



# Integrated GDP & Productivity Account at the Industry Level

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# Motivation

- Long-standing call for statistics on the sources of growth
  - Solow (1957), Denison (1967), Griliches and Jorgenson (1967)
  - Postwar Recovery, Big Slump, IT Boom, the Great Recession
  - “... *differences between the BEA and BLS estimates have led many researchers to construct their own measures ...*”
    - Jorgenson and Landefeld (2006) in *A New Architecture for the U.S. National Accounts*
  
- The Advisory Committee on Measuring Innovation in the 21<sup>st</sup> Century: A Report to the Secretary of Commerce (January 2008)
  - “*Develop annual, industry-level measures of total factor productivity ...*”

# GDP integrated with productivity statistics

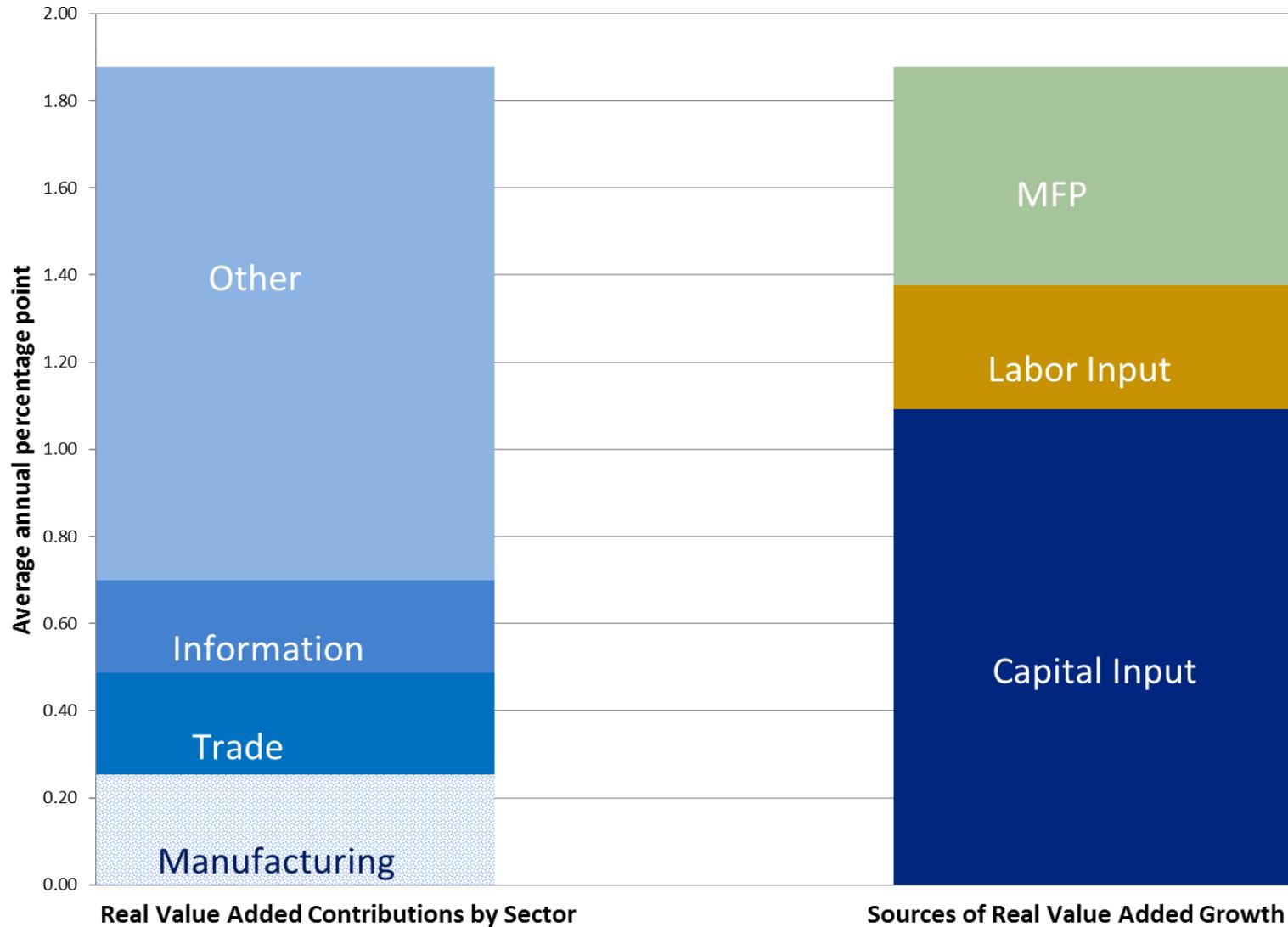
- Allows for integrated analysis on the sources of growth in the economy
  - Jorgenson and Landefeld (2006) provide blueprint for United States
  - Harper, Moulton, Rosenthal, and Wasshausen (2009) integrates account for nonfarm business
  - Fleck, Rosenthal, Russell, Strassner, and Usher (2013) integrates account for GDP at the industry level
    - [www.bea.gov/industry/index.htm#integrated](http://www.bea.gov/industry/index.htm#integrated)

