Technology Optimism, but Employment and GDP Growth Uncertainty

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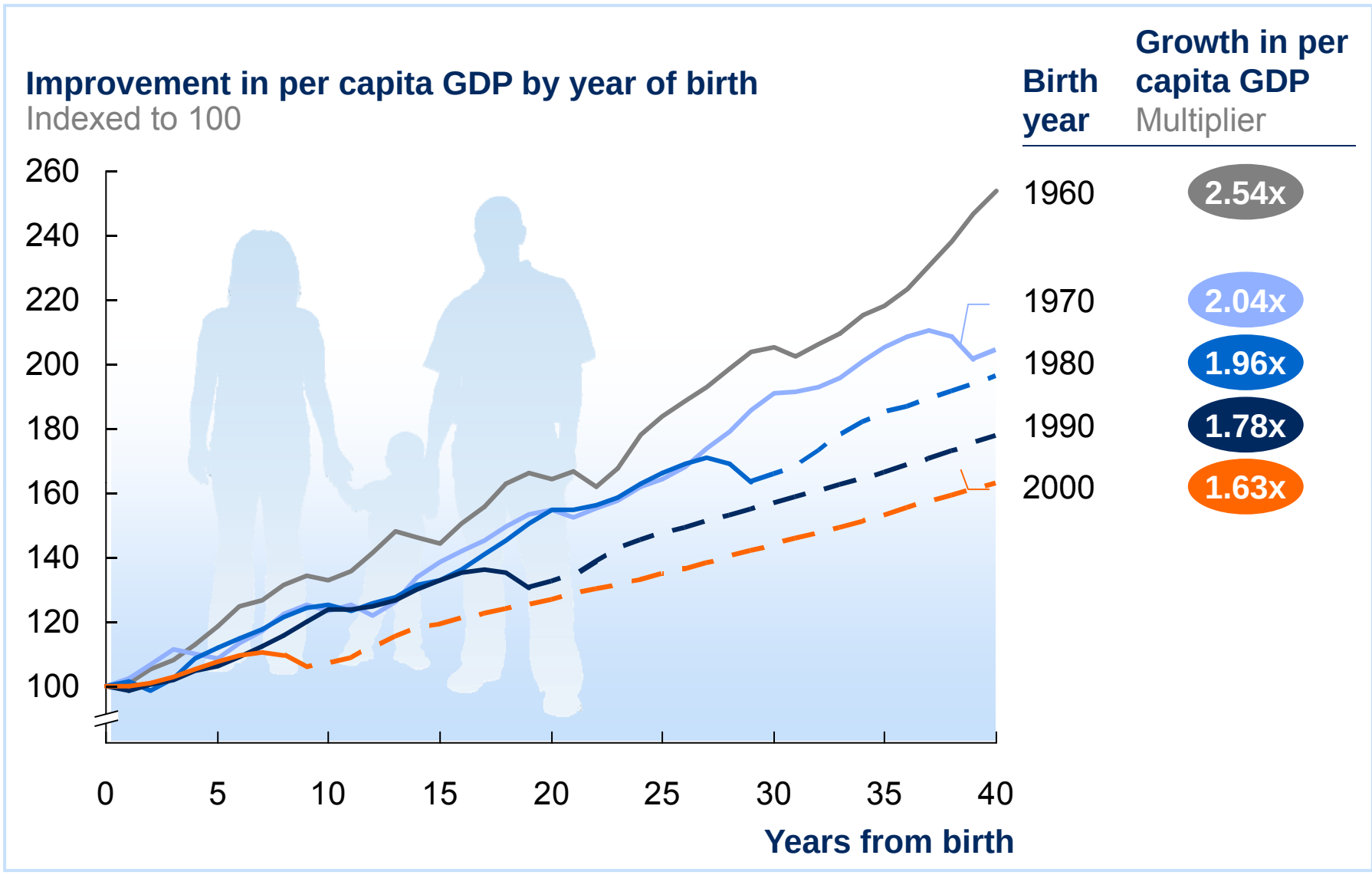
Prepared for the AEA Meetings January 4, 2012

