

# **Productivity Growth: Concepts, Causes, and the Diverging U. S. Performance**

Robert J. Gordon

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# Ultimate Measure of Economic Success

- Standard of Living = Income per capita
  - 1.3% growth, doubles every 53 years (Philippines)
  - 5.6% growth, doubles every 12 years (Korea)
- For very long-term growth or comparing rich and poor nations, Income per capita and productivity are the same thing
- Not the same thing for short-term or comparisons among rich nations

# How Productivity is Related to Total Output

Output (Q) Equal to the product of:

- Productivity ( $Q/A$ )
- Hours per Employee ( $A/E$ )
- Employment Rate ( $E/L$ ), that's just  $(1 - U/L)$
- Labor-force Participation Rate ( $L/N$ )
- Working-age Population ( $N$ )

$$Q \equiv \frac{Q}{A} \cdot \frac{A}{E} \cdot \frac{E}{L} \cdot \frac{L}{N} \cdot N$$

# How Productivity is Related to Output per Capita

Output (Q) Equal to the product of:

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- Hours per Employee ( $A/E$ )
- Employment Rate ( $E/L$ ), that's just  $(1 - U/L)$
- Labor-force Participation Rate ( $L/N$ )
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$$\frac{Q}{N} \equiv \frac{Q}{A} \cdot \frac{A}{E} \cdot \frac{E}{L} \cdot \frac{L}{N}$$

# How Could Europe be So Productive Yet So Poor

Output per Capita ( $Q/N$ )

In Europe 75% of U. S.

Productivity 95% of U. S.

The Difference:

- Hours per Employee ( $A/E$ )
- Employment Rate ( $E/L$ )
- Labor-force Participation Rate ( $L/N$ )

$$\frac{Q}{N} \equiv \frac{Q}{A} \cdot \frac{A}{E} \cdot \frac{E}{L} \cdot \frac{L}{N}$$

# Determinants of Productivity Growth

- Simplest Production Function

$$Q = F(K,N)$$

- Add Technology

$$Q = F(K,N,T)$$

- This is the Solow Growth Model

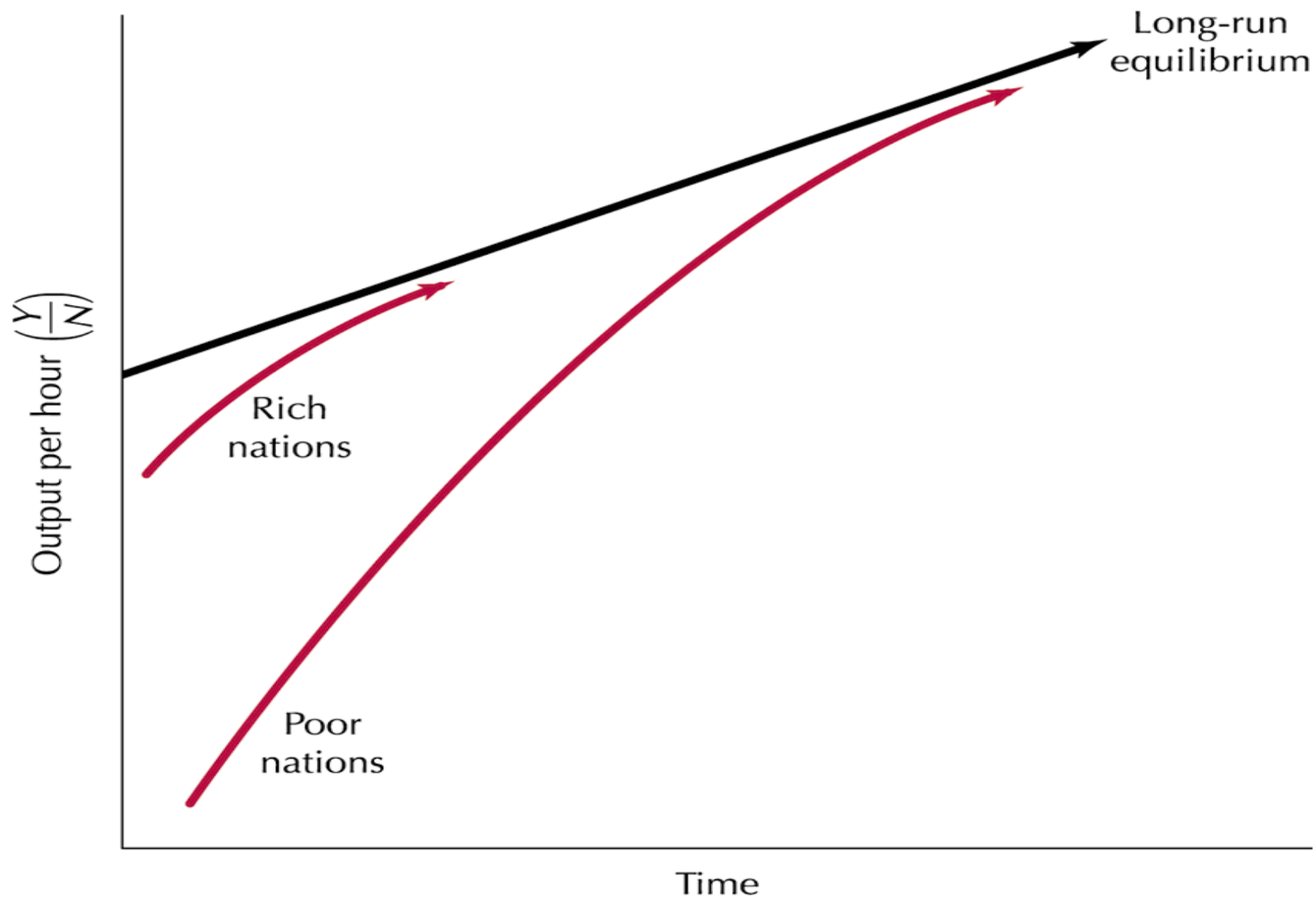
- Predictions:

- Raising saving rate affects growth rate only temporarily
- Universal convergence

