Manufacturing Quarterly Update

April, 2016

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Agenda

1. Data

- Bureau of Labor Statistics
- Institute for Supply Management
- US Census Bureau
- Federal Reserve Industrial Production Index

2. Trends

- Global Manufacturing
- US Global Share

3. Opportunities

- Smart Manufacturing
- U.S Manufacturing Innovation Fund grant recipients
- 3D printing

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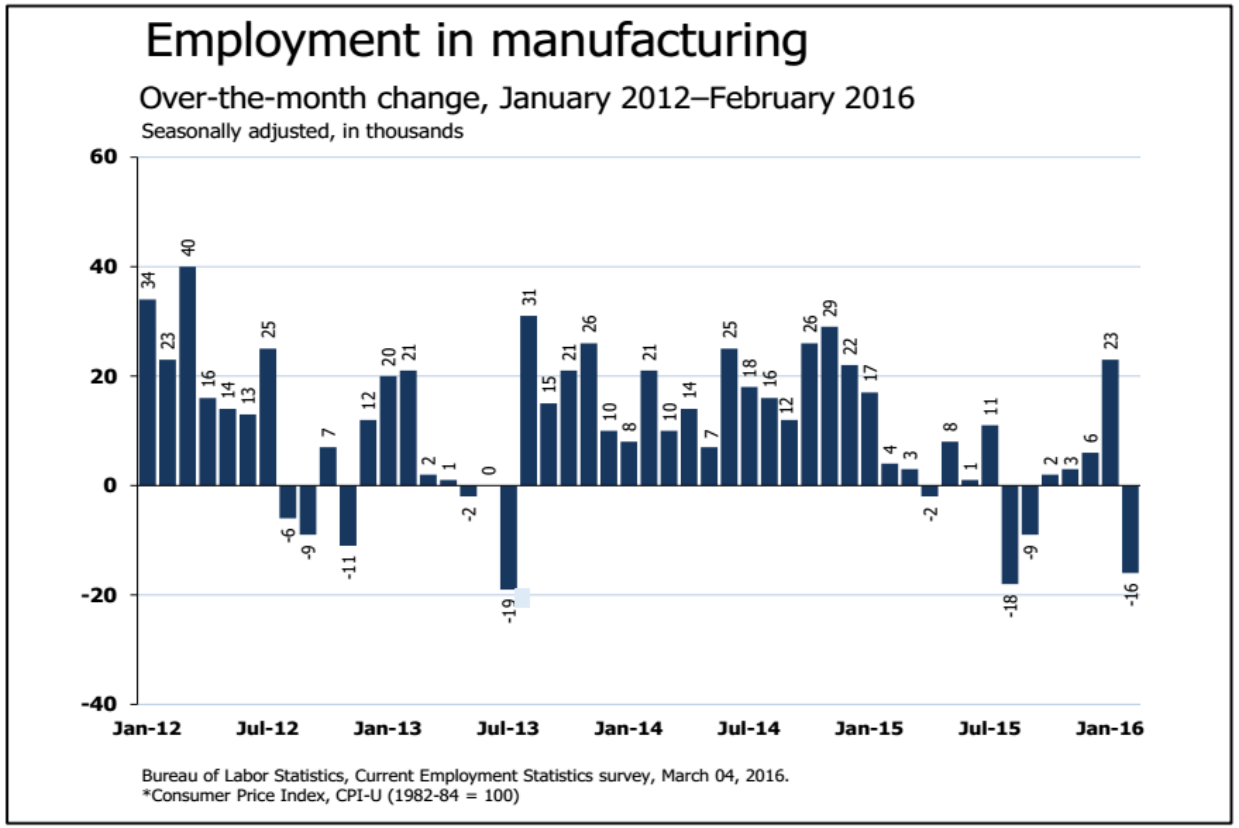
1 Data: Manufacturing Employment – little change



- **Manufacturing employment changed little in February** (-16,000)
- The manufacturing diffusion index fell to 48.7 from 59.5 in January. The diffusion index measures the dispersion of employment change in manufacturing. A value below 50 indicates that **more manufacturing industries are losing jobs than adding.**
- In February average weekly hours in manufacturing were unchanged for all employees