# Big picture questions

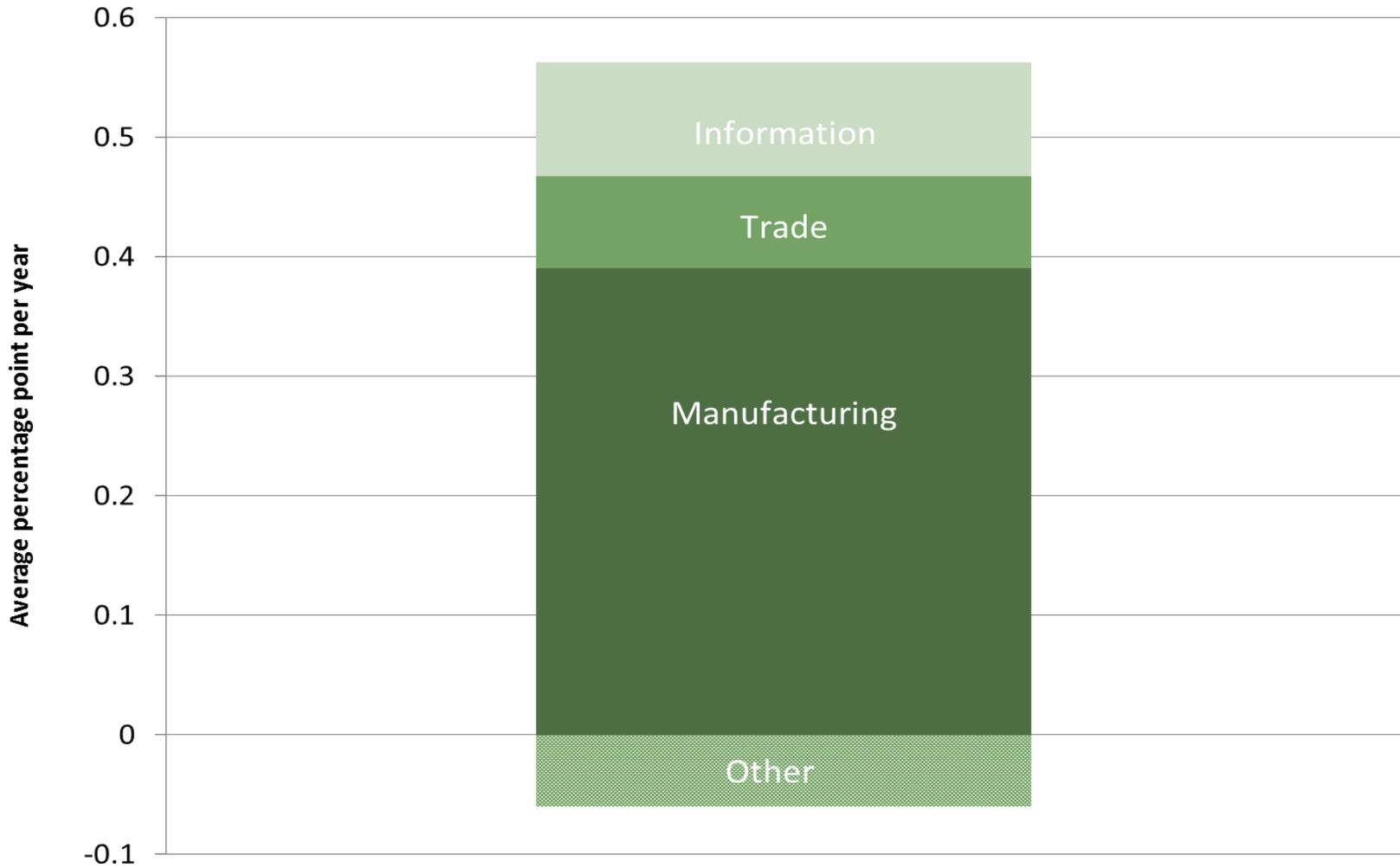
- What are the industry sources of GDP and multifactor productivity (MFP) growth?
  - For example, what is the role of Manufacturing?
  
- What is the contribution of:
  - Information-communications-technology to growth and productivity?
  - Intellectual property products to growth and productivity? Forthcoming ...

Note: Within the framework, this is a decomposition consistent with GDP

# Sources of economic growth, 1998-2011



# Sources of multifactor productivity growth



- Manufacturing accounted for more than 75 percent of MFP growth!

