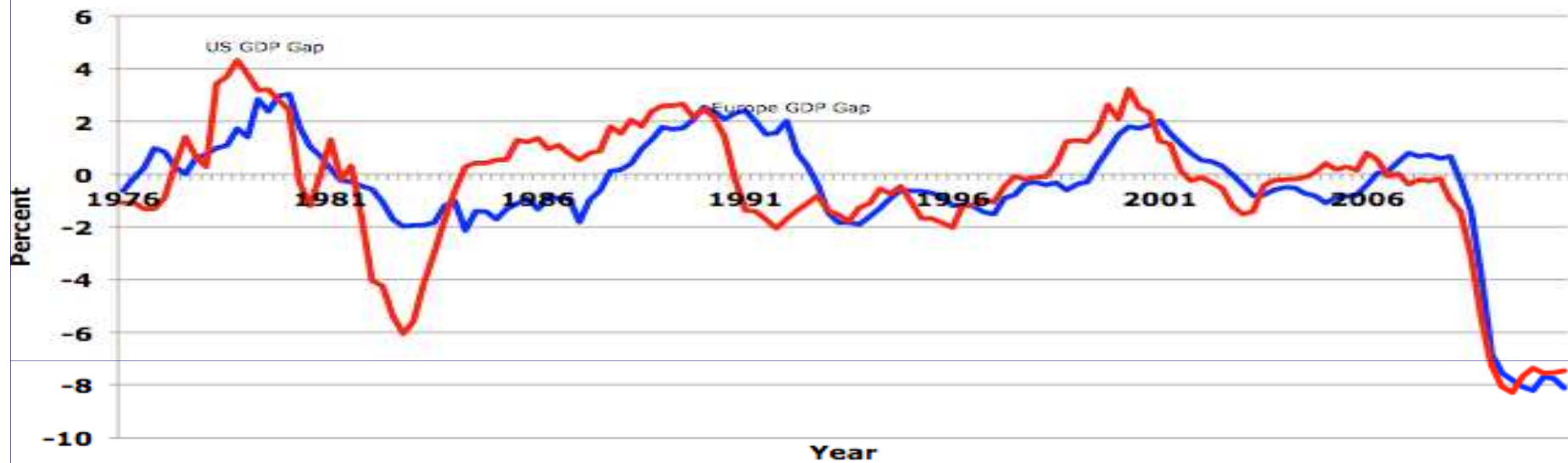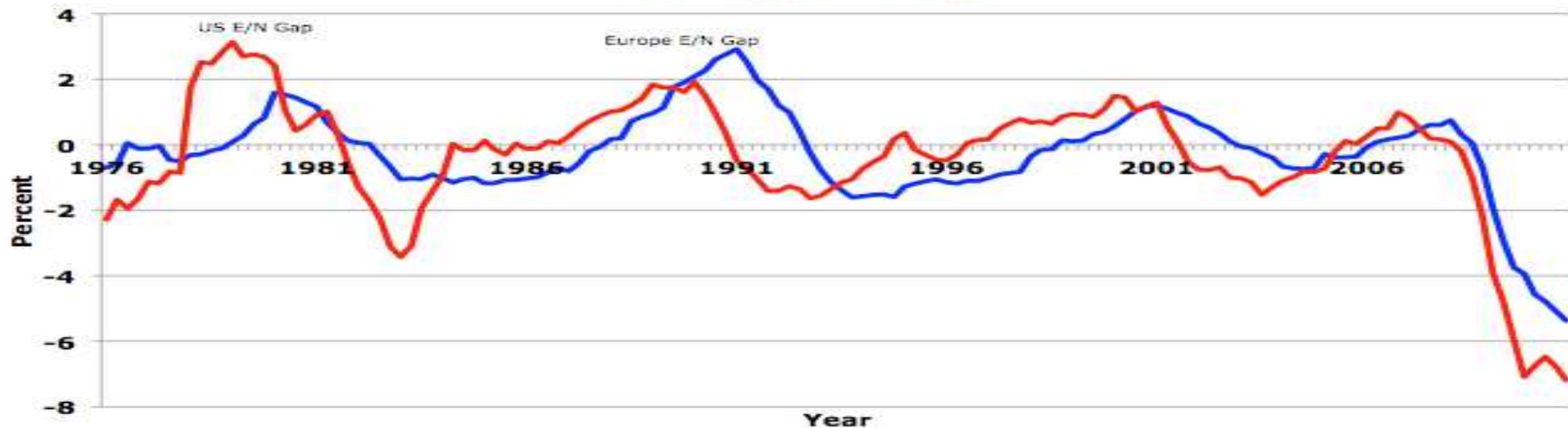Figure 10a. Europe vs US GDP Gap (HP 6400) 1976:Q1 to 2010:Q4

