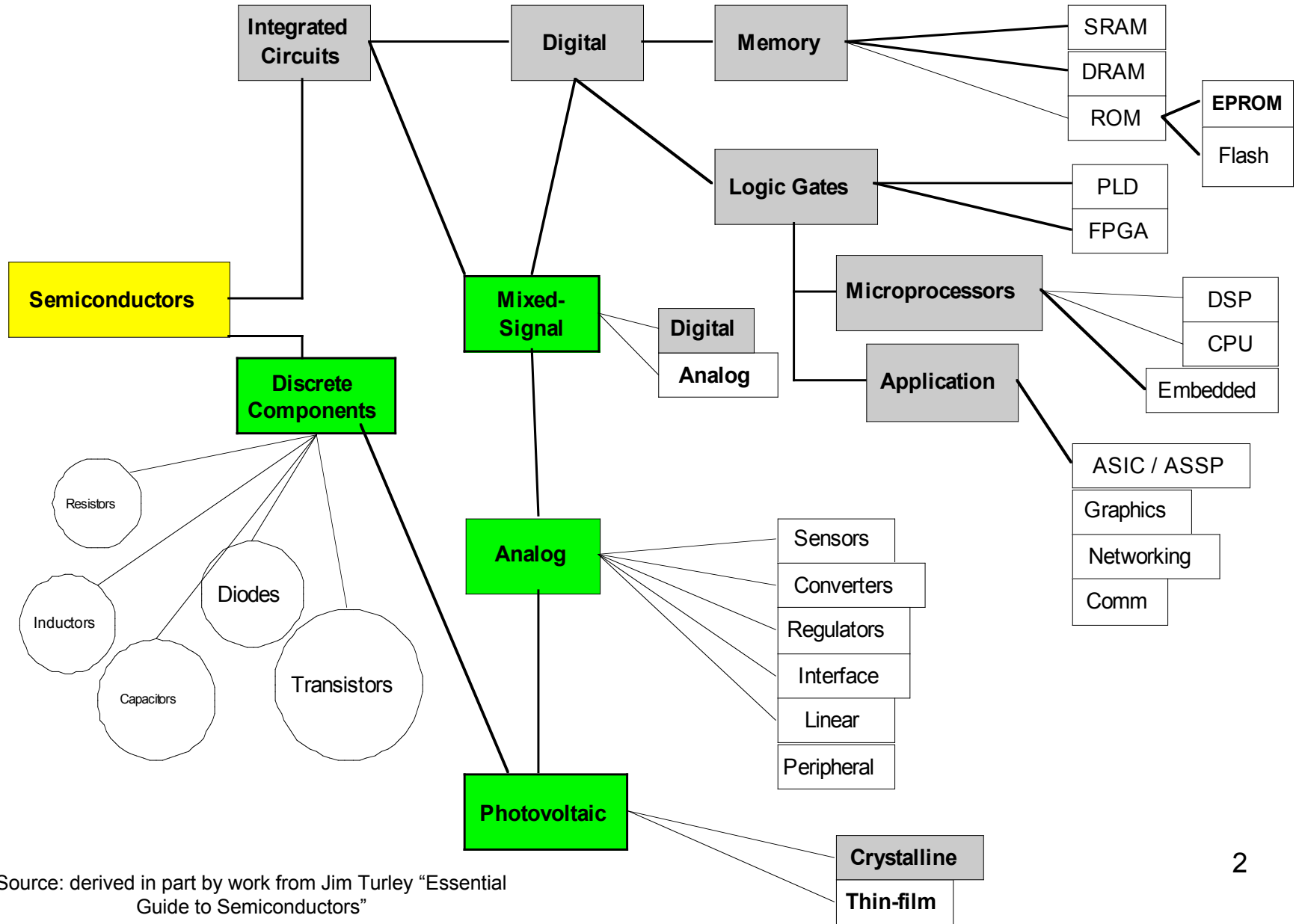


# Semiconductor Industry Primer

fundamental financial analysis

- niche semiconductor
- solar PV suppliers

# Semiconductors



Source: derived in part by work from Jim Turley "Essential Guide to Semiconductors"

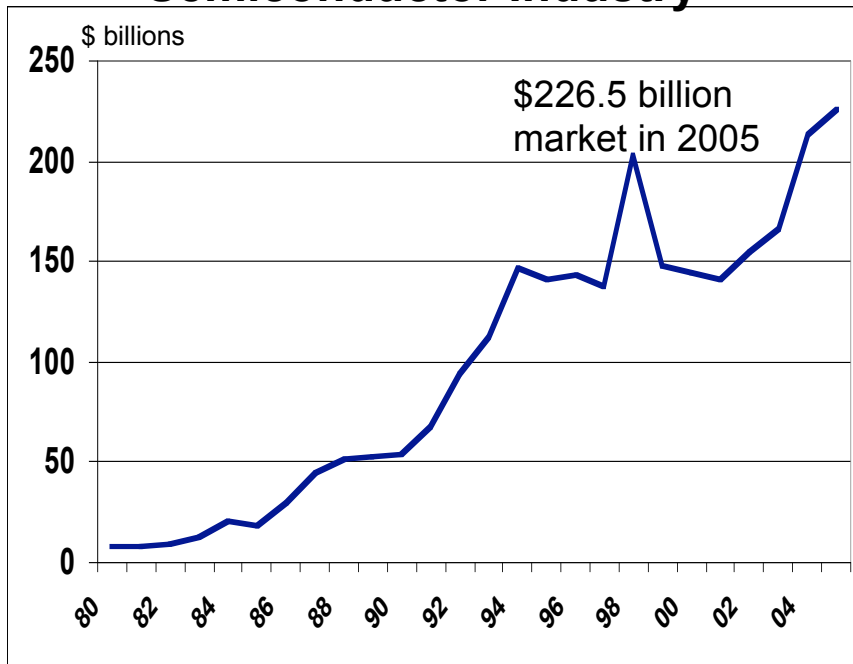
# Semiconductor Market Overview

Components can be classified as discrete devices such as transistors or as Integrated Circuits (ICs)