Contents

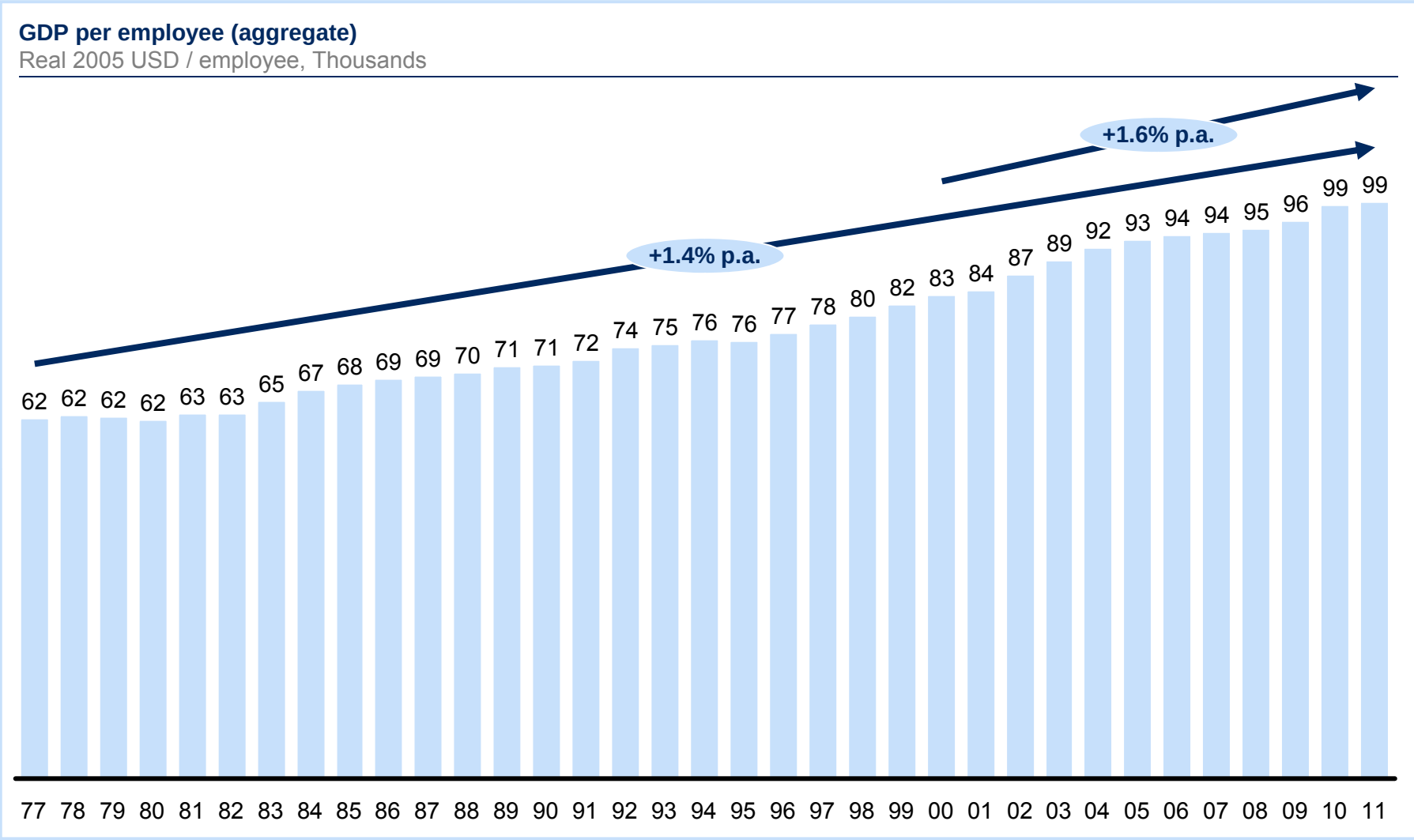
- **Historical and current patterns in US productivity**
- Future trends in productivity

Without a productivity boost, younger generations will experience slower increases in their standard of living



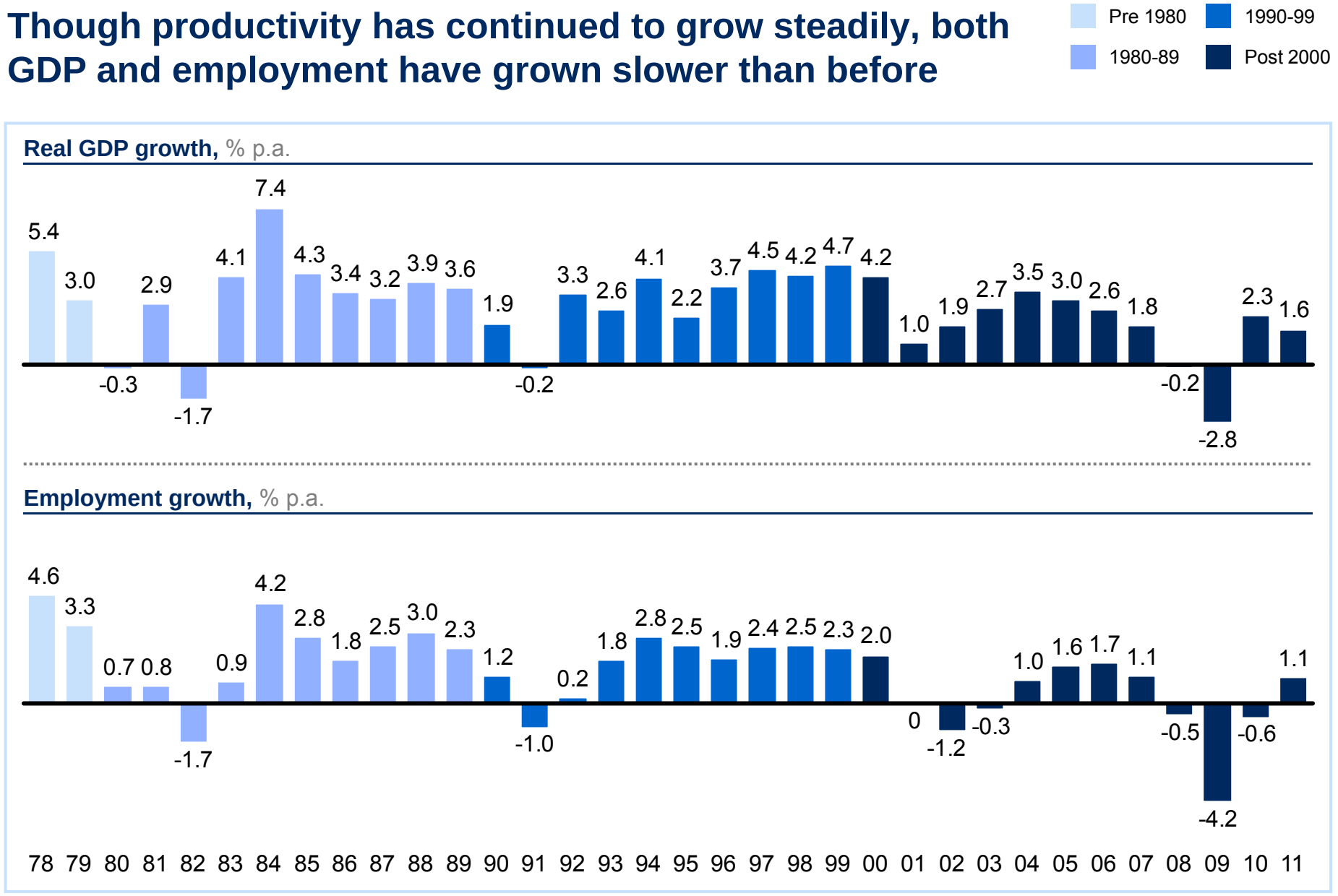
SOURCE: U.S. Bureau of Economic Analysis; U.S. Census Bureau; Moody's Economy.com; McKinsey analysis