Figure 10b. Europe vs US Employment over Population Gap (HP 6400) 1976:Q1 to 2010:Q4

US vs EU: Gaps for Productivity (Output per Employee)

Figure 10c. Europe vs US Output per Employee Gap (HP 6400) 1976:Q1 to 2010:Q4
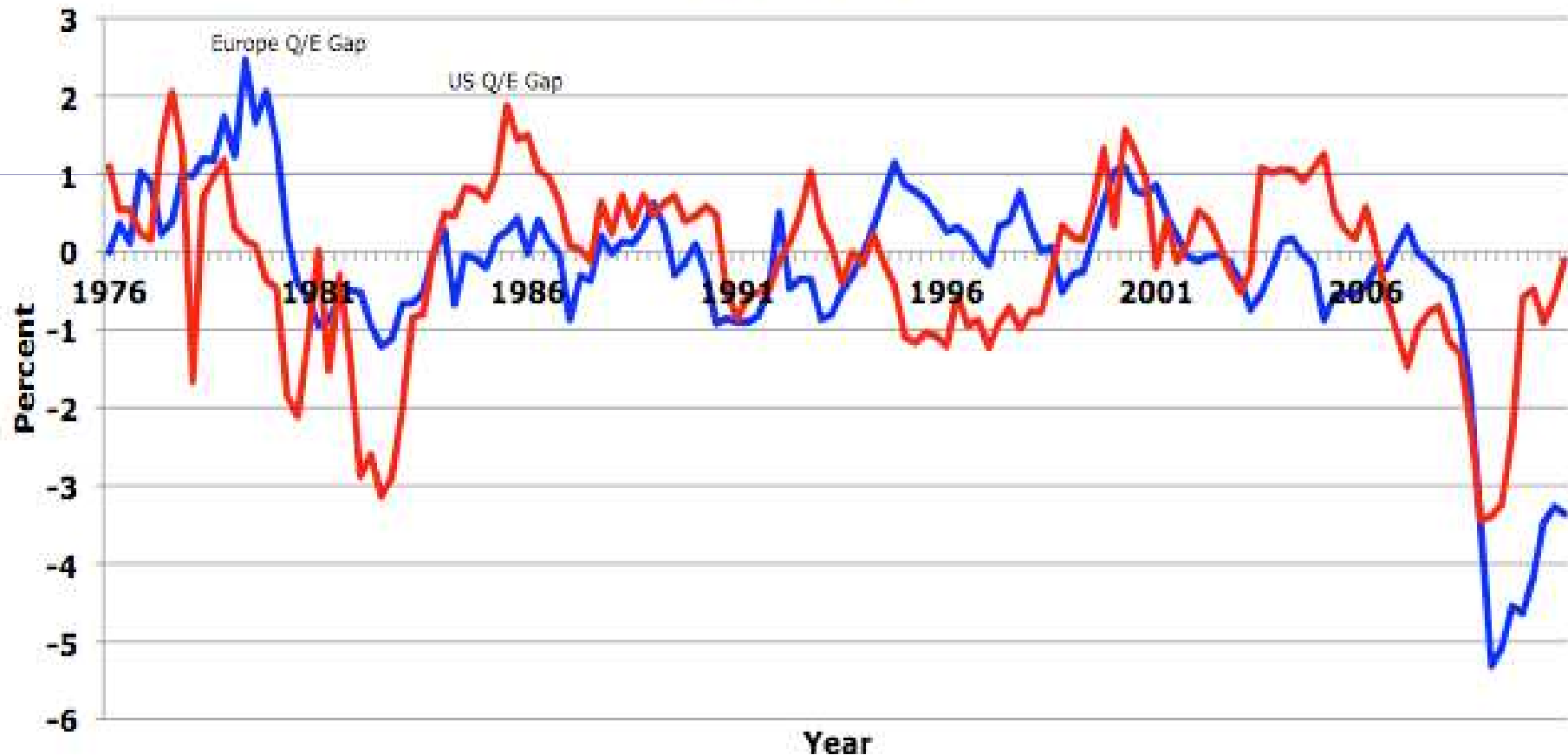
Overall Differences in US and Europe Graphs

