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Lessons from Past Productivity Research and Implications for the Future

for the
Seminar on Productivity in a Time of Change

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Brookings

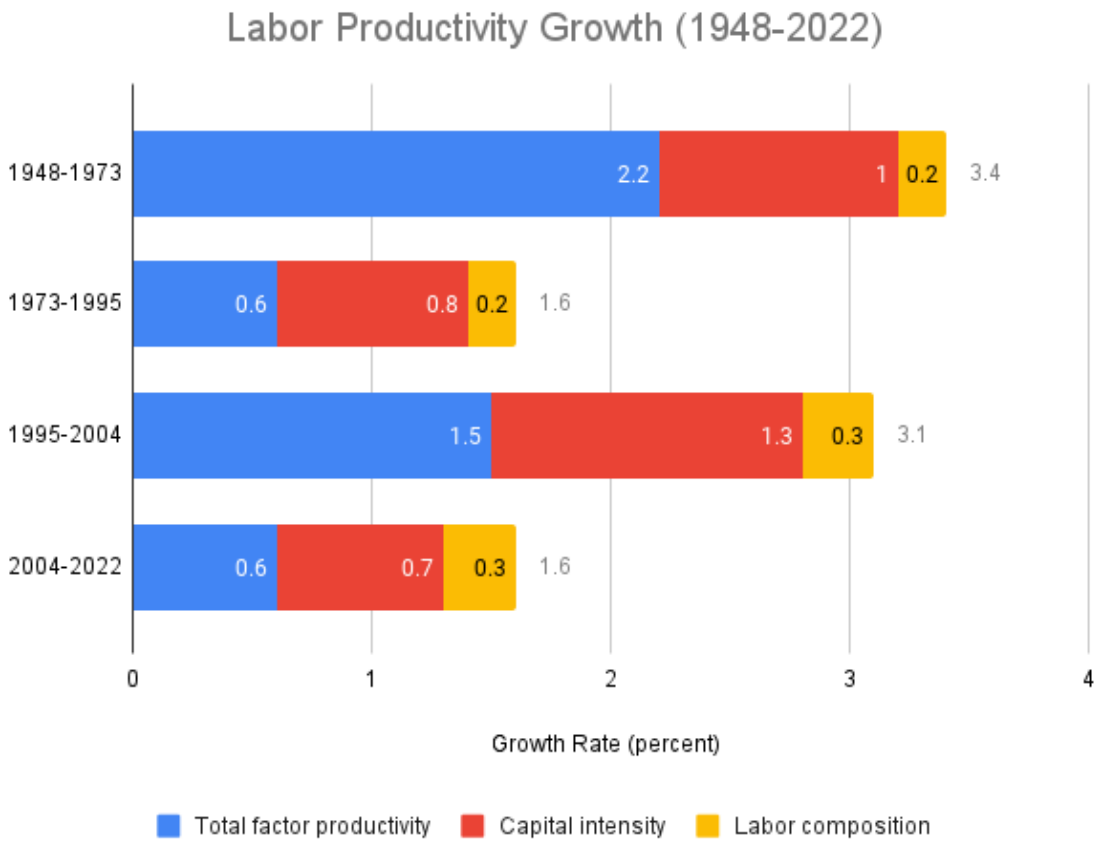
Productivity Questions

- **What is the source of the increases in total factor productivity that generated rapid economic growth in the postwar period?**
- **Why did growth slow abruptly in the early 1970s?**
- **Why did growth speed up for nine years starting in the 1990s?**
- **Why have some economies failed to catch up to the productivity frontier?**
- **What are the reasons for differences in productivity by industry across countries?**
- **Will emerging new technologies drive a resurgence in productivity growth?**

Unfortunately, there are not consensus explanations for many of these puzzles. "I am struck by how little we know" John Fernald told me recently. However, there are interesting things to talk about.

1. US Labor Productivity Growth was rapid in the 50s and 60s. Slowed in the 70s. Recovered 95-04, and then slowed again
2. TFP Growth and Capital Contribution Move Somewhat Together.
3. Contribution of Labor Composition Small, Stable.