- ICs can be further classified as: digital, analog and mixed-signal
  - Digital – three basic types used in most electronic systems
    - Microprocessors
    - Memory
    - Logic Devices:
    - Application Specific IC (ASIC), Application Specific Standard Product (ASSP)
      - Programmable logic devices (PLD) /Field Programmable Gate Arrays (FPGA)
      - Image/graphics Processors
      - Network/Packet processors
      - Digital Signal Processors (DSP)
  - Analog: used to connect to real world applications and instruments
    - Temperature, Photovoltaic
    - Pressure
    - Light, sound, speed
  - Mixed-signal: analog and digital on same IC and can also perform power management functions

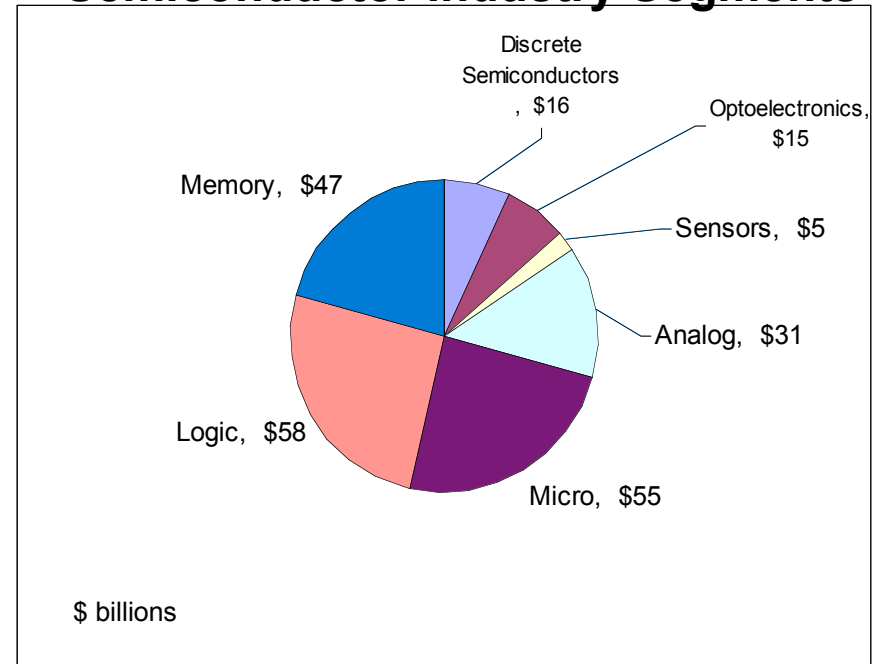
# Chip Market

### Semiconductor Industry



Source: World Semiconductor trade Statistics

### Semiconductor Industry Segments

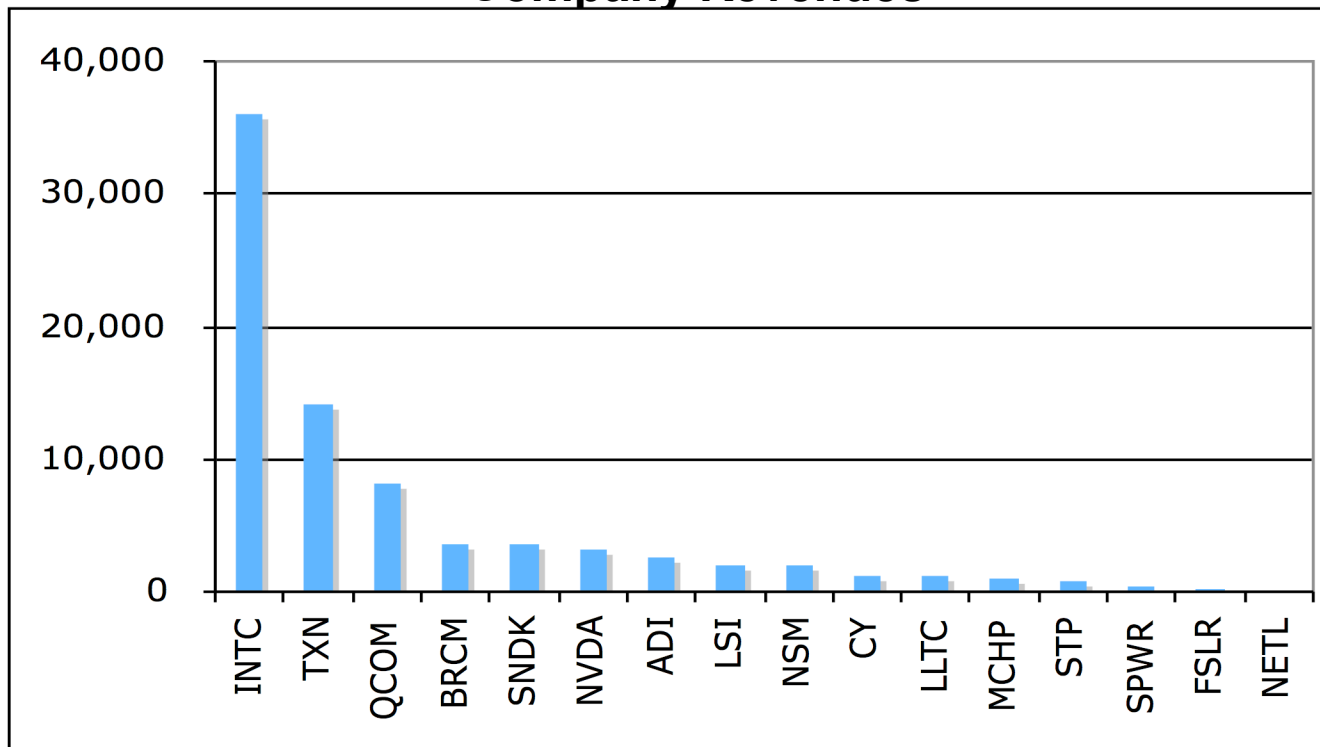


Source: World Semiconductor Trade Statistics

The market for discrete and analog semiconductors is significantly more fragmented than the larger segments of logic, memory and microprocessors. Photovoltaic cells suppliers operating in the same economic framework as traditional chips enjoying operating cost improvements with scale and production capacity.