# Puzzles the Solow Model Does Not Explain

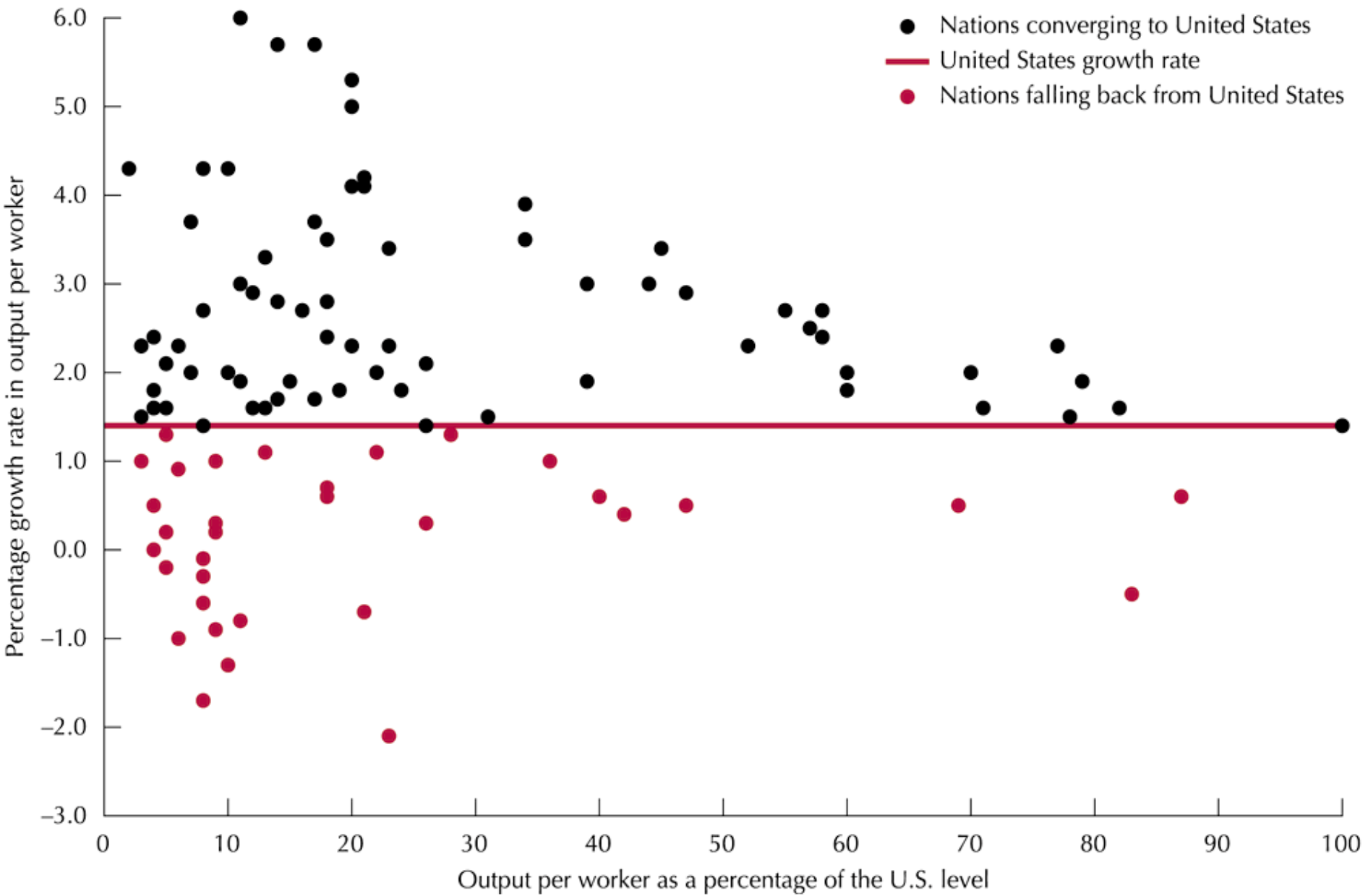
- Lack of Convergence (East Asia vs. Africa and Latin America)
- To explain a 10-1 ratio of  $Q_{pc}$  in rich vs. poor countries, unrealistically requires:
  - 10000 times as much capital per capita
  - 1/1000 the rate of return on capital

# POOR NATIONS GROW FASTER WHILE THEY ARE CONVERGING





# MANY NATIONS ARE FALLING BACK RATHER THAN CONVERGING



# What is Missing?

- Lack of Human Capital
- $Q = F(K, N, T, H)$
- Instead of receiving 25% of national income, total capital (human and physical) receives 90%
- Labor's 75% income share is interpreted as 10% "brute force labor" and 65% as reward to education and experience

# What Else is Missing?

- Human capital resolves the problem about unrealistic ratios of rich-to-poor  $K/N$  and return to capital
- But it leaves the “Rio Grande Puzzle”
- How to go from 40c per hour to \$10 per hour in one easy wade
- Human capital is not changed, must be something else

# Technology is not Free

- The “New” Growth Theory Makes Technology part of economics
  - Must pull resources from production to work in R&D labs
  - Must provide an incentive for innovation
  - Patent Protection
  - Technology requires H, K to be used
- Case of the drug companies, AIDS in Africa, importing drugs from Canada

# The New Comparative Economics: What Else is Missing?

- Geography: The Tragedy of the Tropics (soil, diseases, enervation)
- Crime, corruption
- Infrastructure
  - Lack of phones, electricity, roads

# Putting it Together

- The augmented production function, it starts to explain rich vs. poor
- How this solves the Rio Grande puzzle
  - P = political capital (legal system etc)
  - G = geography
  - R = infrastructure
  - Q =  $F(K, N, T, H, P, G, R)$

# Application #1: How Can Europe be So Productive Yet So Poor

- The History: Europe falls back 1870-1950 and then catches up
- The catch-up is almost complete in productivity ( $Q/A$ )
- The catch-up is incomplete in output per capita ( $Q/N$ )
- Why?
  - Must be that Europe's  $A/N$  is lower
  - Why?