# Industry sources of growth analysis

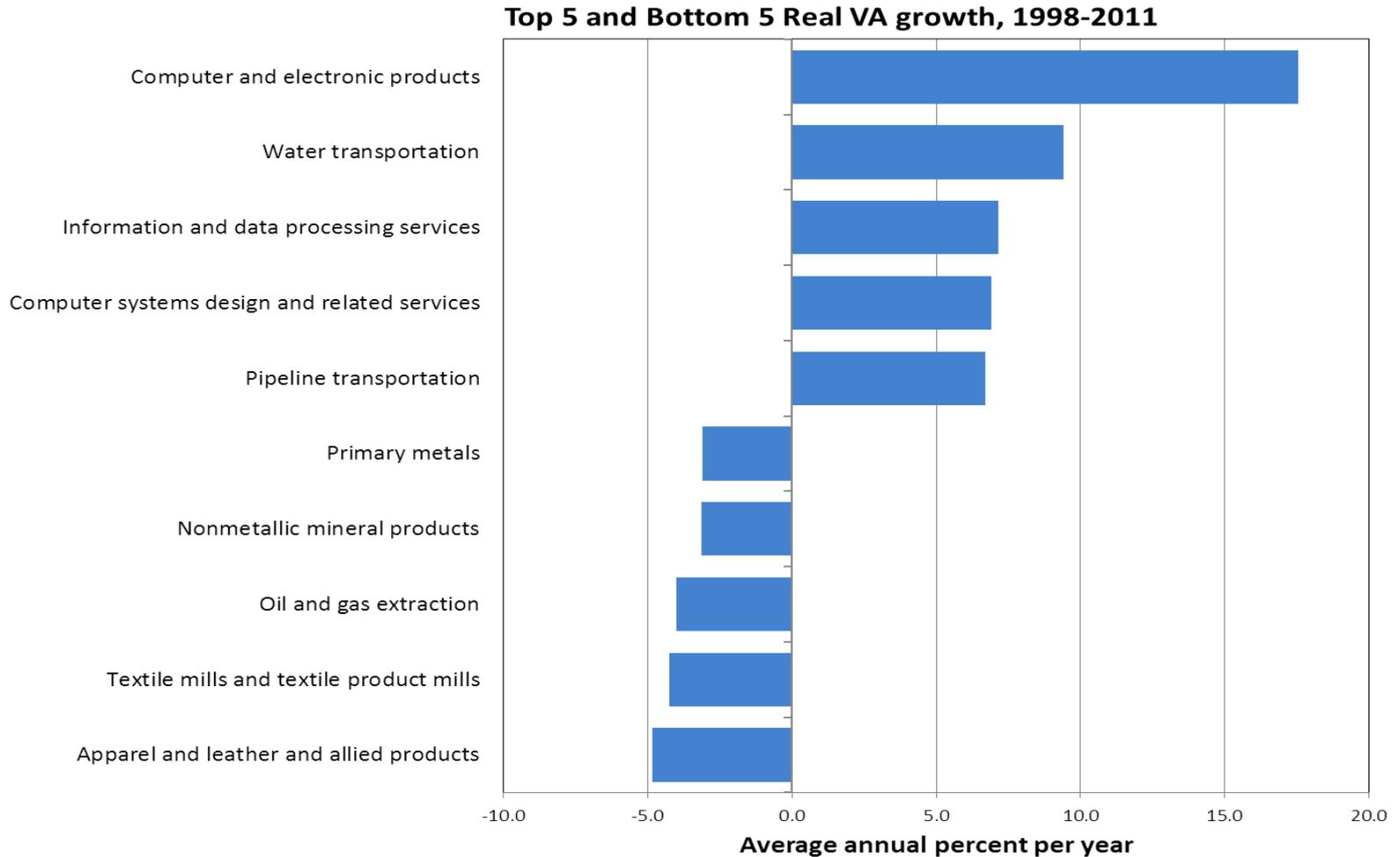
- Requires an industry-level production account
  - Industry-level outputs and inputs in current and constant prices

$$Y_Q Y_P = K_Q K_P + L_Q L_P + X_Q X_P = VA_Q VA_P + X_Q X_P$$

- Symmetric treatment of outputs, intermediate inputs, and value-added inputs
- Consistent with GDP constructed within an Input-Output Framework
  - Sum of industry-level value added equals GDP