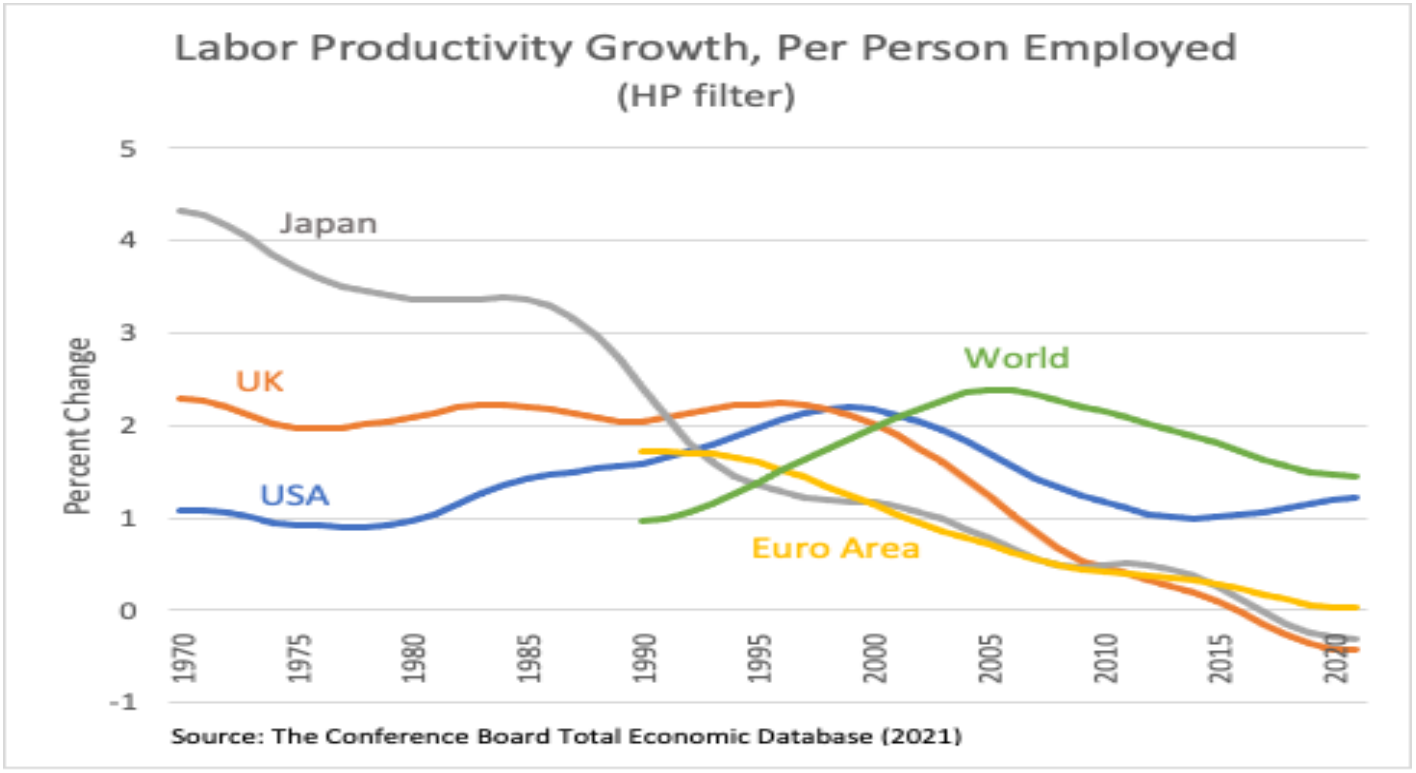
BLS Total Factor Productivity Database



Productivity Growth has Slowed in Almost All Mature Economies

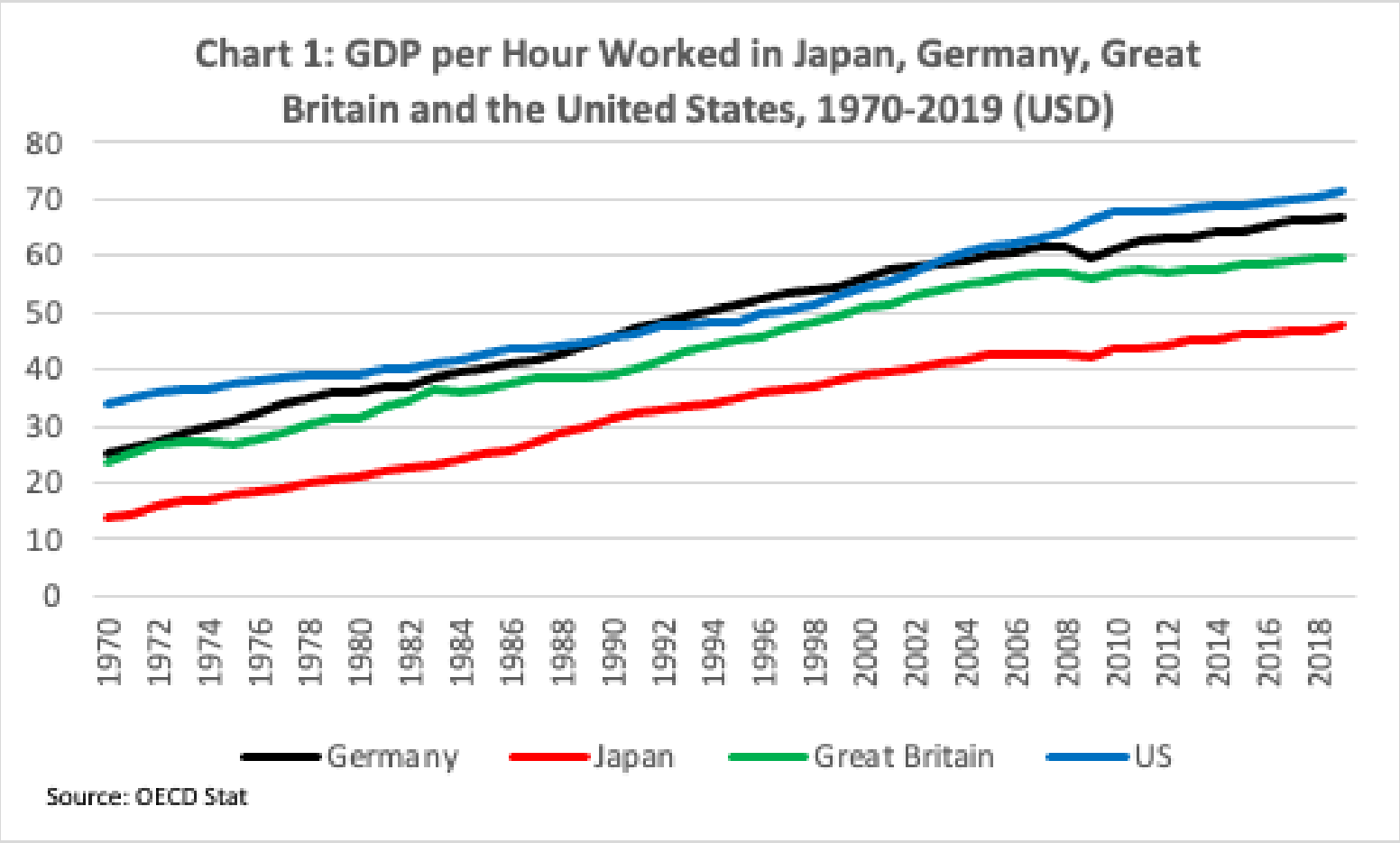
Productivity growth has even slowed recently in emerging economies

Trend growth of GDP per Person Employed using HP filter, Major Regions, 1970-2019



Source: The Conference Board Total Economy Database (adjusted version) 2021

Incomplete Convergence of Japan and the UK



A series of business consulting studies looked at the reasons why the levels of productivity by industry varied across countries.
Academic advisors led by Solow

The Role of Capital

- **Among developed economies, capital intensity was rarely a *major* driver of productivity level differences across economies within the same operating format.**
  - **Capital goods are available globally, auto factories or supermarkets looked very similar across countries.**
  - **More modern equipment with more advanced technology yielded a modest productivity advantage.**
  - **Some countries worked fewer hours, which required a larger capital stock.**
- **Industry evolution impacted capital intensity.**
  - **In retail, for example, some countries restricted big box stores and franchises. These modern formats had higher capital intensity than traditional small standalone retailers, so productivity and capital intensity are correlated, but the driving difference comes from the regulatory environment.**