GDP per employee has maintained its long term rate of growth over the last decade



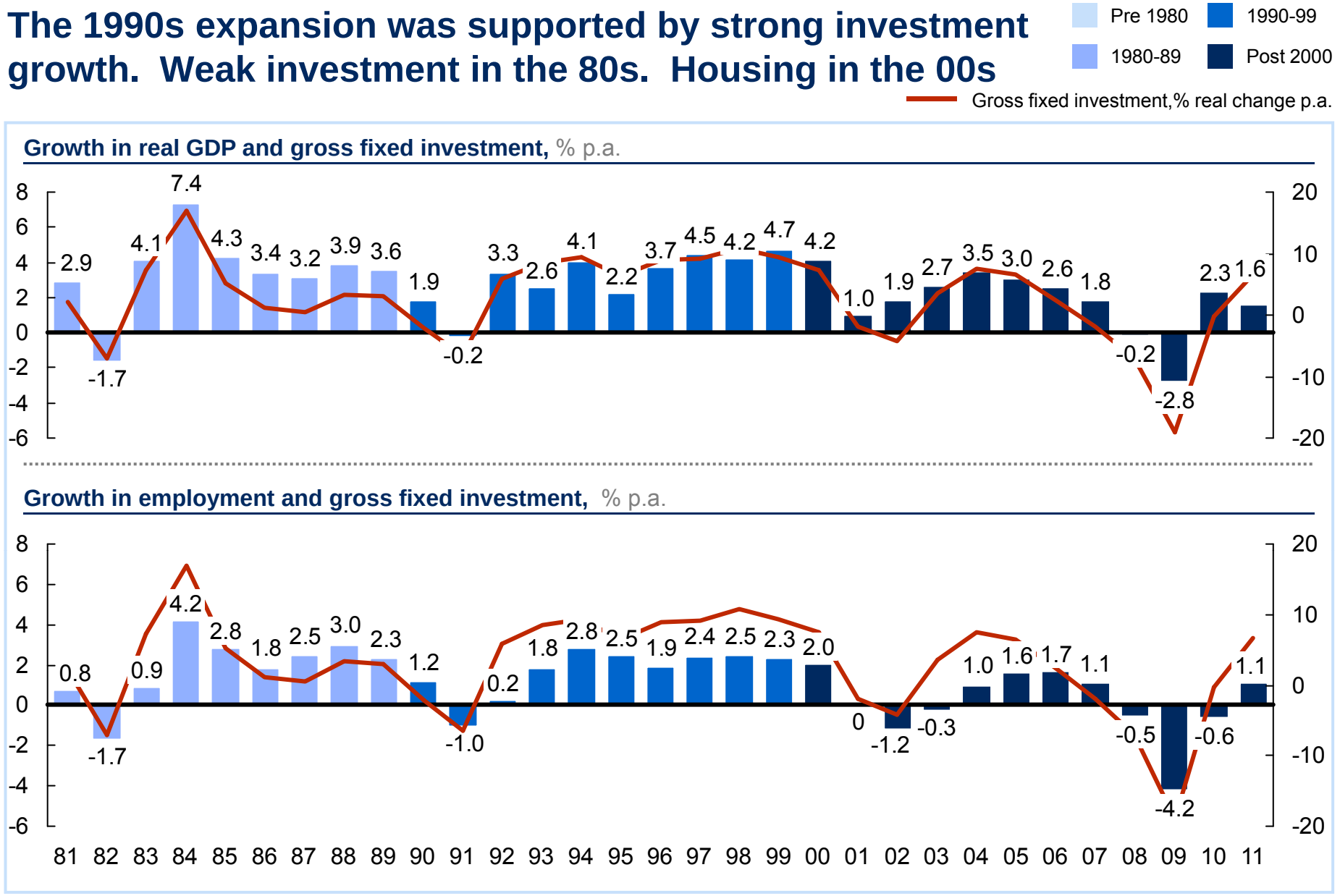
SOURCE: Moody's database

Though productivity has continued to grow steadily, both GDP and employment have grown slower than before