# Industry-level output and intermediate input

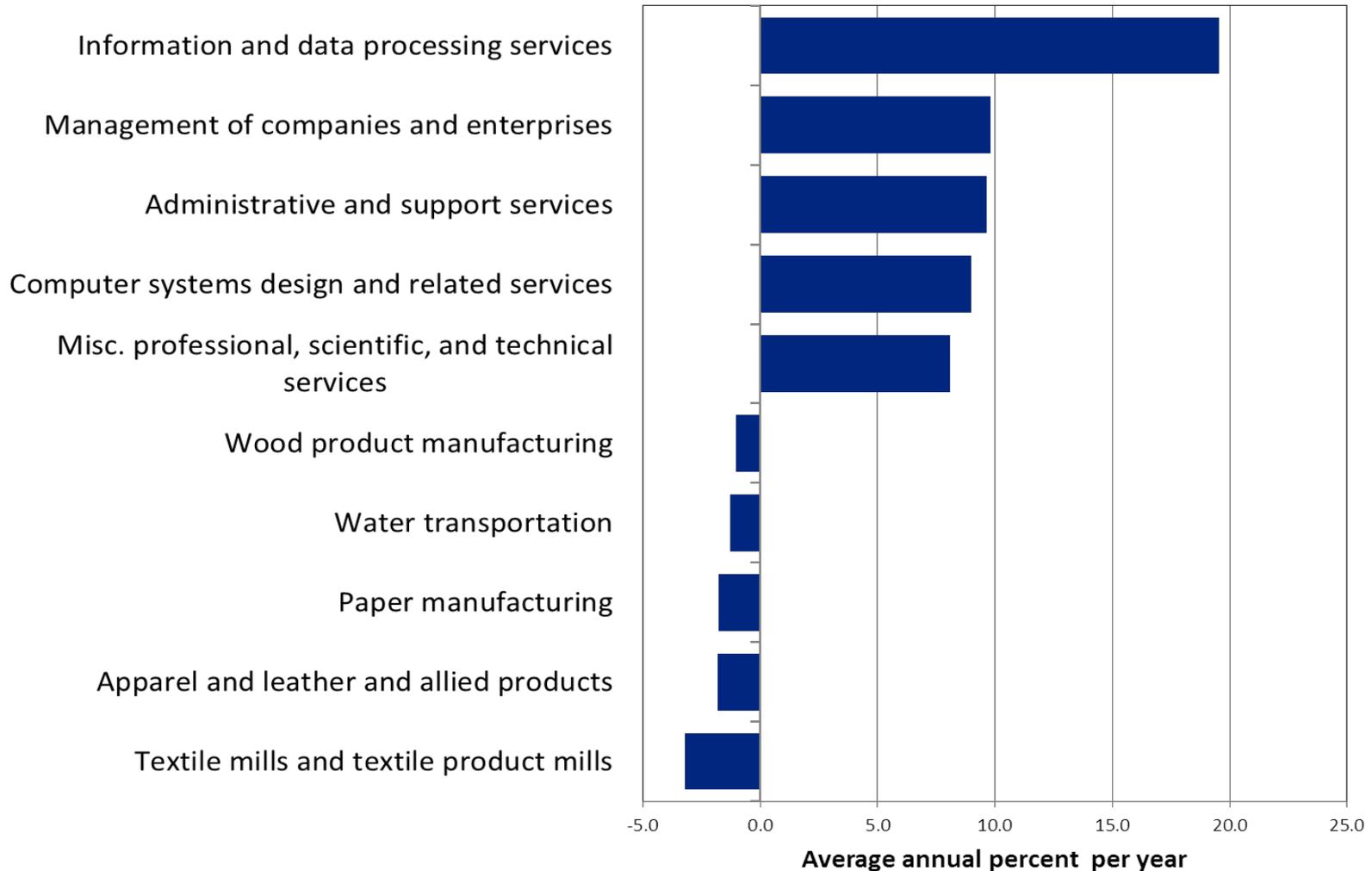
- BEA GDP-by-industry data 1998-2011



# Industry-level capital input

- Capital services: BLS, based on BEA Fixed Assets

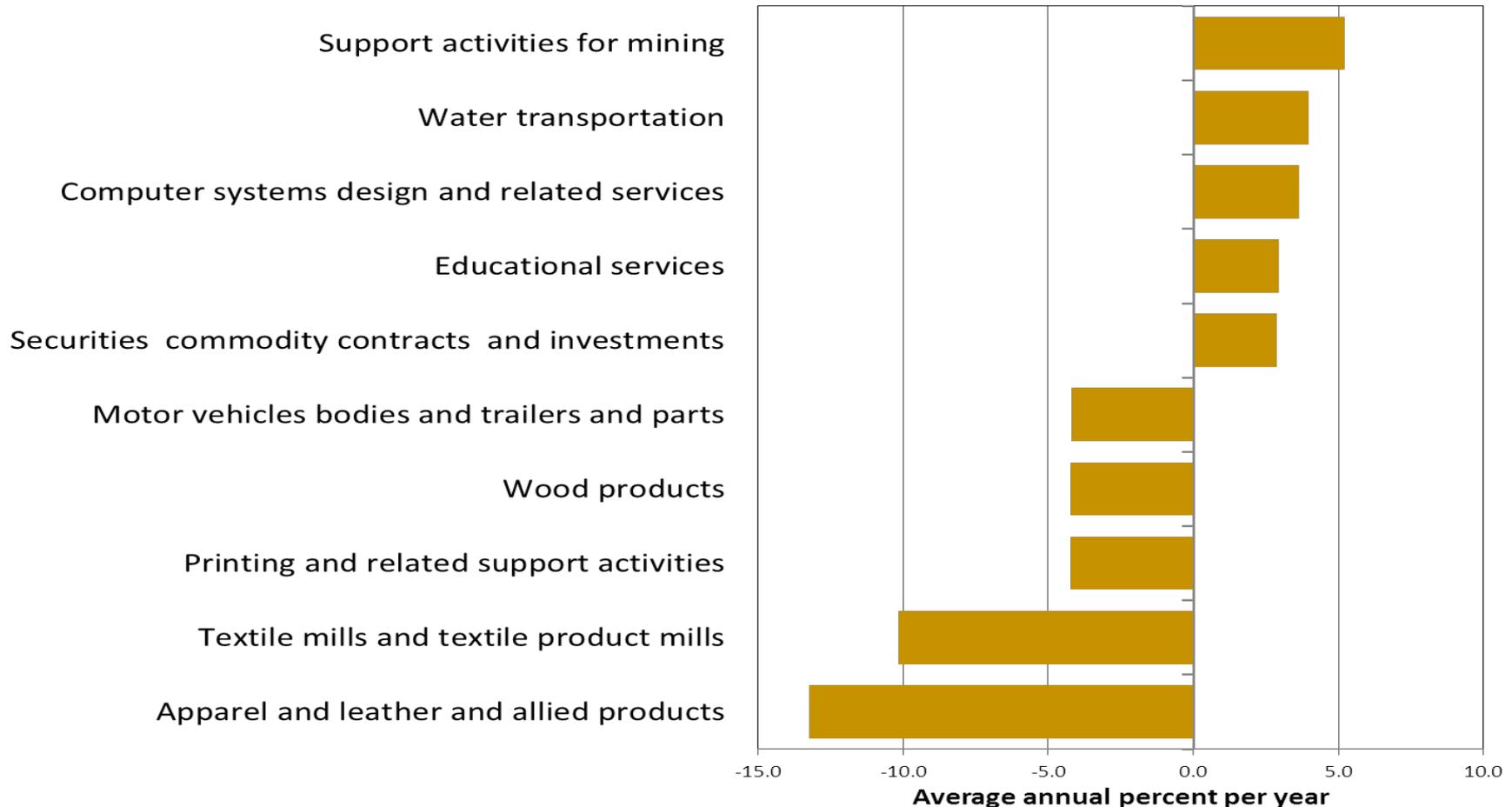
Top 5 and Bottom 5 Capital growth, 1998-2011



# Industry-level labor input

- Labor hours: BLS, based on BLS survey data
- Labor composition: Jorgenson, Ho, Samuels (2012)