The Role of Technology

- **The high-tech sector is small in all countries.**
- **Proprietary technology not a significant source of productivity differences across countries for most industries. The most productive equipment and software are for sale globally.**
- **By contrast. Substantial differences in:**
  - **1. the way companies organized production,**
  - **2. in the design of products and services,**
  - **3. skills in marketing and in the development of new products and services.**
  - **4. large differences in "soft" technologies.**
- **Caveat:**
  - **Proprietary technology is very important in aerospace, computers, semiconductors, software, machine tools, communications, information. As we will see, technology is very important to total factor productivity growth in the US.**

The Role of Human Capital

- **Reports found the level of human capital for production and non-supervisory workers not important to cross-country productivity differences.**
- **Companies adapt their business processes to the labor force that is available. US companies are adept at being productive with workforces that have low educational levels and high rates of turnover.**
- **Examples**
- **1. Labor productivity in Brazil in residential construction was *only one fifth of that in the US*. Widely blamed on workforce with little education, but US construction workers are mostly immigrants with similar education level to those in Brazil.**
- **2. Companies such as McDonalds or Wal-Mart are productive despite high turnover and a low-skill workforce. Productivity built into the business system.**

Was this conclusion about human capital correct?

- **High productivity in US residential construction relied on strong managerial skills, better organization of the job site, better utilization of labor, particularly for skilled trades workers (plumbers, carpenters etc). *Supervisory labor skills important*.**
- **Japanese and German auto companies investing in the US carried out extensive training programs to achieve desired quality levels.**
- **German manufacturing sector not as strong in high-tech as US but supports productivity with skilled workers making unique products.**
- **The reports did not study the importance of human capital for managers and professionals. A later study by LSE (Bloom and van Reenen) and McKinsey's London office found better managerial skills resulted in superior corporate performance.**
- **An ocean of academic research showing the contribution of education to wages.**

What Did the Studies Conclude were the Main Reasons for Cross-Country Differences? *Competitive Intensity, Regulation, Scale*

- **Many companies and industries operated below the productivity frontier. Comfortable oligopolies, often protected by trade barriers or regulation.**
- **As noted, productivity impacted by the way in which factories or offices were operated "organization of functions and tasks". Product designs--easy to assemble.**
- **The highest productivity manufacturing industries were those most exposed to global best practice companies**
- **State-owned companies were usually less productive with protected employment.**
  - **State owned banks in Germany, Sweden**
  - **National champion airlines**
  - **However, some productive state-owned companies. POSCO in Korea. France cell phone service.**

Regulation

- **The most important effect of regulation was in preventing the evolution of an industry into a more productive format.**
  - **Protection of small retailers and farmers in Japan and Europe**
  - **Land-use regulation in retail and residential construction**
  - **Protection of small banks in Germany, often state-owned.**
- **Regulation is often justified as employment protection**
  - **Regulation of the capital labor ratio in India restricted the use of machinery in the textile industry, making it unable to compete internationally.**
- **Sweden deregulated in the 90s in response to EU rules. Had rapid productivity growth.**
  - **UK picture more mixed. Productivity improved with deregulation but remains below the frontier.**
- **Some regulation can raise measured productivity, e.g. reduced opening hours concentrates production in retailing, fast food. (Hurts convenience)**