SOURCE: Moody's database

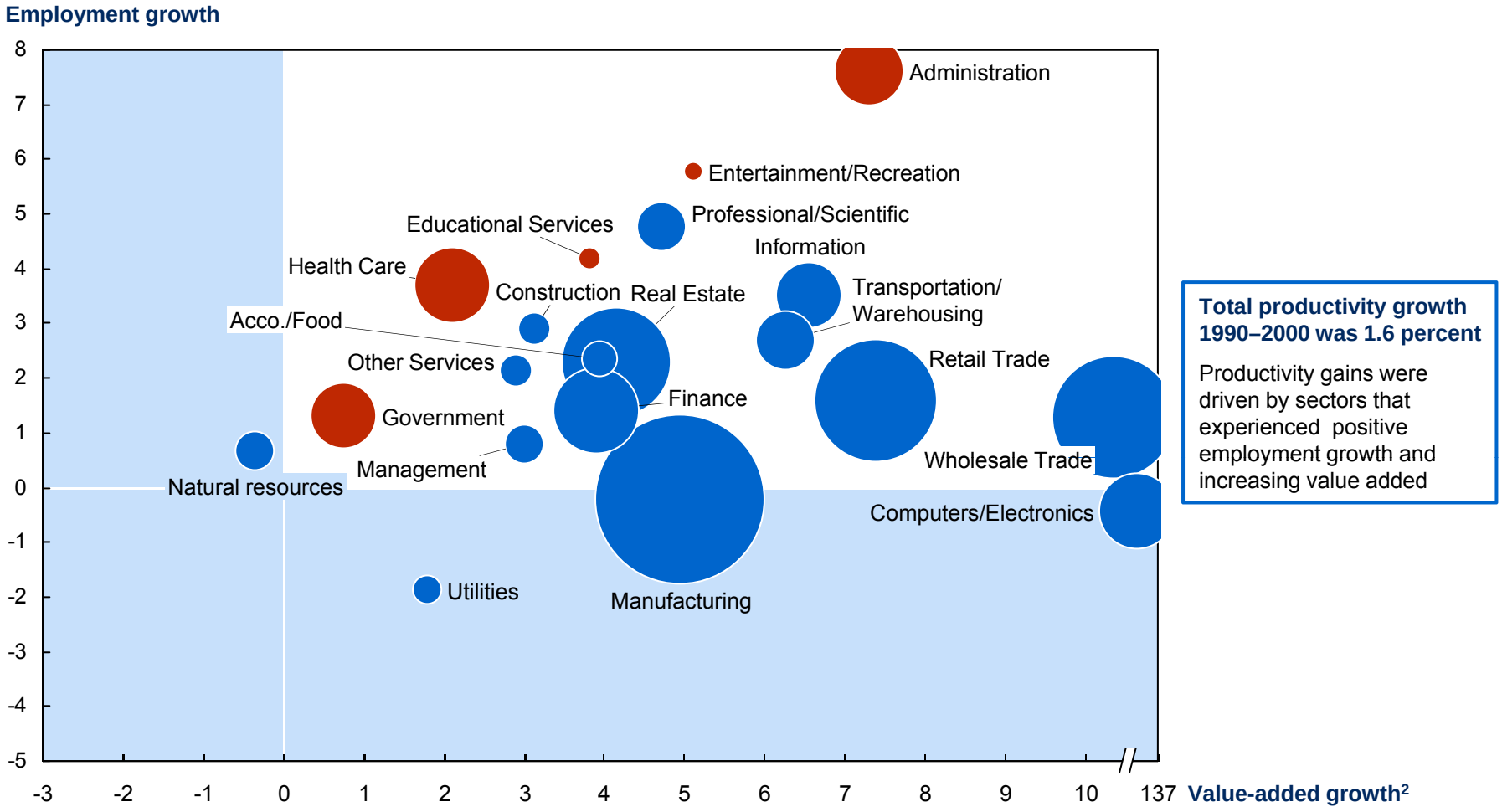
The 1990s expansion was supported by strong investment growth. Weak investment in the 80s. Housing in the 00s



SOURCE: Moody's, The Economist Intelligence Unit

In the 1990s, productivity growth was driven by sectors with a virtuous cycle of job growth and increasing value added

Average annual growth rate, 1990–2000, %

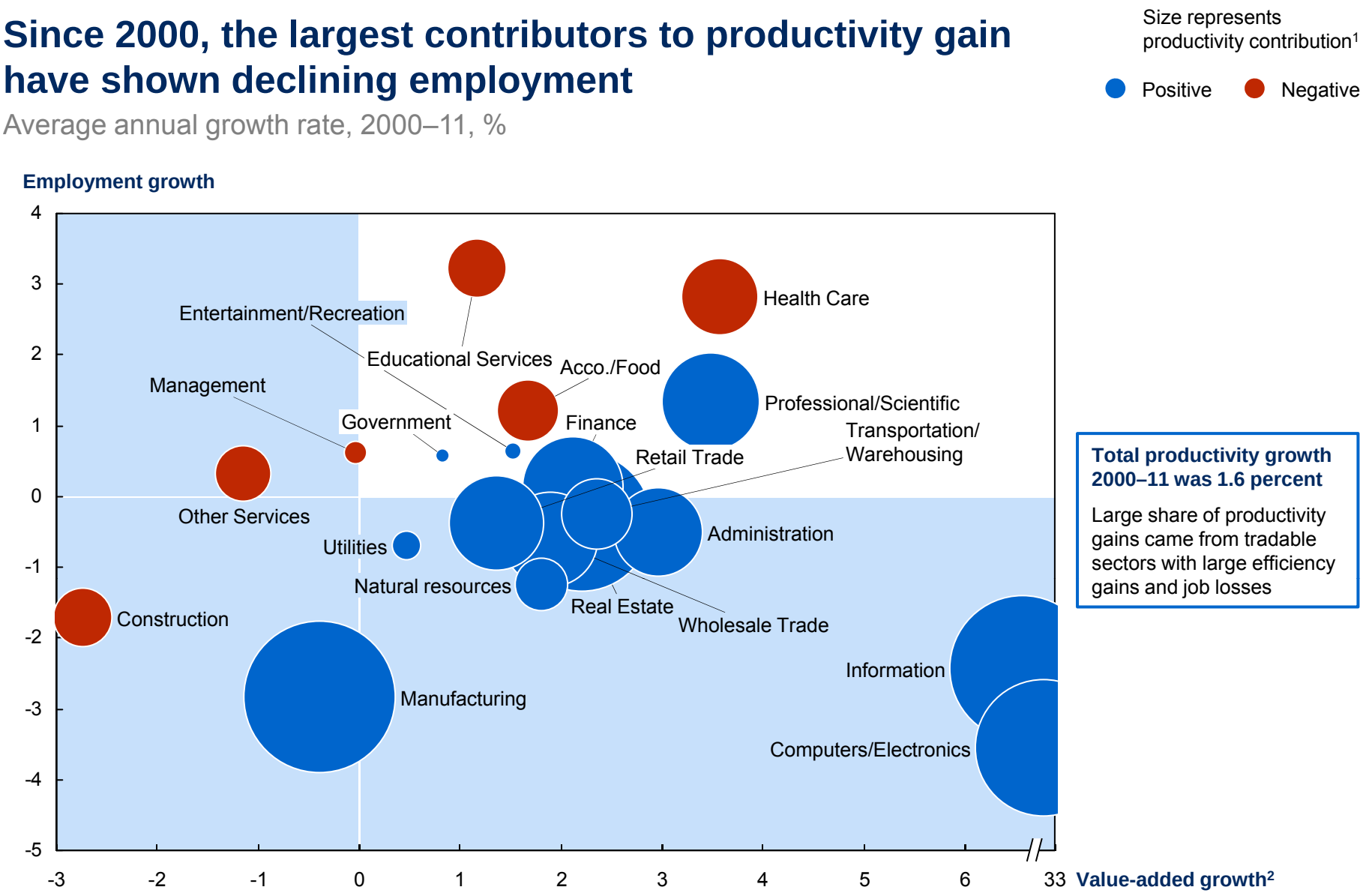


1 Manufacturing excludes Computers/Electronics
2 Valued-added growth is the contribution of each sector to total GDP growth