# Per Capita Real GDP

per Capita Real GDP, Europe and the United States,  
Selected Years, 1820-2000



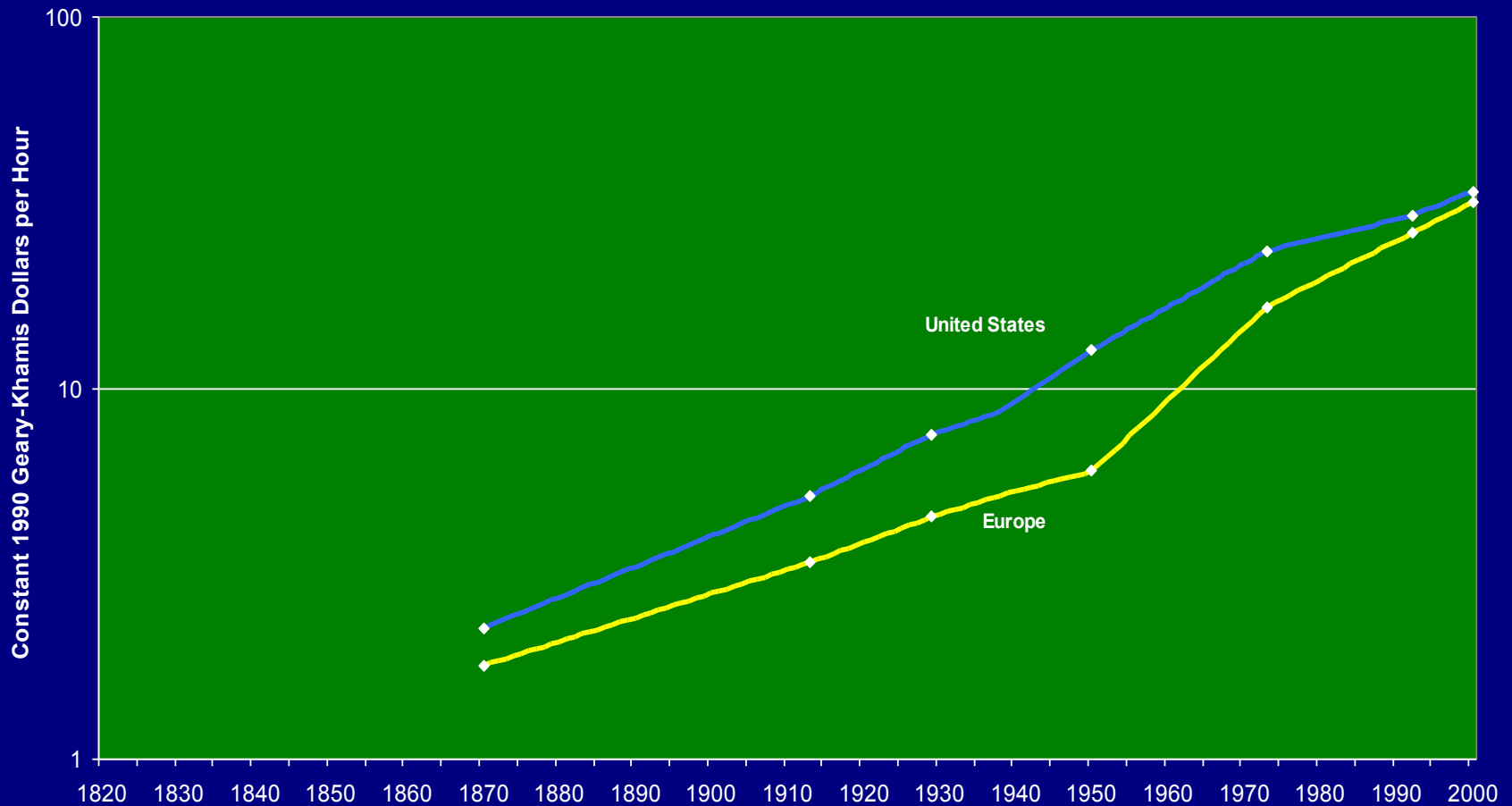


# Essential Features of Income per Capita since 1870

- Steady rate of real GDP per capita growth in the US
  - 1.81% per year growth between 1870-2000
  - Huge acceleration between 1963-73
- Slower growth in Europe
  - 1.67% per year growth between 1870-2000
  - Downward dislocations due to the World Wars
  - Golden years of catch-up between 1950-1973
- Since 1973 catch-up is complete