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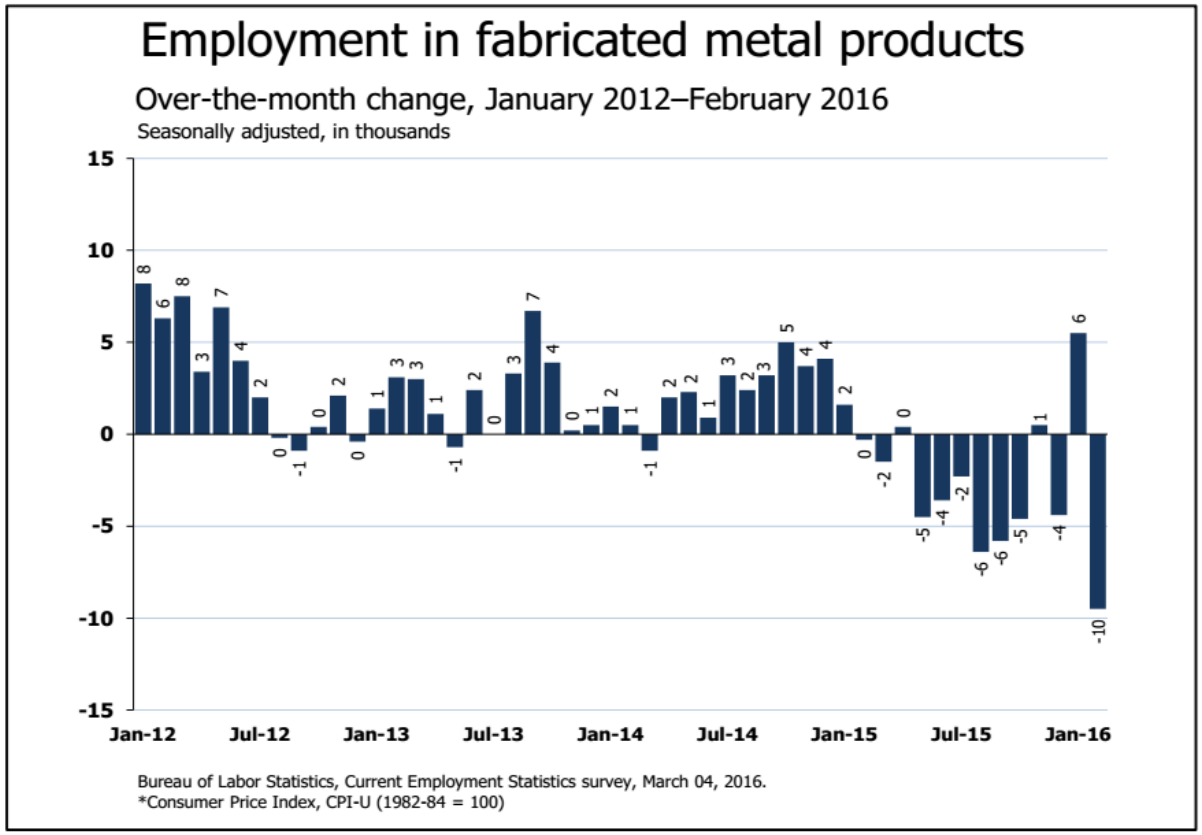
Bureau of Labor Statistics, CES Highlights March 2016

1 Data: Employment in Fabricated Metal Products Declines



- Within durable goods employment in **Fabricated Metal Product Manufacturing** declined -10,000 in February, more than offsetting the gain of 6,000 in January.
- This industry has experienced job losses in 9 of the last 12 months, losing an average of 3,000 employees per month over the year.