SOURCE: US Bureau of Economic Analysis; Moody's Economy.com; McKinsey Global Institute Sunrise Productivity Model

Since 2000, the largest contributors to productivity gain have shown declining employment

Average annual growth rate, 2000–11, %



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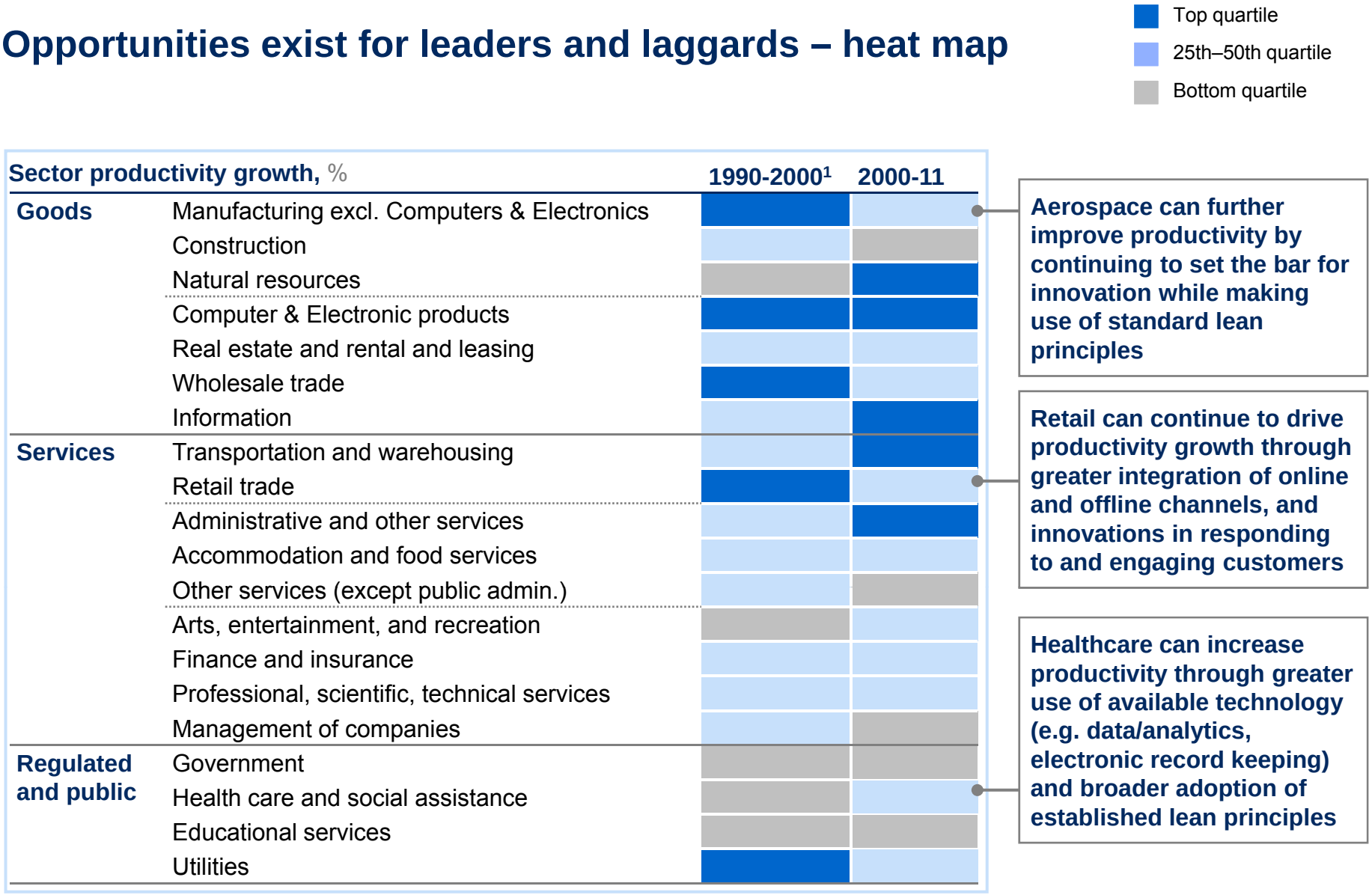
Opportunities exist for leaders and laggards – heat map



1 Productivity contribution was calculated using Moody's Economy.com data.

SOURCE: U.S. Bureau of Economic Analysis; Moody's Economy.com; McKinsey Global Institute Sunrise Productivity Model

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  - Energy
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We have currently identified 8 game changers to evaluate for their potentially significant impact on US productivity, jobs and GDP

		Description
1	 **Domestic energy and energy productivity**	Domestic production of shale gas and light tight oil combined with higher energy productivity in power generation, buildings, transport, and industrials
2	 **Skills revolution**	Increasing K-12 and post-secondary attainment and achievement, aligning skills to job demand, and providing re-employment pathways
3	 **Next-generation infrastructure**	Economic gains from sustainable infrastructure spending, long-term infrastructure investments to address future demand needs, and enabling trade and innovation growth through transport infrastructure
4	 **Innovation in materials, biologics, biosciences**	New products and processes enabled by advanced and lightweight composites, nanotechnologies, biologics, and biosciences
5	 **Diffusion of Big Data, internet innovation**	Productivity impact and innovation in new products and services related to big data, advanced analytics, social technologies, spectrum reallocation, and “internet of things” on large sectors of the economy
6	 **Public-sector productivity gains**	Productivity growth in three major public or quasi-public sectors including healthcare, education and government services delivery
7	 **Restored business creation engine**	Recovery from 23% drop in new business creation since 2007 and reversal of long-term decline in business creation as a share of working-age population
8	 **Sustained export growth**	Acceleration of US gross export growth from current trajectory (at 13% of GDP, already at highest level since 1950) in both tradable goods and services