# Leading Players

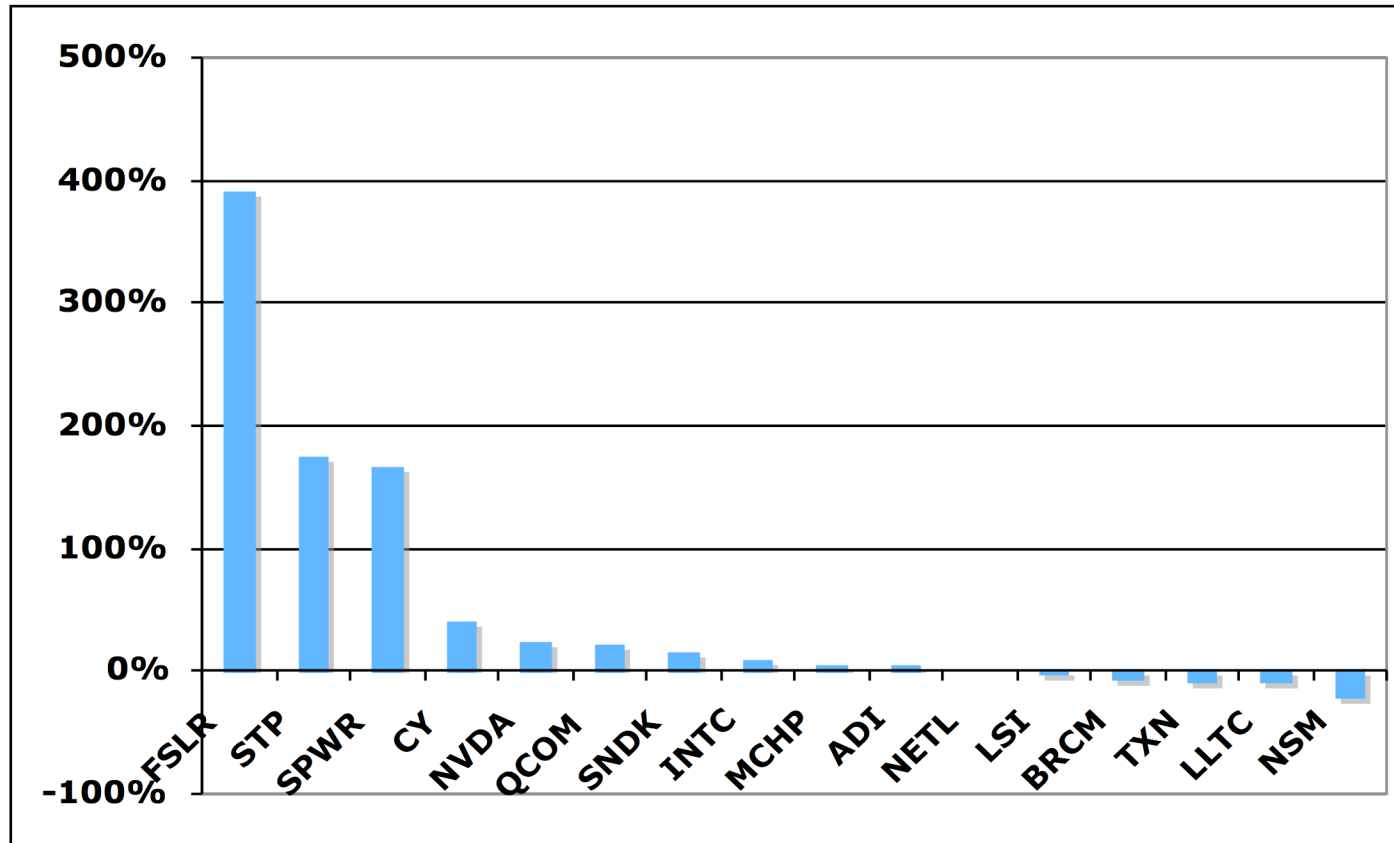
Company Revenues



Source: Company reports

The largest market players are often well entrenched in their respective market.