# Real GDP per Hour

Real GDP per Hour, Europe and the United States,  
Selected Years, 1870-2000

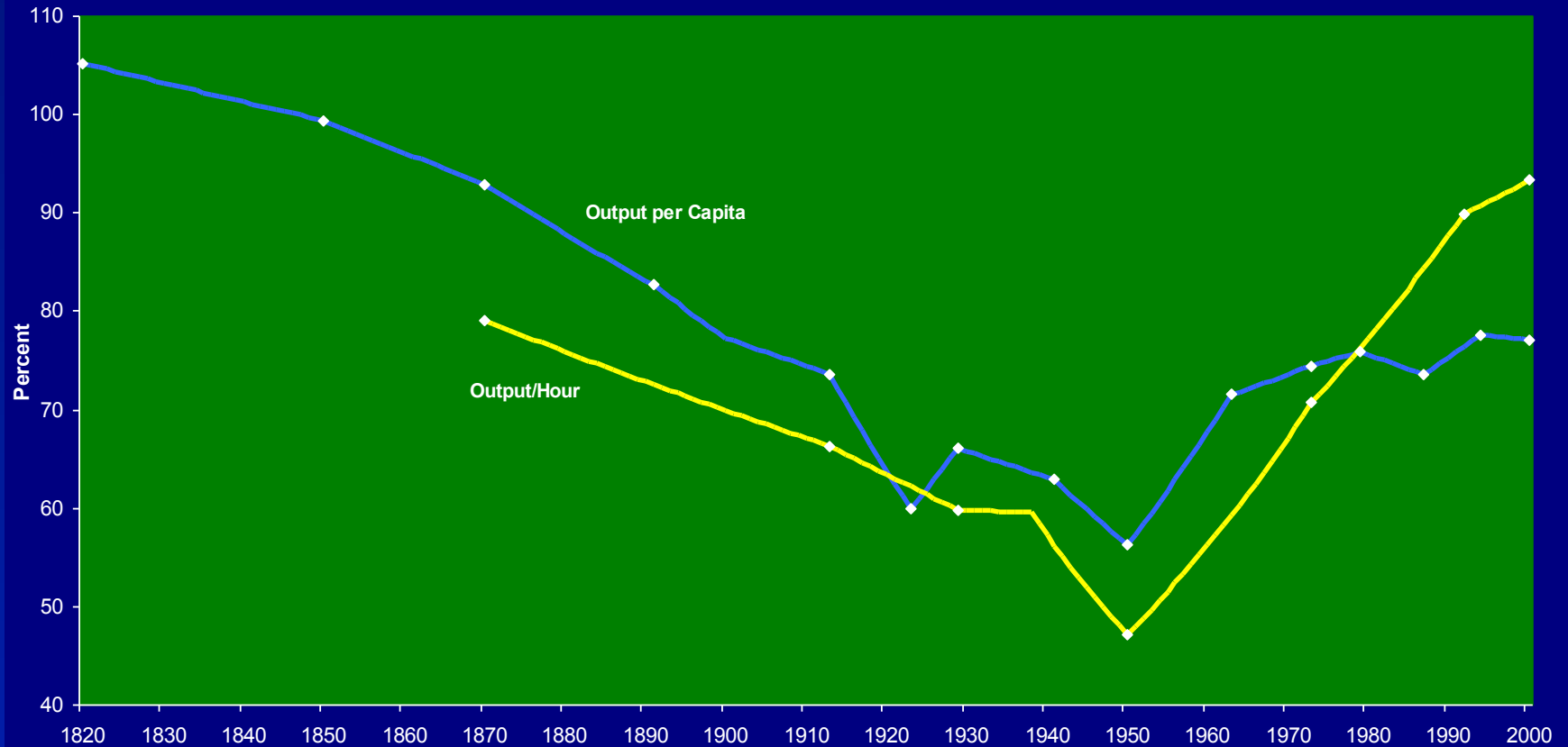


# Summarizing the Productivity Record

- U.S. record of productivity growth is not as steady as for output-per-capita
  - Strongest performance between 1938-50
  - Slowdown between 1973-92
- Europe plays catch-up
  - Much slower growth than the U.S. between 1870-1950 (1.50% vs 2.15% for the US)
  - Nearly closes the gap by 2000
- In this section we're ignoring the new divergence after 2000

# Output per Capita and Output per Hour

Ratio of Europe to the United States,  
Output per Capita and Output per Hour,  
selected years, 1820-2000



# Features of the Output per Capita, Europe/U.S. ratio

- The Europe/U.S. ratio of output per capita declines steadily from 1829 to 1950.
- Upsurge from 1950-1973
- Stagnation between 1973-2000

# Europe/U.S. ratio for productivity growth

- The same downward slide between 1870 and 1950
- Europe has a higher level of hours per capita
- After 1950 much faster growth in the productivity ratio

# Real GDP per Capita and Real GDP per Hour

	1820-70	1870-1913	1913-1929	1929-1950	1950-1973	1973-2000
Output per Capita						
Europe	1.05	1.25	0.97	0.79	3.61	1.77
U. S.	1.29	1.79	1.65	1.55	2.40	1.64
Europe - U. S.	-0.24	-0.54	-0.68	-0.76	1.21	0.13
Output per Hour						
Europe		1.49	1.76	1.35	4.44	2.40
U. S.		1.90	2.40	2.48	2.68	1.37
Europe - U. S.		-0.41	-0.64	-1.13	1.76	1.03
YpC / YpH						
Europe		-0.24	-0.79	-0.56	-0.83	-0.63
U. S.		-0.11	-0.75	-0.93	-0.28	0.27
Europe - U. S.		-0.13	-0.04	0.37	-0.55	-0.90