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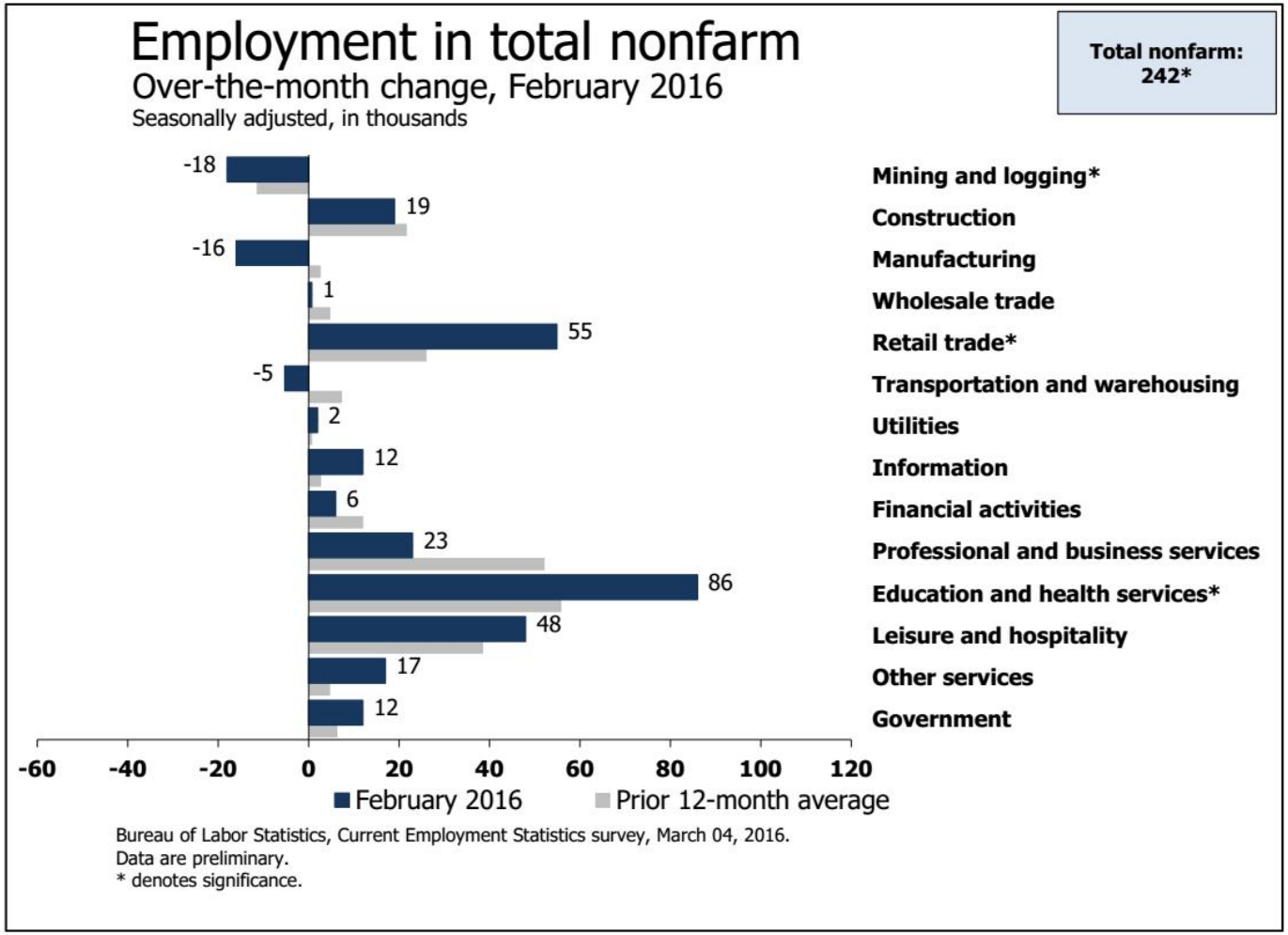
1 Data: Employment Trends Across Sectors: Manufacturing Shows Slower Growth



The chart shows that over the last 12 months manufacturing employment has changed little in comparison to other industries such as Education and Health Services ad Professional and Business Services

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Bureau of Labor Statistics, CES Highlights March 2016

1 Data: ISM Update – Manufacturing PMI Decreasing

- In February, economic activity in the **manufacturing sector contracted for the 5th consecutive month**, while the overall economy grew for the 81st consecutive month
- The Manufacturing PMI® registered 49.5 %, a decrease of 1.3 percentage points compared to January's reading at 48.2 %.
  - A reading above 50 % indicates that the manufacturing economy is generally expanding; below 50 % indicates that it is generally contracting.