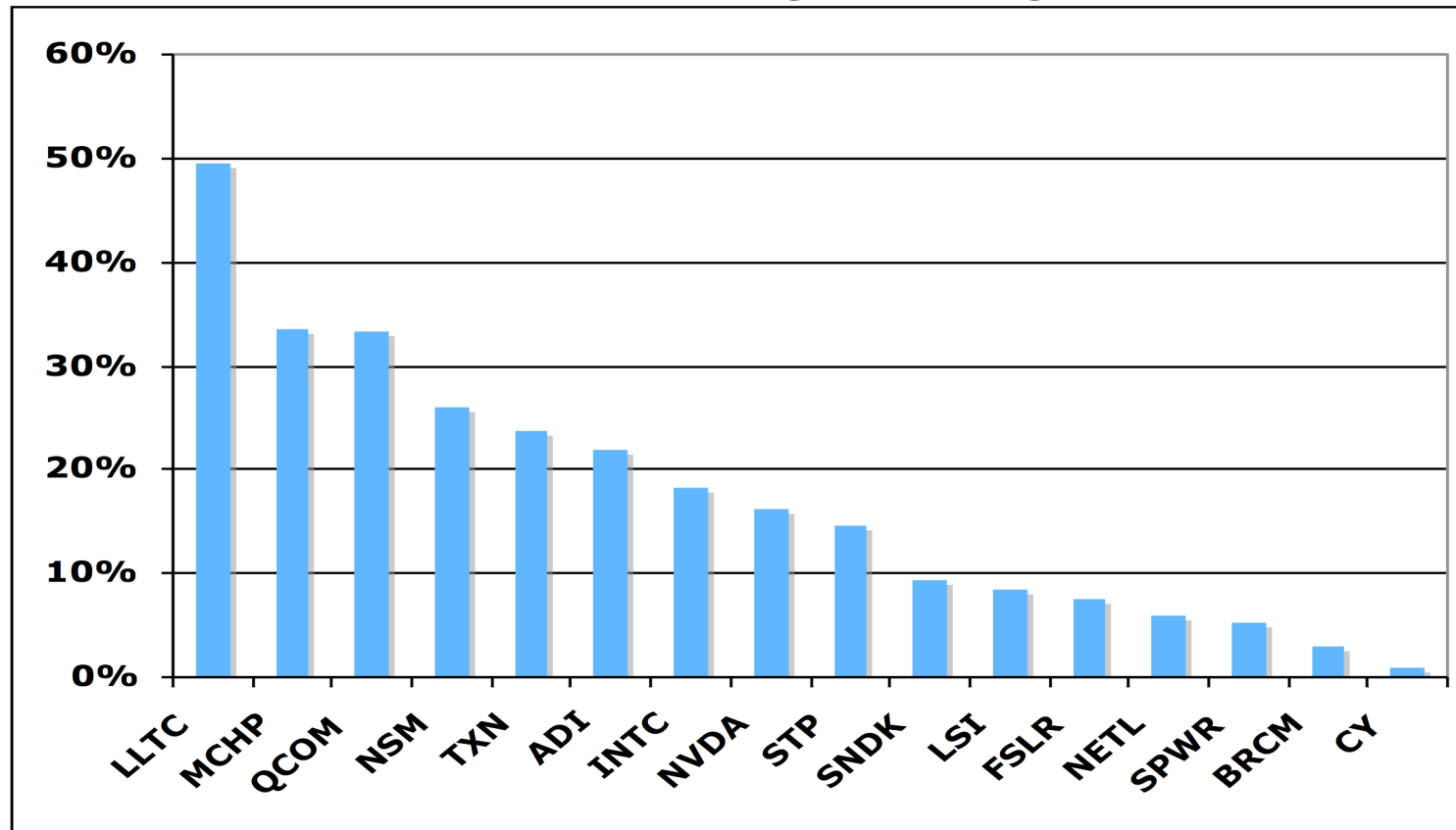
# Revenue Growth



Source: Company reports

Small companies with niche market focus tend to demonstrate faster revenue growth as the law of large numbers works against large companies.

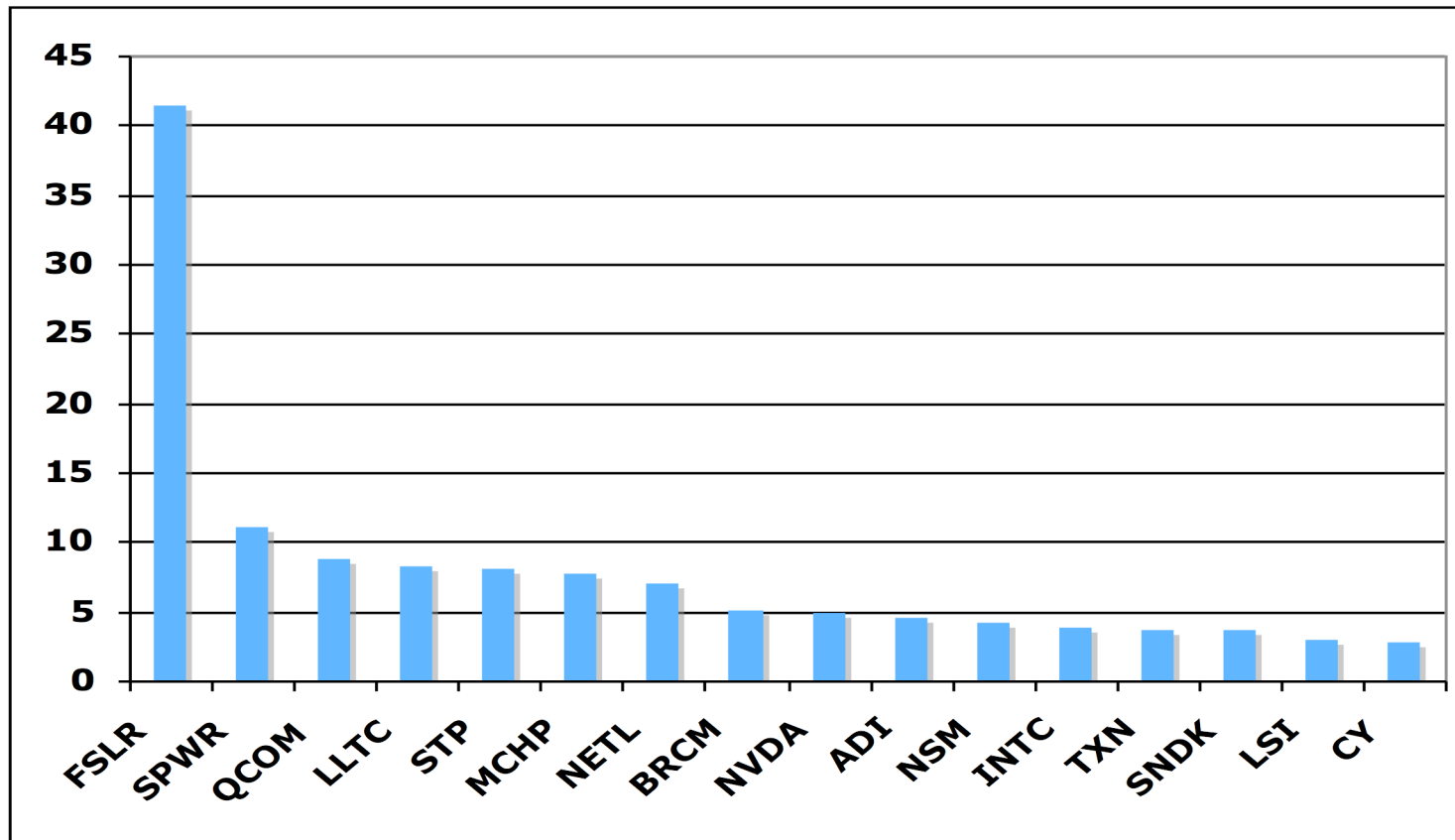
# Operating Margins



Source: Company reports

Variability in operating margins and revenues are the most significant contributors to cash flows and the real basis for determining a company's value.