The Industry Pattern of Growth and the Importance of Manufacturing

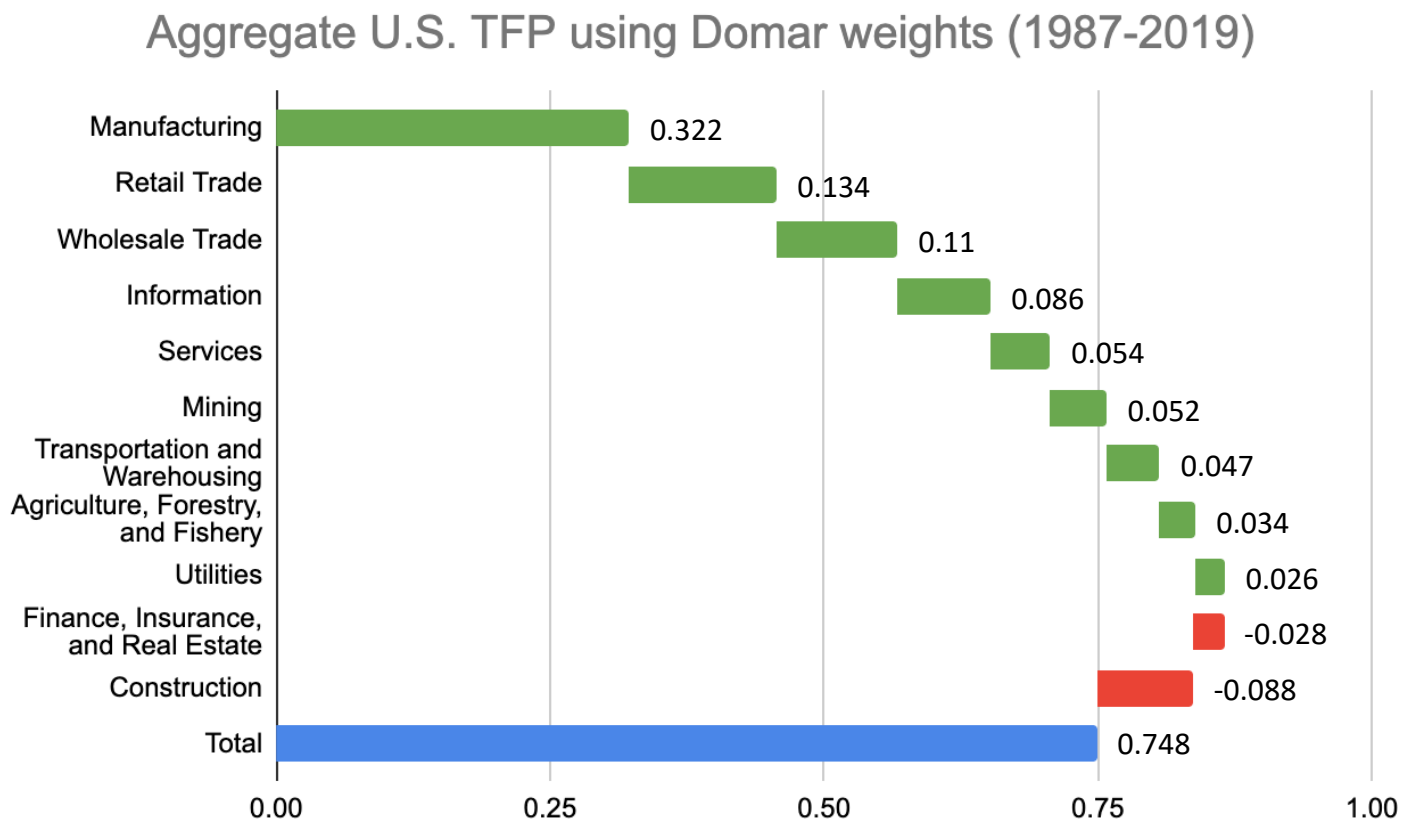
Rate of growth of total factor productivity estimated for each industry, BLS data.

Using Domar weighting, the contribution of each industry to aggregate total factor productivity can be calculated.

Estimates from 1987-2019.

Which Industries Generated US TFP Growth? Manufacturing, Trade and Information account for over 85 percent of US TFP Growth 1987-2019

Contributions to US TFP Growth by Industry. Author's calculations: BLS total factor productivity database, Domar weights