- **Industries reporting growth in February:**
- Textile Mills
- Wood Products
- Furniture & Related Products
- Miscellaneous Manufacturing
- Electrical Equipment
- Appliances & Components
- Food, Beverage & Tobacco Products
- Chemical Products
- Primary Metals
- Paper Products

- **Industries reporting contraction:**
- Apparel, Leather & Allied Products
- Petroleum & Coal Products
- Computer & Electronic Products
- Printing & Related Support Activities
- Transportation Equipment
- Plastics & Rubber Products
- Fabricated Metal Products

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1 Data: ISM Update – Key Manufacturing Data

MANUFACTURING AT A GLANCE February 2016						
Index	Series Index Feb	Series Index Jan	Percentage Point Change	Direction	Rate of Change	Trend* (Months)
PMI®	49.5	48.2	+1.3	Contracting	Slower	5
New Orders	51.5	51.5	0.0	Growing	Same	2
Production	52.8	50.2	+2.6	Growing	Faster	2
Employment	48.5	45.9	+2.6	Contracting	Slower	3
Supplier Deliveries	49.7	50.0	-0.3	Faster	From Unchanged	1
Inventories	45.0	43.5	+1.5	Contracting	Slower	8
Customers' Inventories	47.0	51.5	-4.5	Too Low	From Too High	1
Prices	38.5	33.5	+5.0	Decreasing	Slower	16
Backlog of Orders	48.5	43.0	+5.5	Contracting	Slower	9
Exports	46.5	47.0	-0.5	Contracting	Faster	2
Imports	49.0	51.0	-2.0	Contracting	From Growing	1
OVERALL ECONOMY				Growing	Faster	81
Manufacturing Sector				Contracting	Slower	5

*The number of months the category has been listed moving in the current direction

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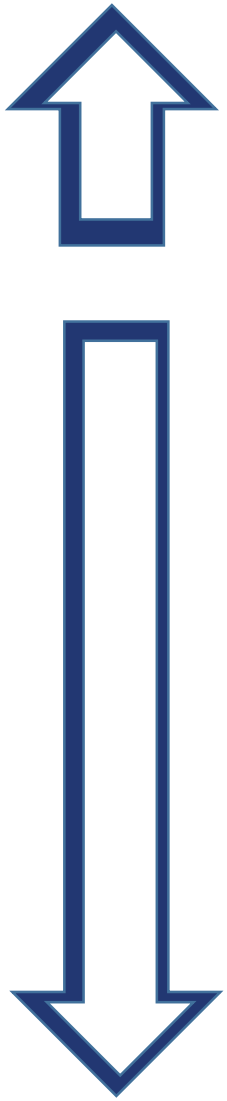
1 Data: ISM Update – Commodity Pricing trending Downward

In February most commodities were reported to be down in price. No commodities were in short supply.



Commodities Up in Price

- Aluminum*
- Polypropylene
- Stainless Steel*
- Steel* (2)
- Steel – Hot Rolled*

Commodities Down in Price:

- Aluminum (15)*
- Aluminum Products
- Copper (4)
- Copper Based Products
- Corrugated Boxes
- Diesel (3)
- Gasoline (3)
- Natural Gas
- Nickel (8)
- Oil (3)
- Oil Based Products
- PET Resin
- Propylene
- Stainless Steel* (16)
- Steel* (8)
- Steel – Hot Rolled* (5)
- Steel Products

Commodities in Short Supply:

- None reported

The number of consecutive months the commodity is listed is indicated after each item.
*Reported as both up and down in price

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1 Data: ISM Update – Growth in Production

Production Growing:

ISM's Production Index registered 52.8% in February, up 2.6 compared to 50.2% in January. **This indicates growth in production for the 2nd consecutive month.**

Industries reporting change in production during the month of February 2016:

UP

- Textile Mills
- Wood Products
- Miscellaneous Manufacturing
- Furniture & Related Products
- Plastics & Rubber Products
- Primary Metals
- Electrical Equipment, Appliances & Components
- Food, Beverage & Tobacco Products
- Machinery
- Fabricated Metal Products