- In EU, employment tends to respond less than in the U.S. to output changes in the late half of the data (1994-2010)

- Difficult to analyze differences before 1994, because both output and employment were more volatile in the US than in the EU during the first 10 years of the data (1976-1986)

Regression Analysis Europe vs. US, 1977-2010

- Dependent variables: labor (E/N), productivity (Y/E)
- Independent variables:
  - 4 lags of dependent variable
  - Current value and 4 lags of output
  - Error correction term
- Measures of productivity and labor are different from full US regression (Y/H and H/N respectively). Because we expect procyclical fluctuation in hours per employee, the long-run US response of employment to output changes in the comparative regression should be lower than in the full regression.

Table 6. Regressions Explaining Cyclical Deviations from Trend in Employment over Population[a], 2007:4 Trend End

Independent Variable	1977:2 - 1993:4		1994:1 - 2010:4		1955:2 - 1986:1	1986:1 - 2010:4
	E/N US	E/N EU	E/N US	E/N EU	E/N US	E/N US
Lagged dependent variable[b]	-0.16	0.59 **	0.08	0.25	-0.14	0.17
Output deviation from trend[c]	0.73 **	0.44 **	0.83 **	0.49 **	0.63 **	0.72 **
Error correction term[d]	-0.19	-0.18	-0.02	0.00	-0.27	-0.03
Adjusted R^2	0.36	0.59	0.68	0.74	0.40	0.62
Standard error of estimate	1.73	0.73	0.99	0.61	1.94	0.97
Sum of squared residuals	170.13	30.40	56.36	21.26	430.00	84.26
Chow Test[e]			0.91	0.44		1.37
Mean Lag/Lead Response to Output Changes	1.13	1.66	1.48	1.29	0.72	1.50
Long Run Response to Output Changes[f]	0.63	1.07	0.90	0.65	0.55	0.87

Table 7. Regressions Explaining Cyclical Deviations from Trend in Output Per Employee[a], 2007:4 Trend End

Independent Variable	1977:2 - 1993:4		1994:1 - 2010:4		1955:2 - 1986:1	1986:1 - 2010:4
	Y/E US	Y/E EU	Y/E US	Y/E EU	Y/E US	Y/E US
Lagged dependent variable[b]	-0.21	0.52 **	0.19	0.09	-0.15	0.24 *
Output deviation from trend[c]	0.50 **	0.17	0.07	0.51 **	0.59 **	0.10 *
Error correction term[d]	-0.11	-0.34 *	-0.03	-0.20	-0.10	-0.06 *
Adjusted R^2	0.68	0.84	0.79	0.89	0.70	0.76
Standard error of estimate	1.75	0.73	0.99	0.58	1.99	0.97
Sum of squared residuals	174.82	30.33	57.38	19.65	449.94	84.56
Chow Test[e]			0.80	0.81		1.07
Mean Lag/Lead Response to Output Changes	-1.37	-1.25	-7.09	-0.89	-0.31	-5.50
Long Run Response to Output Changes[f]	0.42	0.35	0.08	0.56	0.52	0.13

Implications of Regression Results

- In the US there was a distinct shift toward unitary response of labor input to output changes, and zero response of productivity.
  - This response was almost identical in the 1954-2010 and 1976-2010 sample periods
- In Europe there was an opposite shift toward increased responsiveness of productivity and decreased responsiveness of the labor input.
- Need an explanation for these opposing trends

Unified Explanatory Hypothesis: "American Exceptionalism"

- Joint explanation of changes in American and European behavior

- American shifts toward greater labor response explained by "disposable worker" hypothesis

- Europe's opposite shift explained by the absence of the conditions of the "disposable worker" idea and by differing institutions and policies that promote work sharing.