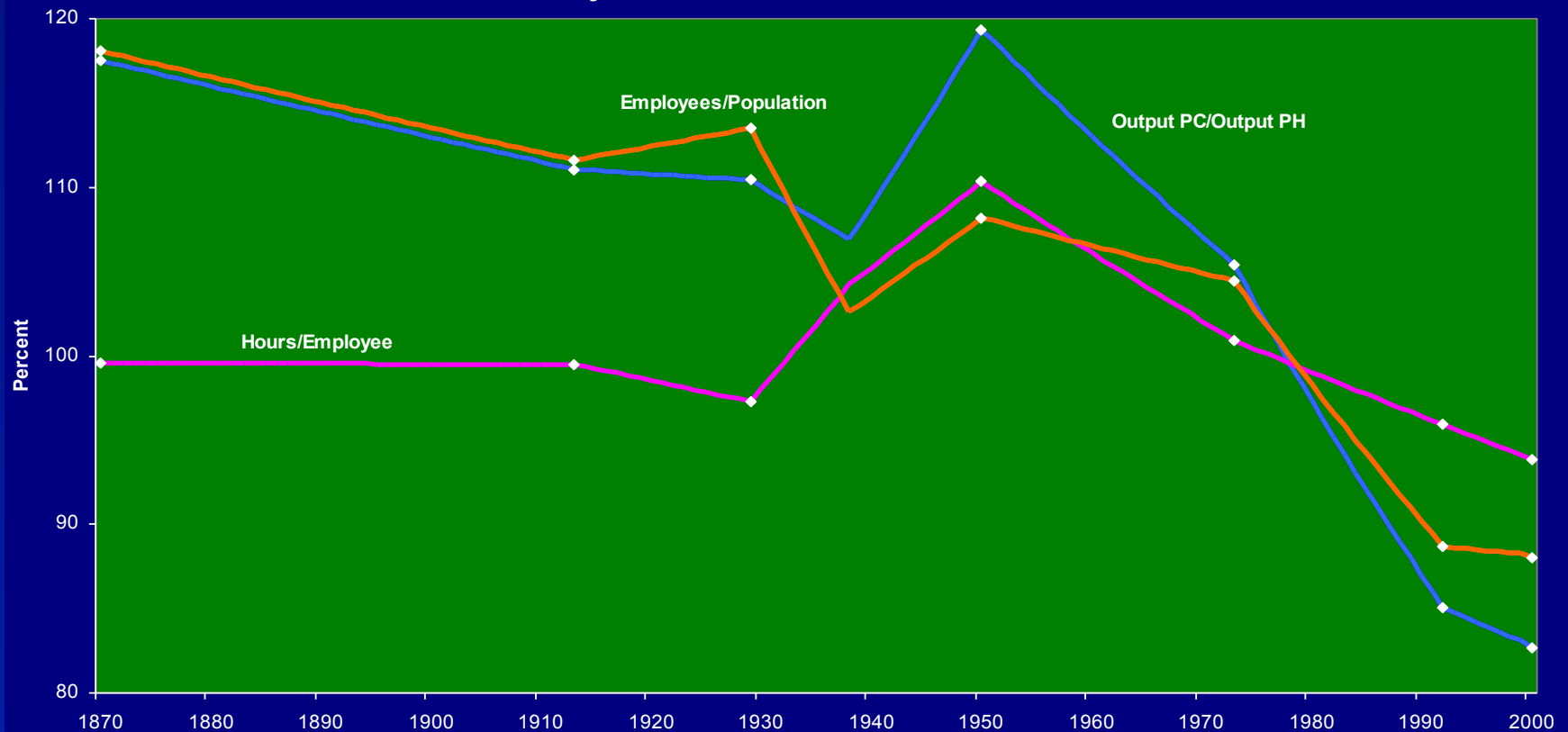
# The Post-1950 Reversal

- Sharp turn of Europe/U.S. ratios of output per capita and productivity after 1950.
- Sharp retardation in growth of output per capita in Europe relative to productivity growth after 1950.
  - Longer vacations contribute to few hours worked per employee



# The Contributions of E/N and H/E

Ratio of Europe to the United States, Ratio of Output per Capita to Output per Hour, Decomposed into Hours/ Employee and Employee/Population Ratios, selected years, 1870-2000



# Standard of living: held down by vacations (H/E)

- Have citizens chosen to use their prosperity to take longer vacations in contrast to Americans?
- Have Europeans been forced to take vacations because of union or parliamentary politics?

# Ian on Work Hours

- “To call long work hours in America a bad thing seems odd”
- “People here have the choice to work as long as they want”
  - “Europeans would work longer if they could”
  - “France wouldn’t need labor police if nobody wanted to work more than 35 hours”

# Europe's Low E/N Matters as much as Low H/E

- High Unemployment
  - High Youth Unemployment
  - High long-term Unemployment
- Low Labor-force Participation
  - Of Youth
  - Of Elderly

# Causes of Low E/N

- Lack of Job Opportunities for Youth:
  - Late Marriage Ages
  - Late Development of Independence
    - U. S. Youths working in High School and College
  - Low Fertility Rates
  - Italy: Living at Home with Mama

# Poor Labor-Market Performance in Europe

- Why is Average EU Unemployment Rate Higher than US, LFPR Lower?
- Minimum Wages, U Benefits
- Regulations on Hiring, Firing, Plant Closings, Plant Openings
- This is an old Story, still valid

# Phelps' Refreshing departure from Vagueness

- Too little competition, too much corporatism
- “penalties, impediments, prohibitions, mandates” that dampen “creative destruction”
- Youth in America vs. Europe, culture of “dependency”
- American teens work at McDonalds, pay part of their college expenses
- Those Italian men!

# Other Big Issues

- GDP Exaggerates U. S. GDP per Capita
  - This has nothing to do with Competition
  - Extreme climate, lots of air conditioning, low petrol prices, huge excess energy use
  - Crime, excessive urban density impose costs
- U. S. Medical Care Inefficiency Creates Medicare Crisis
- U. S. Social Security Crisis can be put off forever through open immigration



# **This is not black vs. white. It reflects different values**

- U. S. Low-density metro areas dependent on auto, high unmeasured cost of traffic congestion, subsidies to auto transit, starvation of public transit
- Europe high-density metro areas, unmeasured time cost of public transit, subsidies to public transit

# Ian on Urban Density

- “We overspend on highways, they overspend on trains”
- “We live in suburbs and have long commutes, they live in cramped homes and are closer to work”
- “We have options: in Chicago I can live in a suburb and drive OR live in an apartment and walk to work”
- Contra Ian, many Americans lack such options
  - Inner city African Americans seeking suburban jobs
  - Many medium and small cities have virtually no public transit options, and there are few jobs where you can “walk to work”

# A Solid Reason why the U. S. Welfare Level is Truly Higher

- Hedonic regressions show: people value square feet of housing and exterior land
- The average American housing unit is more than double the average European unit
- The land area is at least 4x, maybe more
- The time cost of commuting may be less when all the delays of public transit are taken into account

# Summarizing Welfare Comparison

- Started with Europe/ US Ratios

Q/N 77

Q/A 93

- One-third of A/N is voluntary

Q/N 82

Q/A 93

- One-half of remaining YPC difference disappears because U. S. GDP is overstated