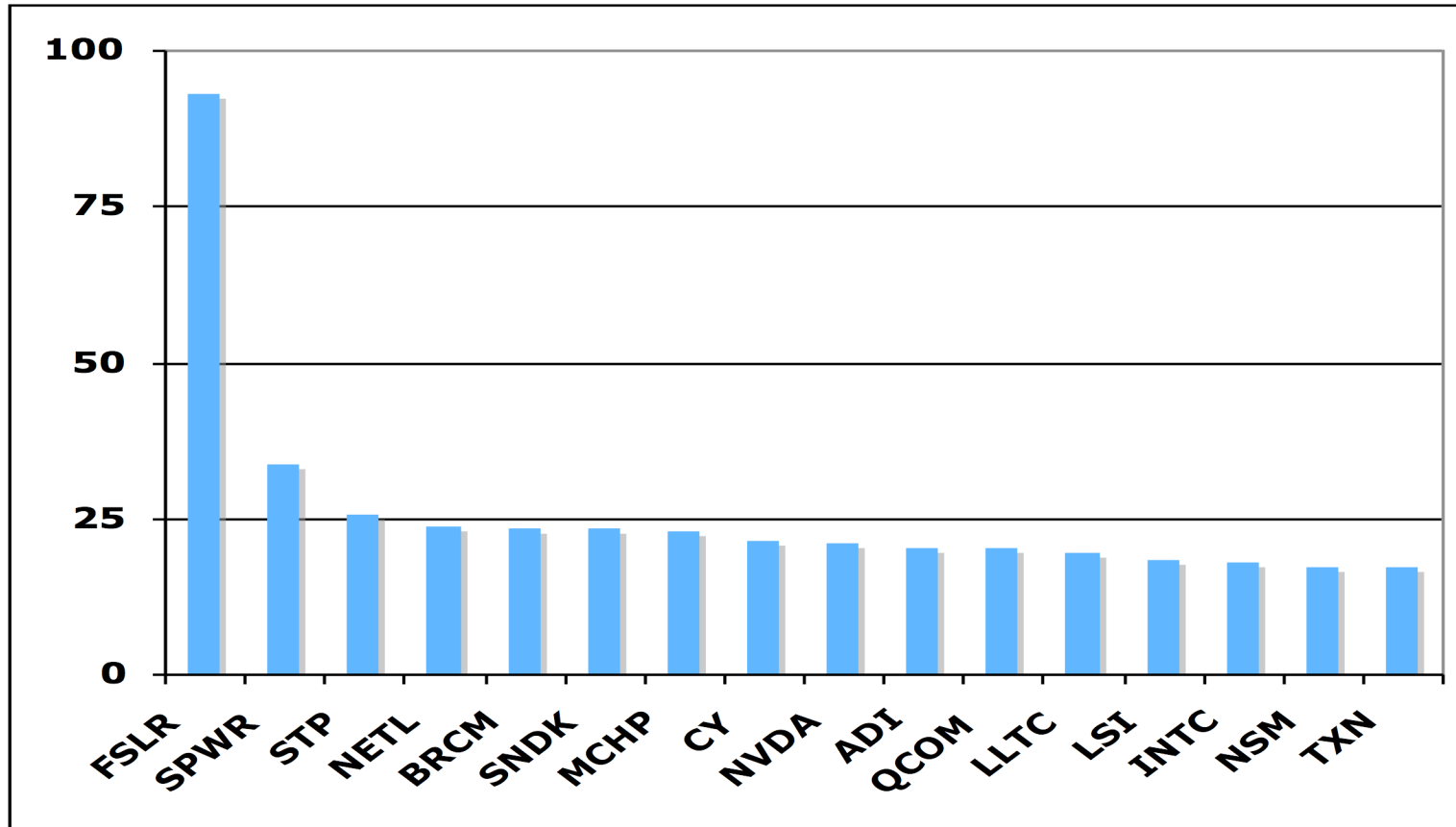
# Price to Sales Ratio



Source: Company reports

By measuring price-to-sales, companies commanding the largest market value relative to their revenues usually are positioned to take advantage of secular trends in the industry. This is the case for PV solar cell suppliers that have P/S ratios of 42 in comparison to industry leaders such as Intel at 4 or Qualcomm at 9