**Top 5 and Bottom 5 Labor growth, 1998-2011**

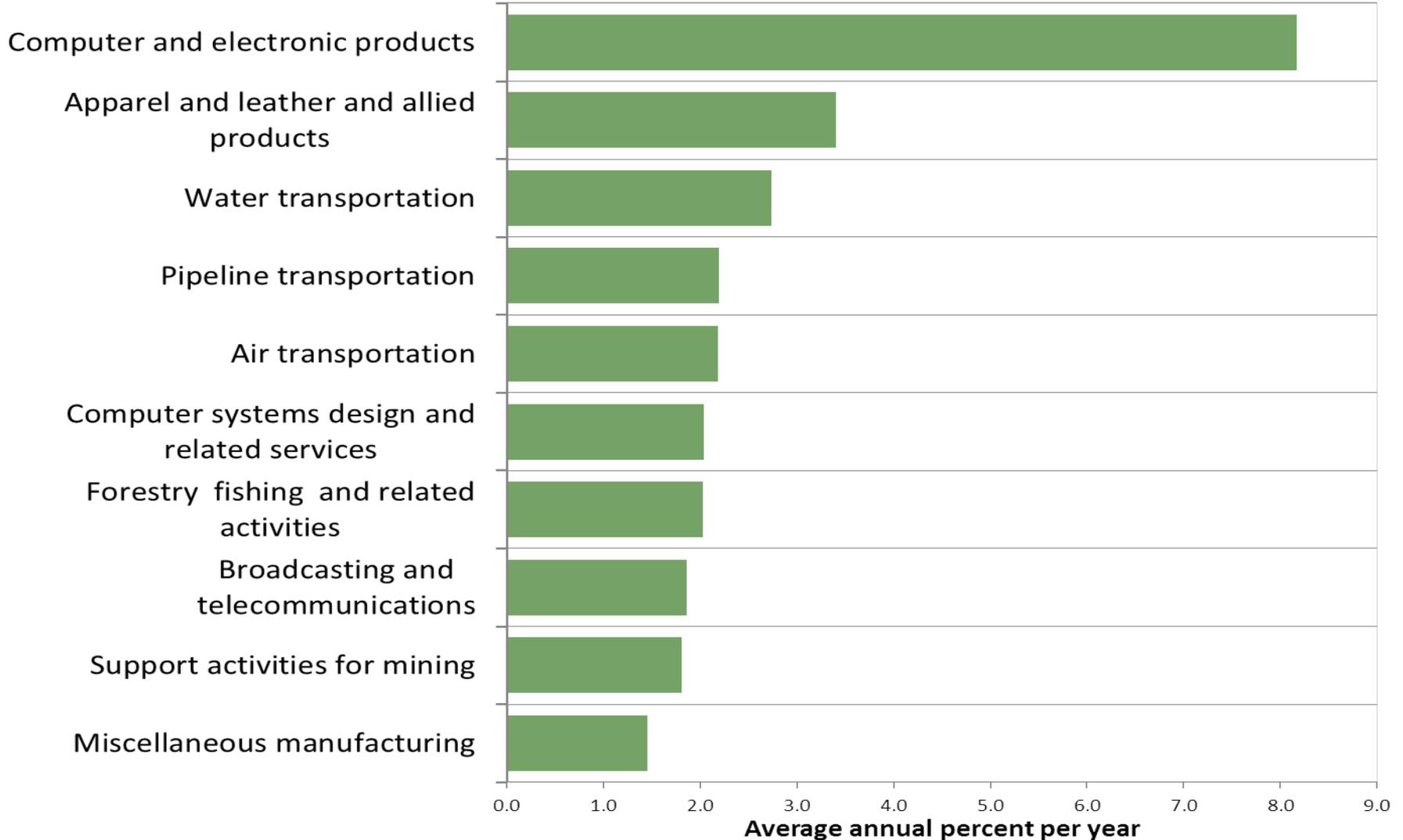


# Constructing multifactor productivity

- Definition: Industry MFP Index =  $\frac{\text{Output Index}}{\text{Input Index}}$
- Growth rates: Industry MFP growth is the change in output not accounted for by change in input
- Under a certain set of assumptions, the change in MFP corresponds to the change in technology (innovation)