Q/N 91

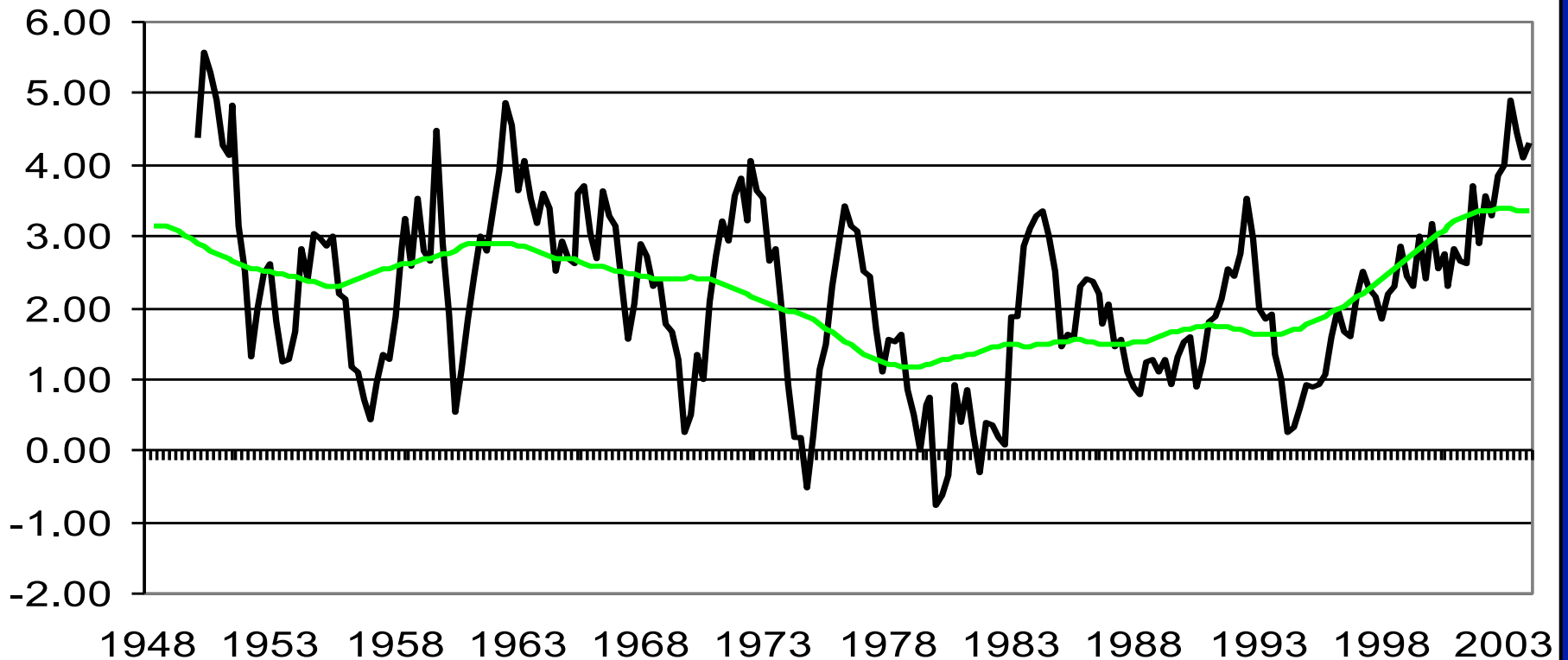
Q/A 102

# The New Productivity Divergence

- Focus on 1995-2003
- Growth rates of GDP per Hour Worked
  - U. S. 2.33
  - Europe 1.15
  - Difference 1.18
- Over eight years, causes Europe/US to fall back from 94 to 85 percent

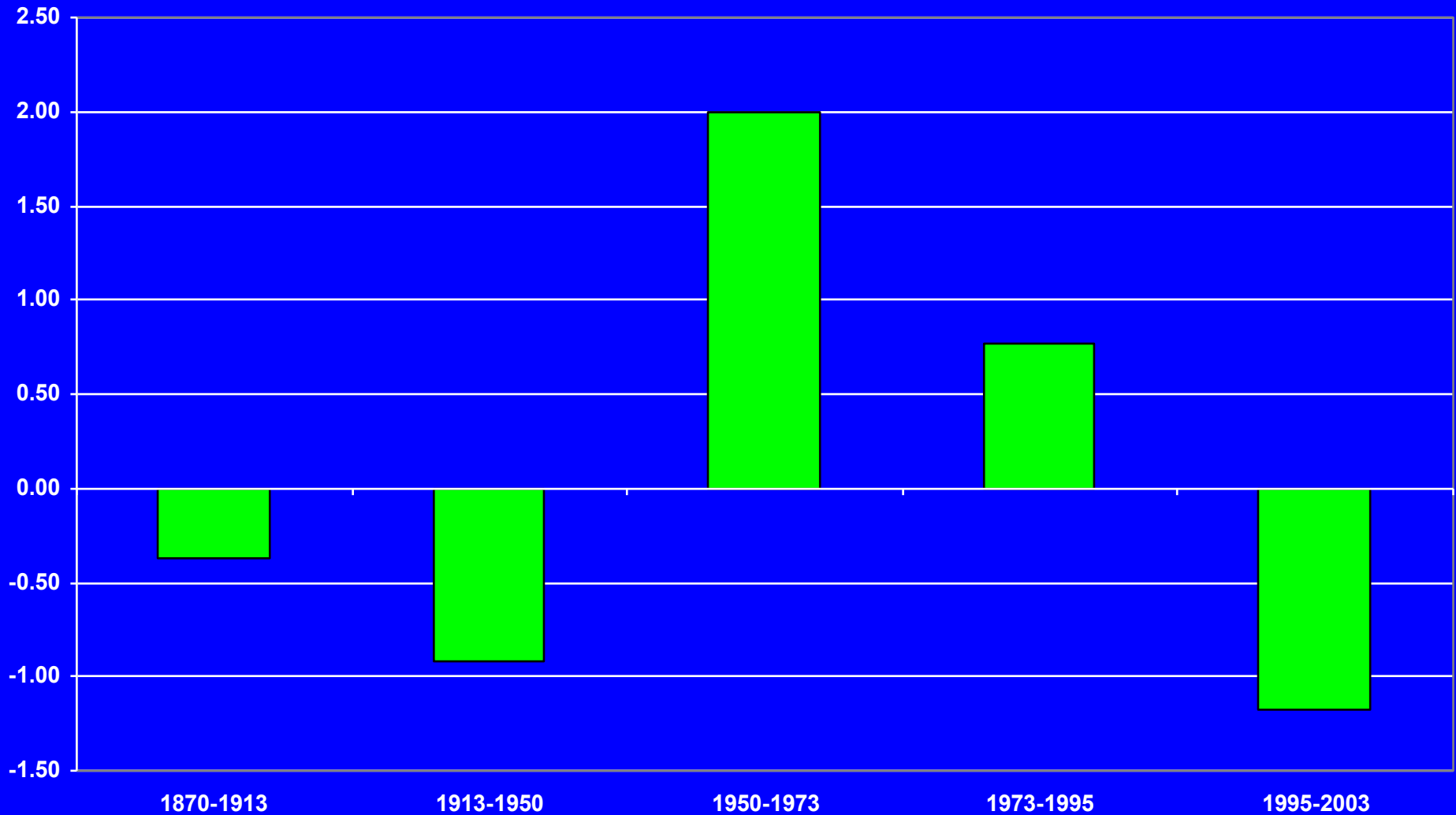
# The U. S. Productivity Growth “Explosion”