SOURCE: McKinsey Global Institute

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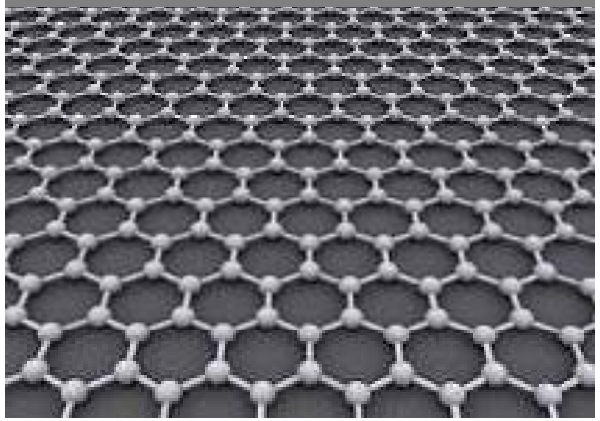
Manufacturing is diverse

Group	Industry	R&D intensity	Labor intensity	Capital intensity	Energy intensity	Trade intensity	Value density
Global innovation for local markets	Chemicals	High	Low	High	Upper-middle	Upper-middle	Low
	Motor vehicles, trailers, parts	Upper-middle	Low	Lower-middle	Lower-middle	Upper-middle	Upper-middle
	Other transport equipment	High	Upper-middle	Low	Low	Upper-middle	Upper-middle
	Electrical machinery	Upper-middle	Lower-middle	Low	Lower-middle	Upper-middle	Upper-middle
	Machinery, equipment, appliances	Upper-middle	Lower-middle	Low	Lower-middle	Upper-middle	Upper-middle
Regional processing	Rubber and plastics products	Upper-middle	Upper-middle	Low	Upper-middle	Low	Upper-middle
	Fabricated metal products	Low	High	Low	Upper-middle	Low	Lower-middle
	Food, beverage, and tobacco	Lower-middle	High	High	Upper-middle	Low	Low
	Printing and publishing	Lower-middle	Upper-middle	Low	Low	Low	Lower-middle
Energy-/ resource-intensive commodities	Wood products	Low	High	Upper-middle	High	Low	Low
	Refined petroleum, coke, nuclear	Low	Low	High	High	Lower-middle	Low
	Paper and pulp	Lower-middle	Upper-middle	Upper-middle	High	Lower-middle	Low
	Mineral-based products	Upper-middle	Upper-middle	Upper-middle	High	Low	Low
	Basic metals	Low	Low	High	High	Low	Lower-middle
Global technologies/ innovators	Computers and office machinery	High	Lower-middle	High	Low	High	High
	Semiconductors and electronics	High	Low	Upper-middle	Low	High	High
	Medical, precision, and optical	High	Lower-middle	Upper-middle	Low	High	High
Labor- intensive tradables	Textiles, apparel, leather	Lower-middle	High	Low	Upper-middle	High	Upper-middle
	Furniture, jewelry, toys, other	Lower-middle	High	Low	Low	High	Upper-middle

New technologies change manufacturing value chains and processes

New materials
- Nanotech
- Composites
- Biologics



Product design
- Internet of Things
- Advanced analytics
- Social media

Production processes
- Modeling and simulation
- Advanced robotics
- Additive manufacturing

Information systems
- Big Data
- Computer-aided design

Business models
- Frugal innovation
- Circular economy
- New service models

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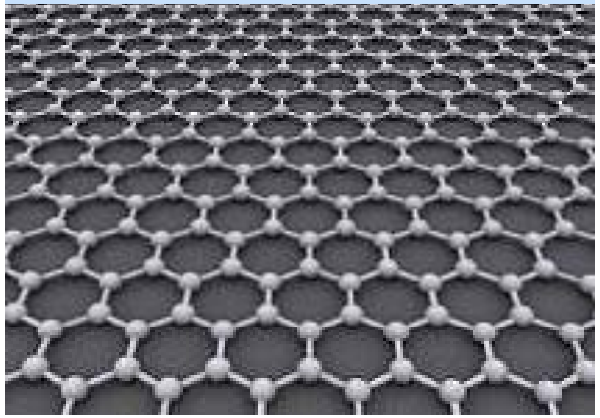

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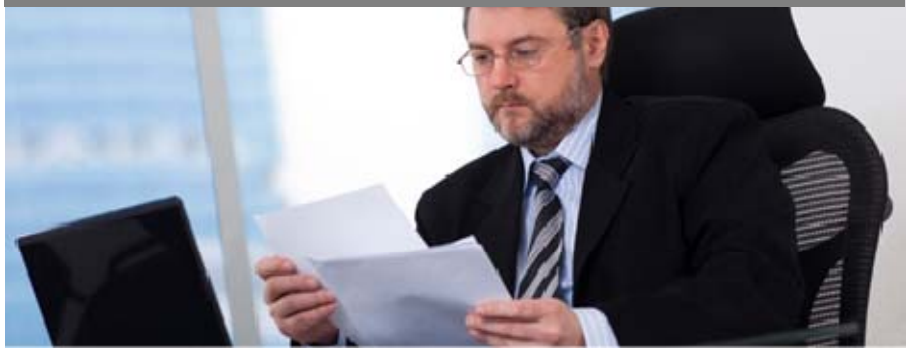
Three major legislative and regulatory changes will force providers to undergo major transformation

	Expected collective impact on healthcare systems
Health Reform	▪ Leap in number of insured (up to 20M+ more lives) ▪ Increased cost and pricing pressure in health care industry ▪ Payor urgency to support change to bend cost curve and remain relevant
ARRA Stimulus	▪ Significant increase in penetration of electronic health records (EHR) resulting in greater medical effectiveness ▪ Increase in patient engagement and knowledge due to access to information
Switch to ICD10/ HIPPA5010	▪ Rise in demand for information/ analytics to drive comparative clinical and health economics research (e.g., provider pay for performance) ▪ Greater complexity in managing compatibility of legacy IT systems with coding upgrades and regulatory changes