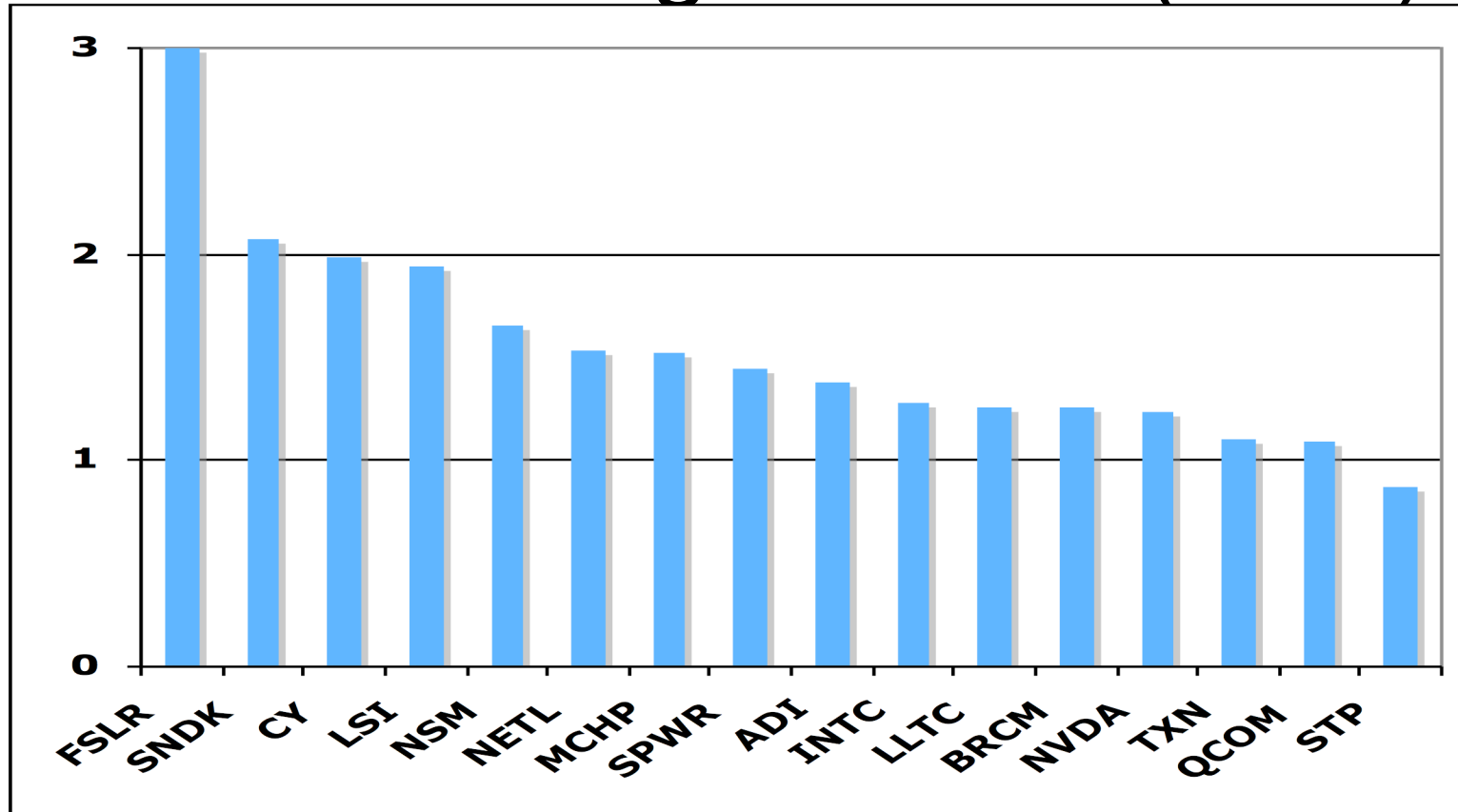
## PE Ratio



Source: Company reports

Assuming the company under evaluation has earnings, PE ratio is helpful measuring its relative stock price. Companies with high PE ratios tend to demonstrate superior and/or accelerating earnings growth. So a company with a high PE ratio should be compared on a earnings growth basis.

# PE to Earnings Growth (PEG)

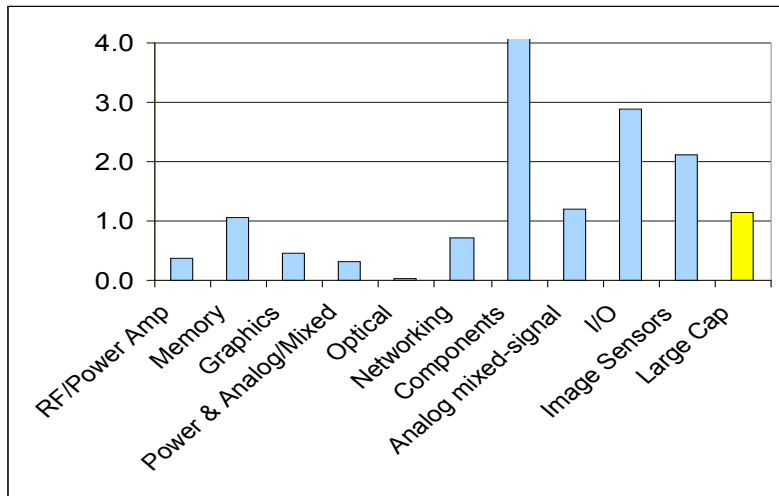


Source: Company reports

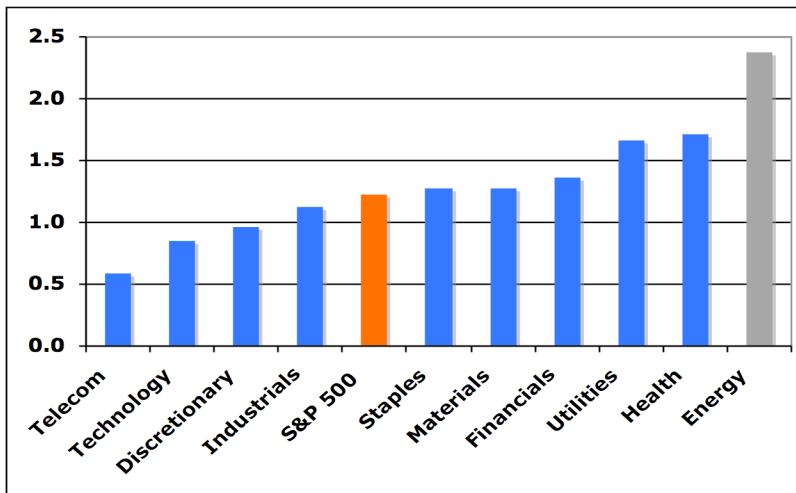
The PE to earnings growth ratio provides a better framework to measure the relative value of the PE itself. By comparing to PEG ratio to companies in other industries or market segments, one can compare a company's PE relative to macro trends impact certain market segments.