# MFP growth by industry

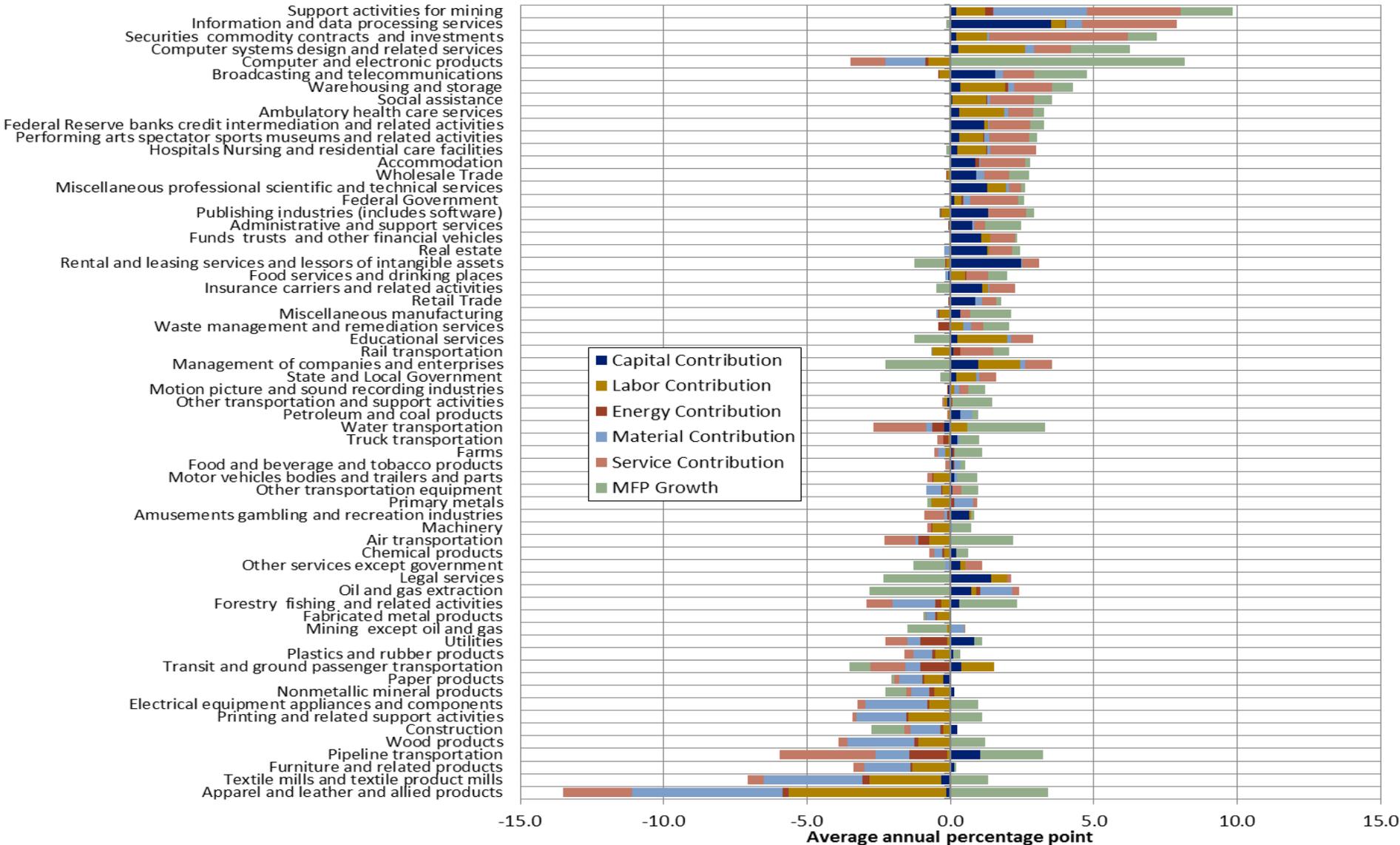
**Top 10 MFP Growth, 1998-2011**



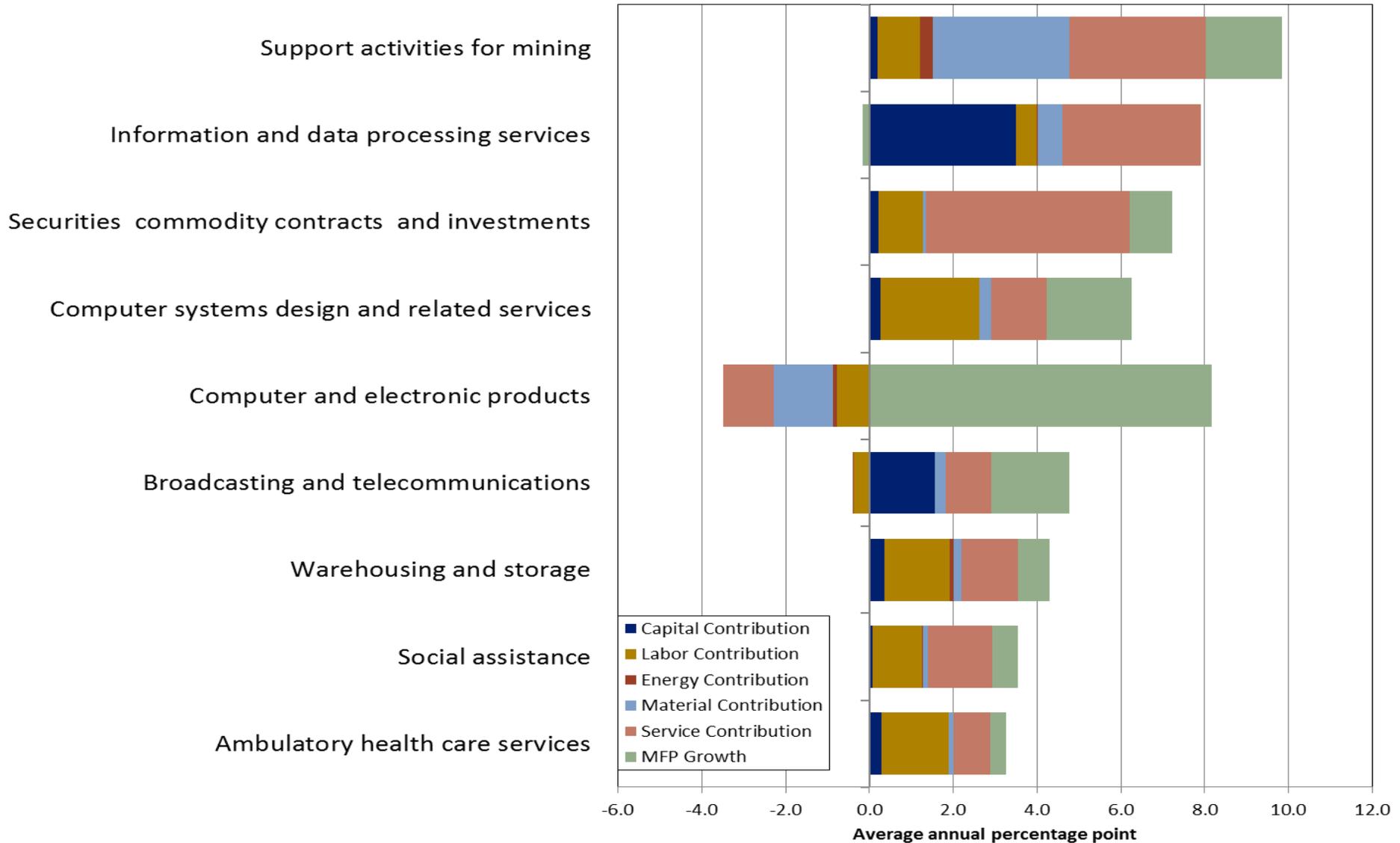
# Putting together the pieces

- Industry growth =
  - Contribution of Labor Input
  - +Contribution of Capital Input
  - +Contribution of Intermediate Input
  - +Contribution of MFP
  
- Industry contribution to aggregate value added growth= $\text{Industry value added weight} \times \text{industry value added growth}$
  
- Industry contribution to aggregate MFP growth= $\text{Domar-weight} \times \text{industry MFP growth}$