SOURCE: Interviews; analyst reports

New technologies in healthcare processes and delivery systems

Data driven decision making
- Data driven R&D for increased efficacy
- Ease of comparing treatments and products
- Analytical forecasts of effects of EMR and CDS
- Analytics driven marketing



Transparency in information flow
- Increased usage of online sources for healthcare information
- Transparent pricing driven by ease of comparing prices
- Use of social media for health information and marketing

Low cost channels and solutions
- Technology enabled redistribution of care, e.g. minute clinics and “clinic-in-a-box”
- Remote care tools, e.g. Orange healthcare
- Self-service, e.g. in vision exams

Personalization
- New data sources for more granular information on individuals, e.g. genome sequencing
- Individually customized products, e.g. Herceptin breast cancer drug paired with HER2 protein detection test
- Individually customized treatment regimes

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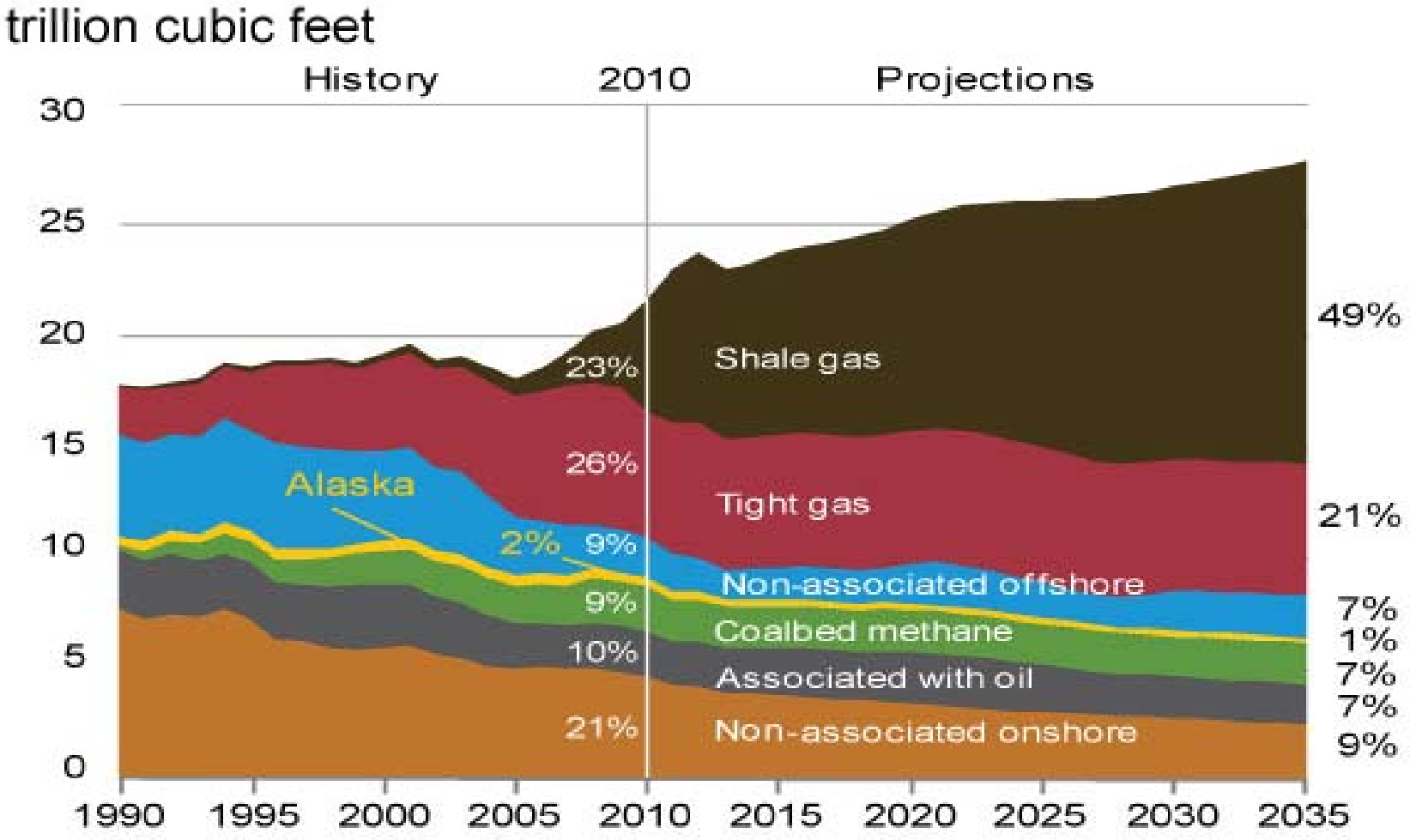
U.S. Natural Gas Production, 1990-2035



Source: U.S. Energy Information Administration, AEO2012 Early Release Overview, January 23, 2012.

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The United States now ranks 25th in the world for infrastructure quality, down from 5th in 2002