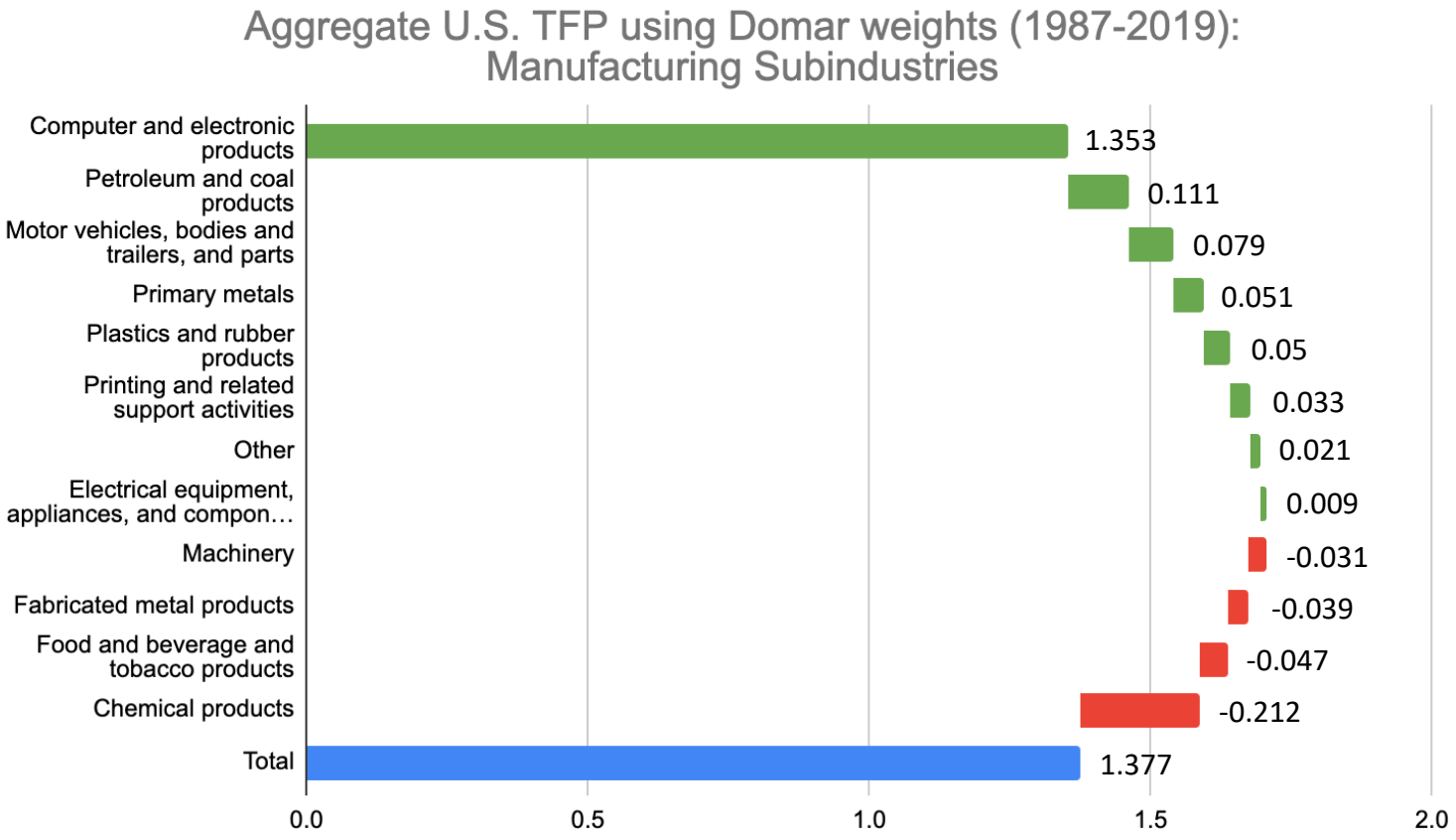


Contributions to US Growth by Industry

- **Manufacturing, retail trade, wholesale trade and information were the biggest contributors to TFP growth for the private economy.**
- **Mining, agriculture, utilities, transport and warehousing made smaller growth contributions. Services added a tiny contribution.**
- **Construction and finance subtracted from TFP growth over this period.**
- **Manufacturing by itself was equal to 44 percent of the amount of total TFP growth**

Within manufacturing, the computer & electronics subsector is responsible for the vast majority of TFP growth.

Contributions to US TFP Growth by Manufacturing Subindustry. Author's calculations: BLS total factor productivity database, Domar weights



Contributions from Sub-Industries in Manufacturing

- As expected, computers and electronics very important—98 percent of manufacturing total (with offsetting pluses and minuses from other industries).
- That translates into 43.6 percent of TFP growth for the whole nonfarm business sector 1987-2019!
- A big drop in TFP in this sub-industry recently contributed very heavily to negative manufacturing TFP 2014-19 (see appendix table).
- Earlier conclusion about the small size of high-tech and, hence, its relative unimportance must be qualified.