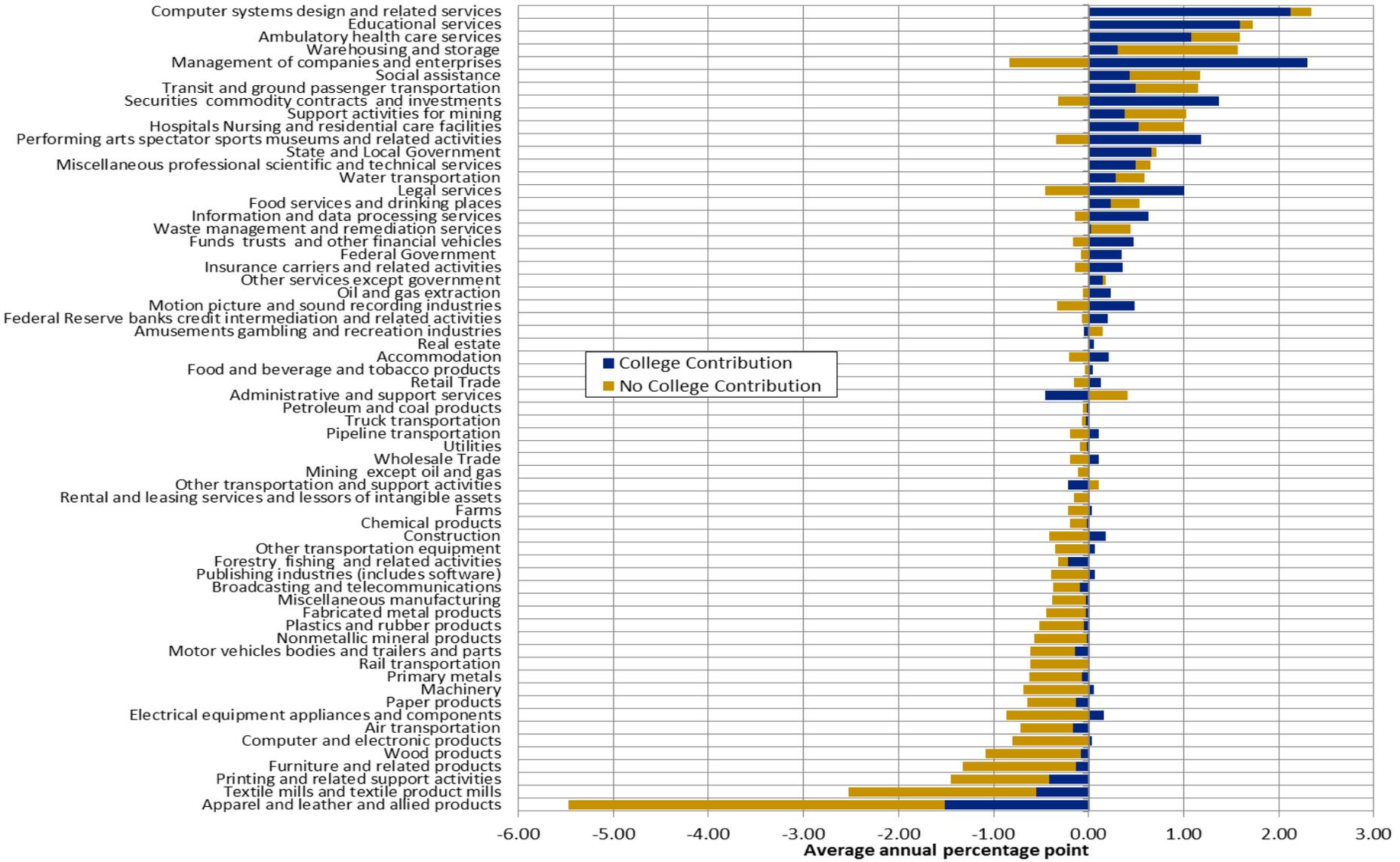
# Gross output growth and sources



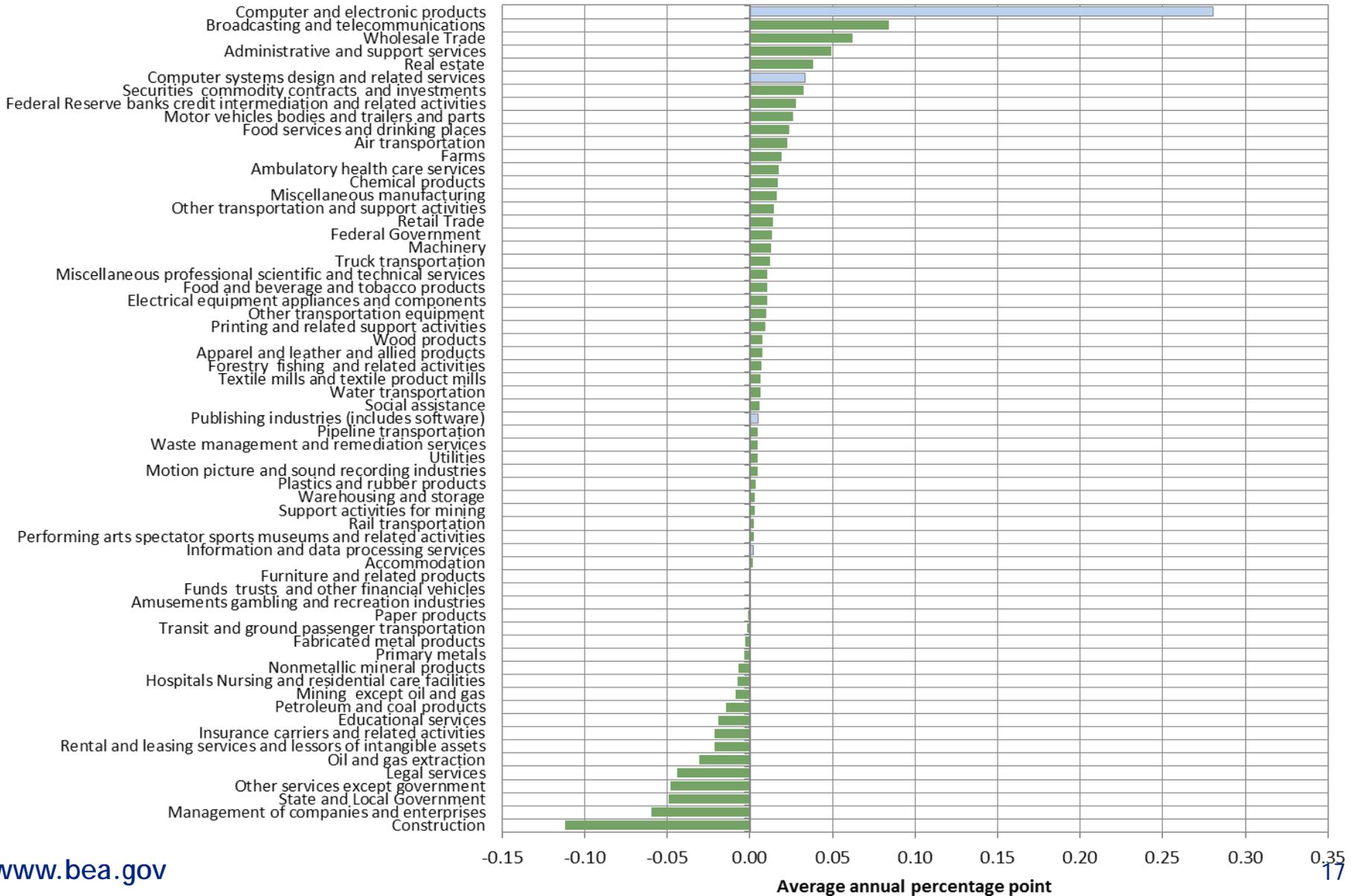
# Gross output growth and sources—top 10



# Labor contributions to gross output growth by education



# Contributions to aggregate MFP by industry



# Sources of economic growth

	1998-2011
<b>GDP</b>	1.88
IT-producing industries	0.40
IT-using industries	1.16
Non-IT industries	0.31
<b>Capital Input</b>	1.09
IT-producing industries	0.07
IT-using industries	0.63
Non-IT industries	0.39
<b>Labor Input</b>	0.28
IT-producing industries	0.01
IT-using industries	0.36
Non-IT industries	-0.09
<b>Multifactor productivity</b>	0.50
IT-producing industries	0.32
IT-using industries	0.17
Non-IT industries	0.01

Note: Contributions to GDP growth, avg annual

- Capital input accounted for about 60 percent of growth
  - 60 percent due to IT-using industries
  
- MFP accounted for 25 percent
  - 65 percent due to IT-producing industries
  
- Labor input accounted for about 15 percent

# Uses of “KLEMS” data

- International comparisons
  - Example: The World KLEMS initiative ([www.worldklems.net](http://www.worldklems.net))
- Policy-related work
  - Example: Analysis and projections of potential output → projection of tax revenue
- Research
  - Example: Carvalho, Vasco and Xavier Gabaix, “The Great Diversification and its Undoing.” *American Economic Review* (Aug. 2013)
    - Finding: Great moderation due to shift towards service industries that have lower “fundamental” volatility (MFP)

# Next steps

- Update available in Summer 2014 to incorporate:
  - Intellectual Property Products and results of the comprehensive revision
  - 2007 NAICS
  - 1998-2012
  
- Longer run: Extend historical time series following JHS (2013)