## PEG Valuations

### PEG Ratios



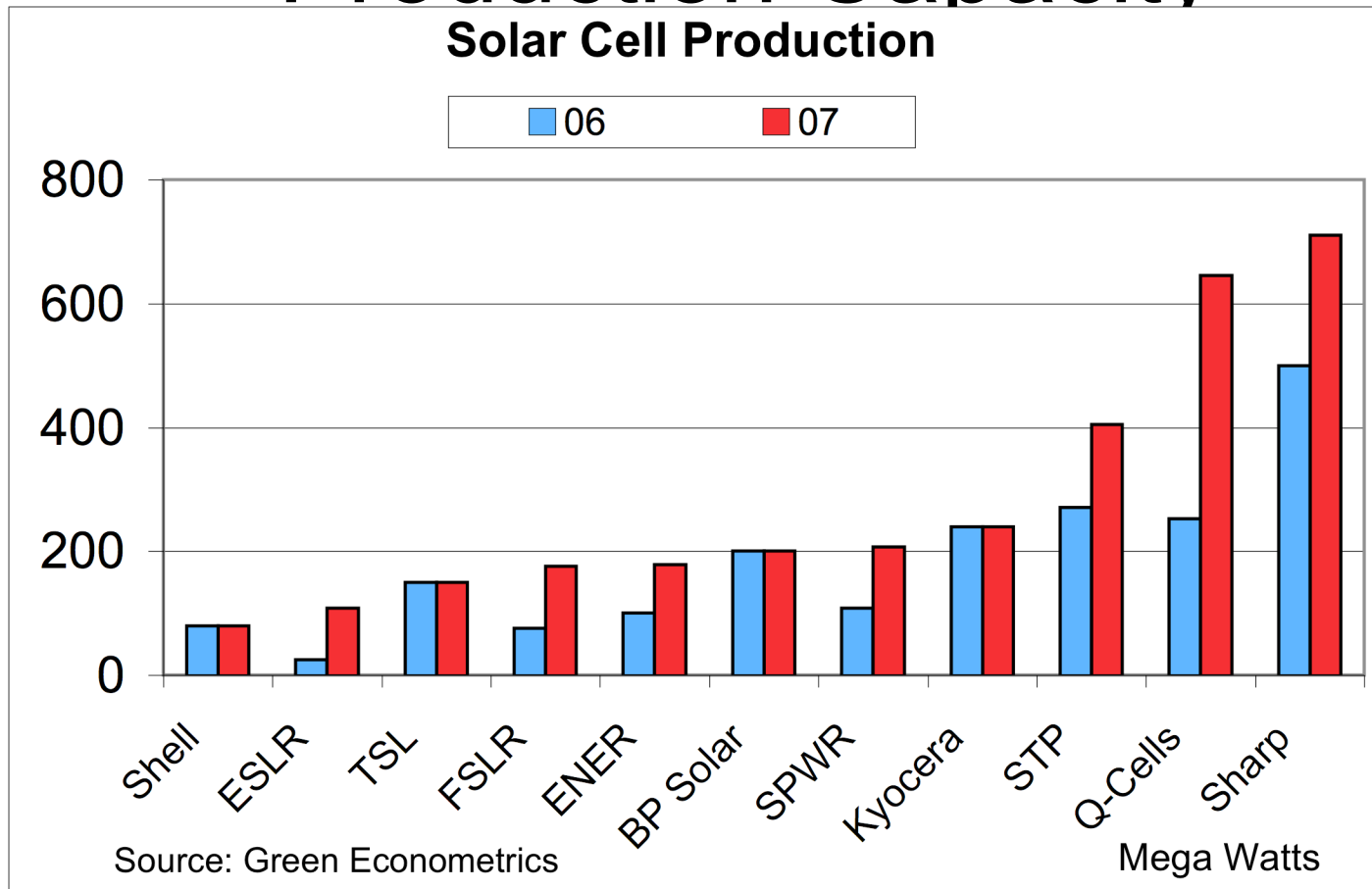
### PEG Ratios S&P 500 Sectors



PEG ratios indicate that several IC market segments trade at a significant discount to most sectors within the S&P 500

Given the unique characteristics of some IC market segments and their respective growth potential, some specialized chip plays trade at a discount to the S&P 500 and its associated major market sectors.