Responses to the Questions

- **Innovation drives TFP growth in the long run. Soft innovation is very important. New business models, product and process design, organization of production**
- **Don’t know why productivity slowed abruptly in the 70s. Presumably innovation slowed, but it is puzzling. Innovation in high-tech remains very dynamic.**
- **The cross-country comparisons suggest that the path to productivity growth for most countries/industries involves moving to global best practice. Competition, trade, direct foreign investment, avoid anti-competitive regulation.**
- **Not discussed here, but there is a broad consensus that a surge of computer investment in the 90s drove the nine-year productivity surge.**
- **Human capital: skilled managers and technical staff are crucial. Role of education for production and non-supervisory workers remains a question.**

The Role of Technology and Future Prospects

- **The cross-country industry comparisons played down the importance of technology to differences in the levels of productivity.**
- **Paul Krugman finds little sign of a productivity benefit from the internet.**
- **However, very large contribution of the high-tech sector to US TFP *growth*. The collapse of that growth has contributed to recent productivity weakness.**
- **Computerization has not always been disappointing, witness 1995-2004.**
  - **Computers became cheap and user-friendly enough, there was a productivity boom.**
  - **LLMs are general purpose technology, easy to use, potential to make a broad section of the workforce more productive. Very rapid development taking place. Not just LLMs.**
  - **Byrne and co-authors have shown weaknesses in high-tech measurement. May not capture the productivity of the software sector.**

Appendix

The Cross-Country Studies were All Published in Reports. A Sample of Publications

- Martin Neil Baily, Competition, Regulation and Efficiency in Service Industries, Brookings Papers: Microeconomics 2, 1993.
- Martin Neil Baily and Hans Gersbach, "Efficiency in Manufacturing and the Nature of Competition," Brookings Papers on Economic Activity, Microeconomics, 1995.
- Martin Neil Baily and Alan Garber, “Health Care Productivity” Brookings Papers on Economic Activity, Microeconomics; 1997.
- Martin Neil Baily and Eric Zitzewitz, “Extending the East Asian Miracle: Microeconomic Evidence From Korea,” Brookings Papers on Economic Activity, Microeconomics, 1998.
- Martin Neil Baily and Robert M. Solow, “International Productivity Comparisons Built from the Firm Level,” Journal of Economic Perspectives, 15 (3), Summer 2001.
- William W. Lewis, The Power of Productivity: Wealth, Poverty, and the Threat to Global Stability, University of Chicago Press, 2005.
- Increasing Global Competition and Labor Productivity: Lessons from the US Automotive Industry, McKinsey Global Institute, McKinsey & Company, November 2005.

Contribution of Each Manufacturing Subindustry to Manufacturing TFP Growth (Domar weights)

Subsector name	Measure Title	AVG 1987-2019	AVG 2014-2019
Computer and electronic products	DA TFP	1.35262318	-0.128318847
Petroleum and coal products	DA TFP	0.110586605	-0.020759265
Motor vehicles, bodies and trailers, and parts	DA TFP	0.078723569	0.005368743
Miscellaneous manufacturing	DA TFP	0.053428209	0.003930834
Primary metals	DA TFP	0.051326334	0.002388774
Plastics and rubber products	DA TFP	0.04990766	0.049526982
Printing and related support activities	DA TFP	0.032793853	-0.239149819
Textile mills and textile product mills	DA TFP	0.021097164	0.03736298
Nonmetallic mineral products	DA TFP	0.016062767	-0.016493682
Electrical equipment, appliances, and components	DA TFP	0.009201352	0.035321423
Paper products	DA TFP	0.004429981	0.035529309
Furniture and related products	DA TFP	-0.003177887	-0.028369773
Apparel and leather and allied products	DA TFP	-0.005105	-0.094388972
Wood products	DA TFP	-0.015695072	0.271818187
Machinery	DA TFP	-0.030918596	0.037785368
Fabricated metal products	DA TFP	-0.039226963	-0.148651368
Food and beverage and tobacco products	DA TFP	-0.046975739	-0.08000048
Other transportation equipment	DA TFP	-0.050030878	0.023921432
Chemical products	DA TFP	-0.212342979	0.010777118
TOTAL (manufacturing):		1.376707559	-0.242401057