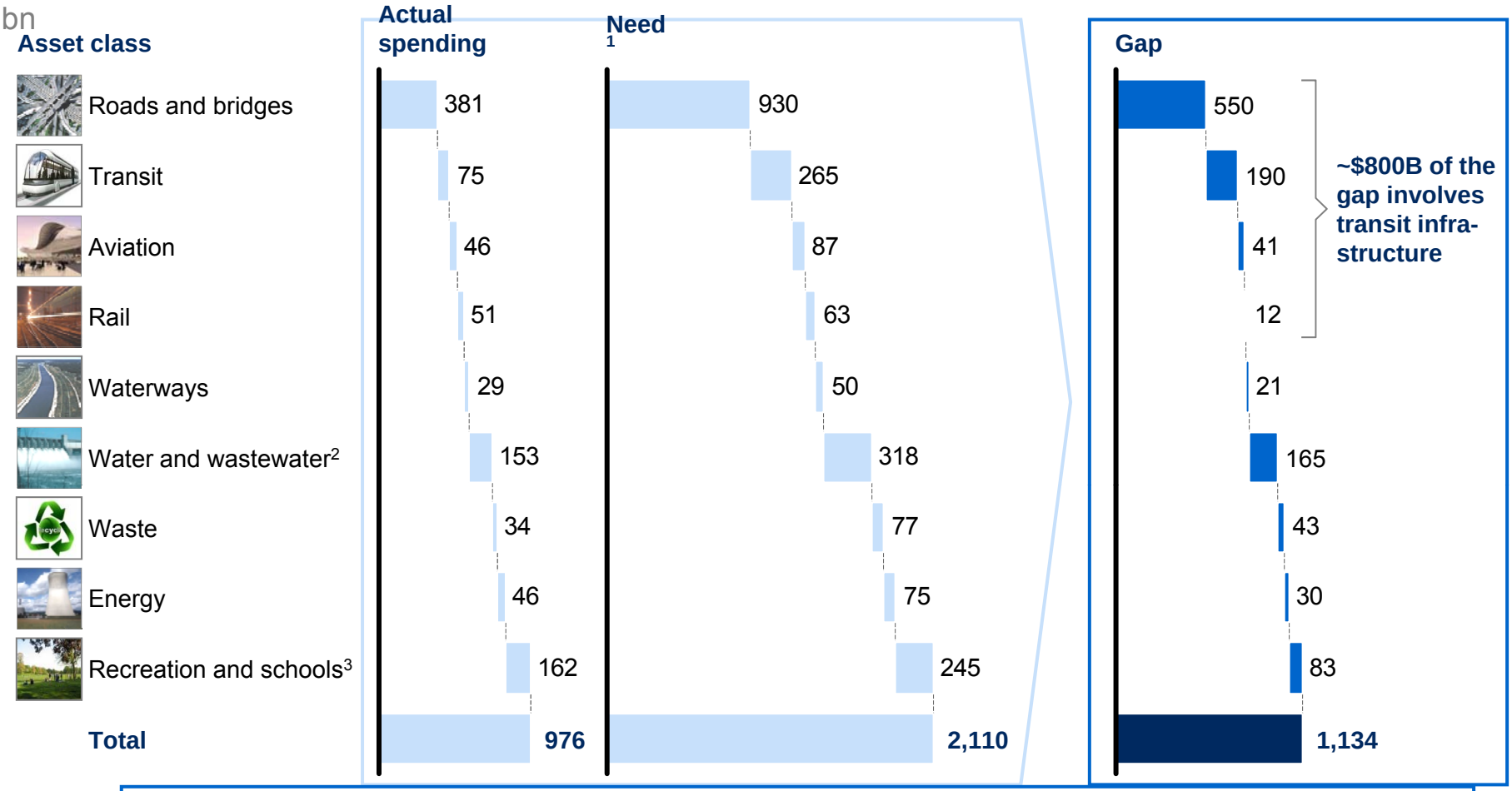
Question: How would you assess general infrastructure (e.g., transport, telephony, energy) in your country?

1	Switzerland	11	Portugal	21	Barbados
2	Singapore	12	Luxembourg	22	South Korea
3	Finland	13	Denmark	23	Saudi Arabia
4	Hong Kong SAR	14	Bahrain	24	United Kingdom
5	France	15	Canada	25	United States
6	UAE	16	Japan	26	Qatar
7	Iceland	17	Belgium	27	Taiwan, China
8	Austria	18	Spain	28	Czech Republic
9	Germany	19	Sweden	29	Malaysia
10	Netherlands	20	Oman	30	Slovenia

SOURCE: World Economic Forum Global Competitiveness Report, 2012-2013

The American Society of Civil Engineers estimates the US has a 5-year, $1.1T funding gap, ~70% of which comes from transport infrastructure

Estimated infrastructure investment shortfall for the U.S. 2009-14, $ bn



"The U.S. is falling dramatically behind much of the world in rebuilding and expanding an overloaded and deteriorating transport network." *Urban Land Institute, 2011*

1 Not adjusted for inflation 2 Includes dams and levees 3 Public parks and recreation and schools

SOURCE: American Society of Civil Engineers – 2009 Report Card for America's Infrastructure

However, there are many barriers that could prohibit these economic benefits

Barriers to infrastructure success

Sustainable financing	▪ New project financing difficult in **budget constrained environment** ▪ **Project selection** with positive ROI critical to realizing the full prize
Inward FDI	▪ Importance of **considerations** (trade agreements, relationships with new countries etc.) **beyond infrastructure** ▪ Political questions around **selection of export/FDI nodes**
Expansion of industry	▪ **Slow moving process** to begin to develop new industry practices and expertise ▪ **Environmental concerns**, e.g. global climate concerns around expanding coal exports

Conclusions

- Very uncertain productivity trend. GDP per employee has continued to grow. Nonfarm business per hour has had trend growth of about 2.5 percent, 1996 to the present, but has slowed in recent quarters. CBO estimates the trend in nonfarm business per hour growth at 2.2 percent.
- Since 2000 productivity growth has been associated with slow employment growth or layoffs. Restructuring productivity. For sustained growth going forward the economy needs output/numerator driven growth, which requires greater thrust on innovation and competitiveness on skills.
- We do not find any evidence of technology stagnation. 3-D chips have prolonged Moore's law, probably for another 10 years. There are multiple new technologies emerging from Silicon Valley and elsewhere.
- There has been a revolution in the US energy picture with plentiful natural gas and possible self-sufficiency in oil. Energy is not a large part of total cost for most industries, but the stability and certainty of supply adds to the attractiveness of investing in the US.
- There are emerging technologies and business process changes that could boost health care productivity. The barrier to such growth is institutional not a lack of opportunity.
- Infrastructure is not currently holding back business productivity (except for urban congestion). Significant investment is needed to preserve and improve the infrastructure. There are opportunities to make better use of the capital in place.