Explanatory Hypothesis: The Disposable Worker

- Explains both rise in cyclical responsiveness and of income inequality
- Ingredients in increased management power: exec pay based on stock options, sensitivity to 2000-02 and 2007-09 stock market debacles
- Stock options help explain huge increase in share of top 1% 1982-2000 and fluctuating share since then
- Increased emphasis by management on *maximizing shareholder value*

Not just Strong Management, Weak Workers

- Contributions of weak labor bargaining power the same list as the sources of increased income inequality in the bottom 90 percent

- Lower real minimum wage, reduced penetration of unions in the private sector, more imports, more low-skilled immigration

Explanations for EU Behavior

- Three broad differences between the US and Europe offer a point of departure for developing explanations:
  - 1) Different evolution of inequality
  - 2) Longstanding European regulations that protect employment
  - 3) Explicit European institutions encouraging work-sharing and reducing hours, both in the long run and during a cyclical downturn

Differences in Inequality

- The U.S. exhibited a move toward maximizing shareholder value and cost-cutting. This move has the same causes as the increasing income inequality in the U.S. as compared to Europe.

- Factors leading to lower European inequality and lower responsiveness of labor to output:
  - Smaller role of short-term profit maximization in management
  - Greater power of unions
  - Corporatist tradition: unions join with management in making decisions that ultimately effect labor responsiveness
    - (Obviously this differs across different nations within the EU-15)

Differences in Inequality (cont.)

- Income share of top 0.1% in the US quadrupled from 2 to 8 percent between 1975 and 2000.

- Top share in France has remained remarkably stable, increase in U.K. has been relatively moderate compared to U.S.

- Gini Coefficients: EU Average = 0.31, US = 0.45

- Cultural customs and institutions (e.g. traditional role of labor of German corporate boards) play a large role in determining inequality.

- US unions have very little influence over management, leading to decisions that can cut jobs and make labor much more responsive to output swings

Employment Protection Legislation

- Pre-1980, EU had consistently lower unemployment than US
- After 1980 EU Governments enacted policies that reduced employment per capita to deal with the hardships of higher unemployment
- Employment Protection Legislation (EPL) – An attempt by EU governments directly to regulate layoffs
  - Outright bans as well as mandated severance packages. This helps to explain the shift toward less elasticity in the response of labor to output swings in Europe.
  - Timing question: EPL reached its peak in the early 1990s
- Backlash against EPL: After 1995 several EU countries introduced a flexible second tier of employment

Work Sharing

- Legislation and policies by EU countries since 1985 aimed at cutting work hours instead of firing employees
  - Sweden: reduction in hours is aimed at providing parental leave to parents of both genders
  - Netherlands: shift to part-time work to accommodate the cultural norm that mothers should not work full time
  - Germany: hours reductions have been achieved through corporatist negotiations between employers and unions
  - France: switched to a compulsory 35-hour work week

Work Sharing (cont.)

- Work sharing in Europe represents a link to the responsiveness of labor input
  - shows that European countries view hours as an adjustment mechanism to respond to output changes, while US cost-cutting most often takes the form of layoffs
  - Further exploration of this requires data on aggregate hours

Conclusions for Macro

- US Changes after 1986
  - Okun's Law is Dead
  - Procyclical productivity innovations are dead
  - RBC model and "technology shocks" are no longer relevant as core determinants of business cycles
  - "Technology shock" paradigm represents an arbitrary exclusion restriction on 10 or 12 other important causes of output fluctuatios
- Europe
  - Comparisons are tentative under the absence of quarterly hours and labor force series
  - Analysis shows that trends in responsiveness of labor and productivity have been opposite in Europe and the U.S.

Further Research

- Much remains to be accomplished in this line of investigation.
- Need a data series on European aggregate hours
  - Makeshift solutions: (a) look just at annual hours, (b) look at quarterly, available only 2000-2010
- Need to recognize differences among EU countries
  - Could split Europe between AU-GE-NL vs. the others and/or between northern and southern Europe