# Production Capacity

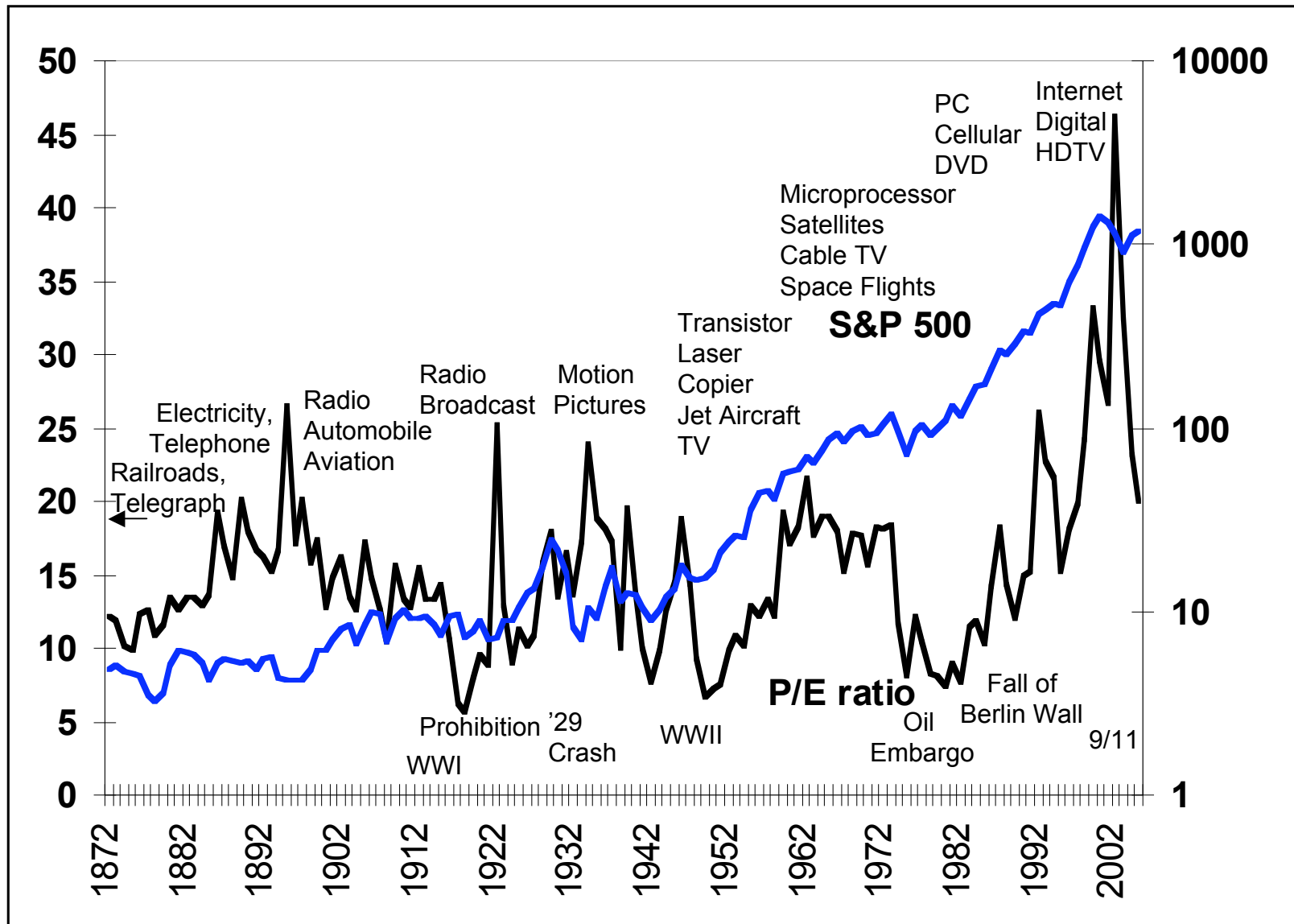


Source: Company reports

Photovoltaic cell suppliers can benefit from economies of scale as their production capacity increases. Leading players such as Sharp and Q-Cells have leading production in terms of annual mega watt solar cells. The rapid increase in total production should lead to lower solar cell prices.

# Green Econometrics

## P/E and S&P Index

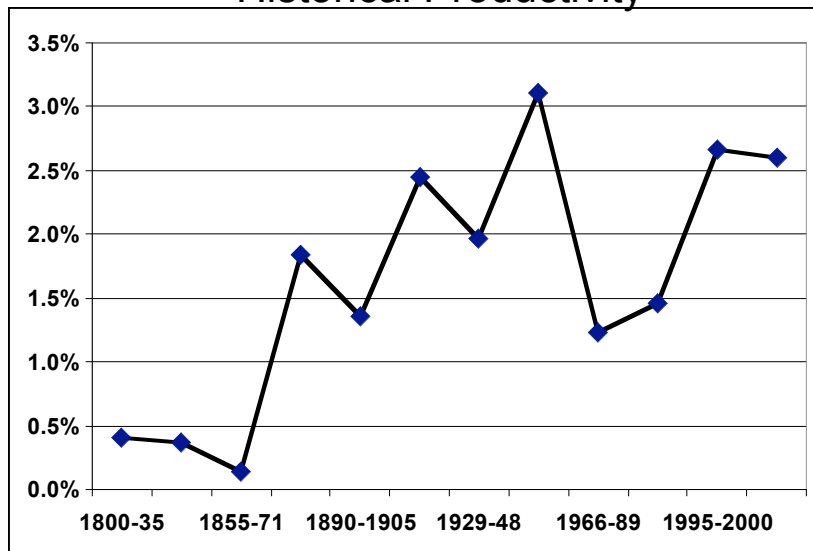


Source: Standard & Poors

What are the factors contributing to high PE multiples?

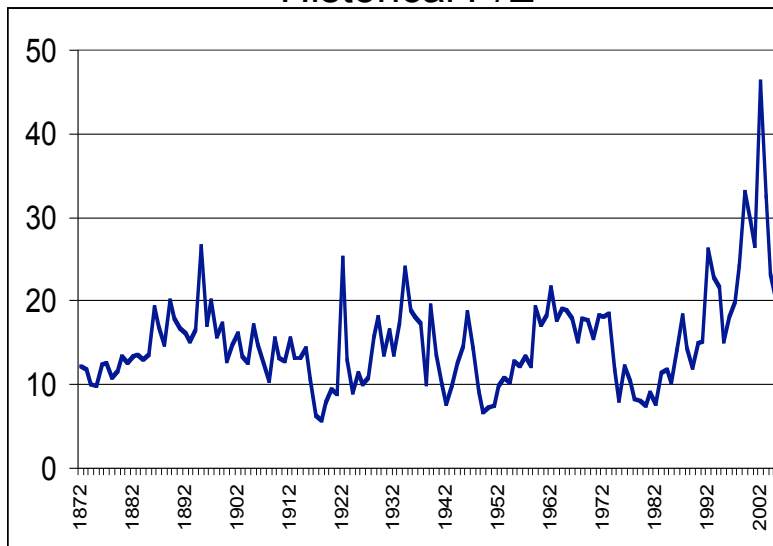
## Productivity and P/E Ratios

### Historical Productivity



Source: The New Economy, Roger Alcaly, 2003

### Historical P/E



Source: R. Shiller, MIT Press, 1989, and Irrational Exuberance, Princeton 2005.

- Average productivity from 1800 to 2005 has improved
- Improvements in non-farm business productivity tend to correlate with higher P/E multiples
- Technology investment tends to improve productivity and support higher P/E ratios

# Key Trends

- Drive towards faster, smaller, lighter, and more power efficient chips
  - Integration of more functionality into consumer products
  - Increasing focus on audio and visual functionality
- Increasing use of wireless devices and multi-content connectivity
- Quadruple play over packet networks (voice, video, data, and wireless)
  - Increase Internet and wireless users
  - Acceleration in broadband deployment
  - Transition to IP v6
- Expanding markets as chips find themselves in many new products and industries
  - Industrial; control
  - Data processing and storage
  - Communications
  - Automotive
  - Medical
  - Consumer
  - Defense