LP Actual vs Trend



# 133 Years: Falling Behind, Catching Up, Now Falling Behind

Annual Growth Rate of GDP per Hour,  
EU minus US, 1870-2003



# The Reversal Shown in Levels

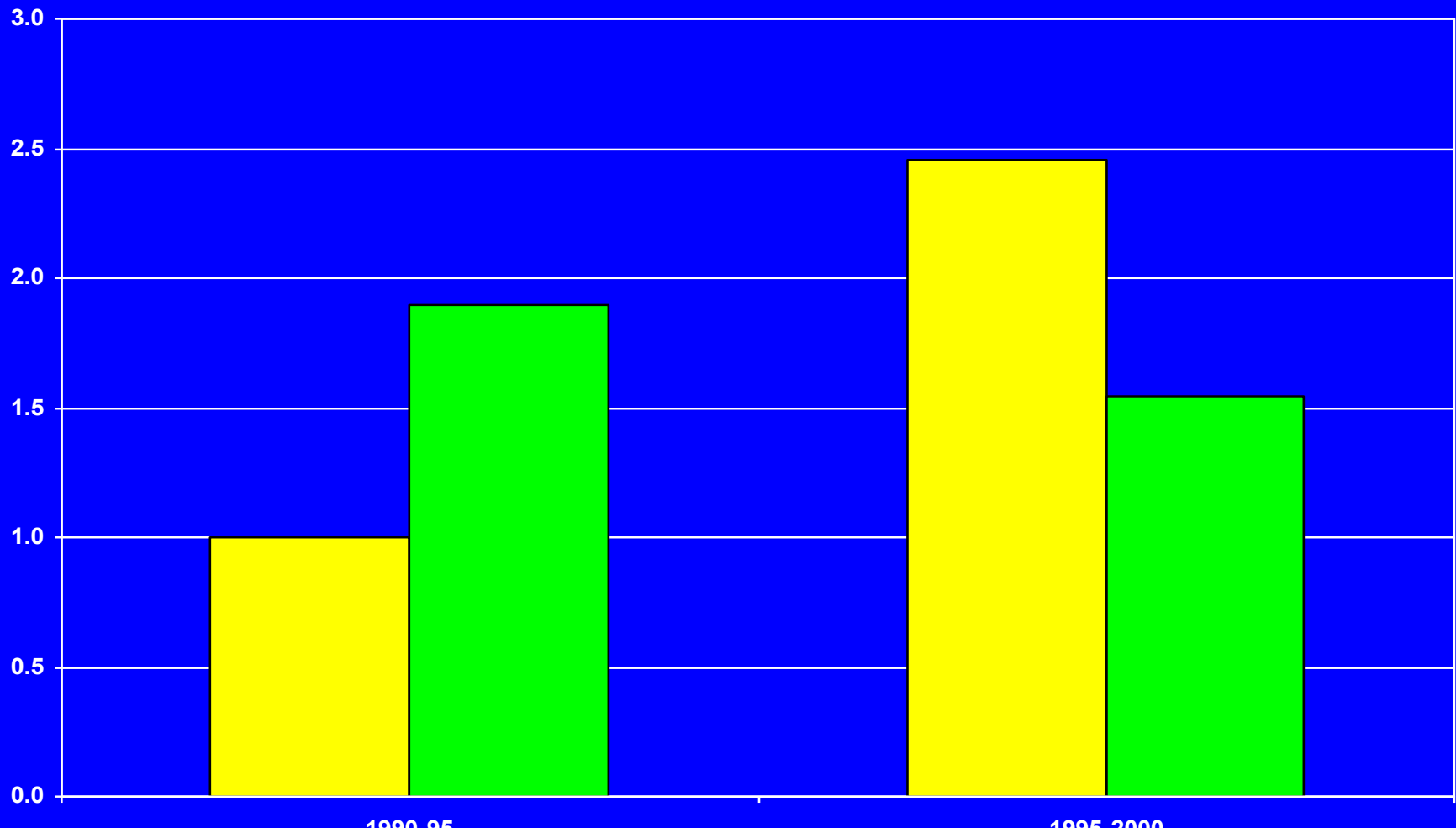
## GDP per Hour, EU as a percent of US, 1870-2003





# A Closer Look at the Last Decade

Annual Growth Rate of GDP per Hour, EU and US, 1990-2003

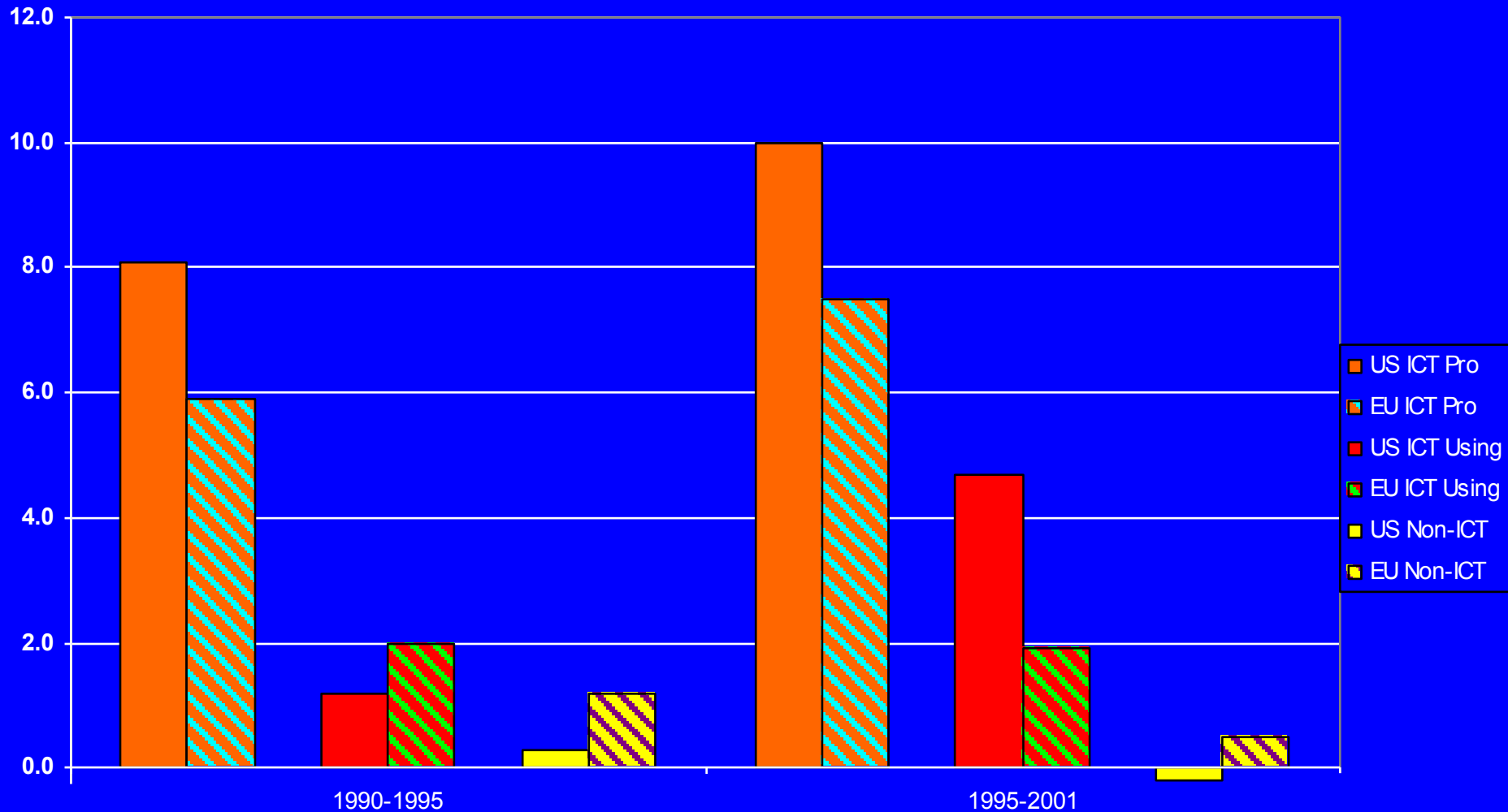


# Basic Paradox about IT

- Both Europe and U. S. Rapidly Adopted New Economy Technology
  - Personal Computers
  - Web Access
  - Mobile Phones
- But Europe hasn't taken off
- Conclusion: Role of IT in U. S. revival must have been exaggerated

# Finding the Culprit Industries

## Output per Hour by Industry Group, EU and US, 1990-2003



# Where is the Difference? The Van-Ark Decomposition

- 55% retail trade
- 24% wholesale trade
- 20% securities
- Rest of the economy: ZERO
- U. S. negative in telecom,  
backwardness of mobile phones

# Europe in Retailing

- Not uniform – Carrefour, Ikea
- U. S. “Big Boxes” (Wal-Mart, Home Depot, Best Buy, Target)
- Europe:
  - Land-use regulation, planning approval
  - Shop-closing restrictions
  - Central-city congestion, protection of central-city shopping precincts

# Not enough emphasis on new vs. old

- It's not just that land-use planning prevents Wal-mart from setting up a new big box on every highway interchange in Europe
- It's that the MIX of retailing in Europe is heavily composed of small, old-fashioned firms

# Let's Walk down a street in Paris on the Left Bank

- Every few blocks, a green cross indicating a pharmacy
- To American eyes, these are antique anachronisms
  - One-by-one service at the counter, no check out stations
  - Tiny, small, don't carry any of the obvious things that a pharmacy should carry. Walgreens.

# University Funding

- Block grants for ugrad tuition subsidies
- U. S. peer reviewed grants to young professors, not young students
- NSF, NIH



# Explanations of Rapid U. S. Productivity Growth: 2000-2003

- Unusual degree of downward pressure on profits
- Intangible capital became important after ICT boom
  - Productivity benefits of ICT investment could have been delayed
  - Mismeasurement of timing of productivity growth
- Outsourcing and changes in labor markets
- Are payroll employment or real GDP underestimated?

# Cost Cutting and the Profit Squeeze

- Productivity growth leads output
- Income shares reveal effect of productivity cycles on profits
- NIPA says profits doubled between '92 and '97, then declined through '00
- S&P reported profits grew by 70% between '98 and '00
  - Shady accounting
  - Low ratio of reported to operating earnings
  - Write-offs to correct for accounting and business mistakes

# Delay and Hidden Capital

- O-S requires full productivity payoff occurs at moment computer is produced
- David argues for delay
  - O-S overstates productivity post-'95 and understates '01-'03
  - Comparison to electricity, 1880-1920
- Intangible capital complements ICT capital

Measurement effects

# Other Substantive Explanations

- Outsourcing
  - Reduced cost benefits
  - Some productivity benefit
    - Actual number of jobs outsourced unclear
- Labor Market Flexibility
  - Share of part- time and self-employed has stayed constant
  - Erosion of union membership and rise of temp agencies is nothing new

# Four Reasons Why 2000-03 Productivity Growth Should not be Extrapolated

- #1 Profit Squeeze has been reversed
- #2 Intangible Capital Hypothesis; disequilibrium is being corrected
- #3 Diminishing returns: geometric growth of Moore's law vs. limits of human brain and fingers
- #4 Jorgenson-Ho-Stiroh on Labor Quality
  - 1995-2001 0.38 percent contribution
  - 2001-2011 0.16
  - 2011-2021 0.02
- #5 What is the right time horizon for forecasting 10 years, 20 years, 75 years?