DOWN

- Apparel, Leather & Allied Products
- Nonmetallic Mineral Products
- Paper Products
- Transportation Equipment
- Computer & Electronic Products

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1 Data: ISM Update – Growth in New Orders

New Orders Growing:

ISM's New Orders index registered 51.5% in February, the same as in January, indicating **grown in new orders for the second consecutive month.**

Growth in New Orders during February

- Textile Mills
- Wood Products
- Furniture & Related Products
- Machinery
- Plastics & Rubber Products
- Petroleum & Coal Products
- Nonmetallic Mineral Products
- Miscellaneous Manufacturing
- Primary Metals
- Transportation Equipment
- Chemical Products
- Fabricated Metal Products

Decrease in New Orders during February

- Apparel, Leather & Allied Products
- Paper Products
- Electrical Equipment, Appliances & Components
- Computer & Electronic Products

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1 Data: ISM Update – Customer's Inventories Too Low

ISM's Customers' Inventories index registered 47% in February which is a decrease of 4.5 percentage points when compared to the 51.5 % reported for January. **Customers' inventories were considered to be too low in February following six consecutive months where customers' inventories were considered too high.**

Customers' Inventories Too High during February

- Apparel, Leather & Allied Products
- Furniture & Related Products
- Fabricated Metal Products

Customers' Inventories Too Low during February

- Primary Metals
- Textile Mills
- Plastics & Rubber Products
- Electrical Equipment, Appliances & Components
- Transportation Equipment
- Miscellaneous Manufacturing
- Food, Beverage & Tobacco Products
- Machinery

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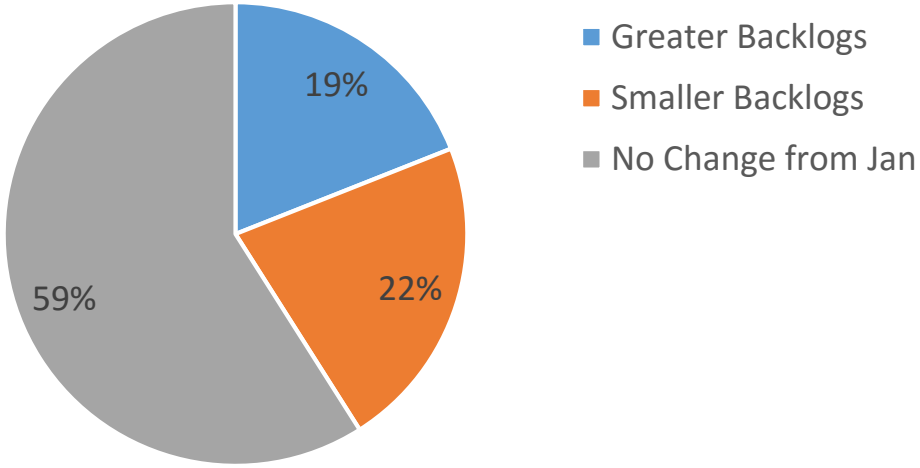
1 Data: ISM Update – Backlog of Orders Contracting

ISM's Backlog of Orders Index registered 48.5% in February, and increase of 5.5 percentage points compared to January reading of 43%. This indicates contraction in order backlogs for the ninth consecutive month.

Backlog of orders in February
(86% of ISM respondents answered)



Industries Reporting an Increase in Order Backlog during February

- Textile Mills
- Furniture & Related Products
- Machinery
- Transportation Equipment
- Fabricated Metal Products

Industries Reporting a Decrease in Order Backlogs during February:

- Apparel, Leather & Allied Products
- Paper Products
- Food, Beverage & Tobacco Products
- Chemical Products
- Electrical Equipment, Appliance & Components
- Computer & Electronic Products

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1 Data: U.S. Census Report - New Orders Increased

- **New orders for manufactured goods in January increased $11.1 billion (4.9%) to $237.5 billion**
- This followed 2 consecutive monthly decreases, including 4.6% decrease in December.
  - **Transportation equipment**, also up following two consecutive monthly decreases led the increase $8.2 billion or 11.5 % to $79.7 billion

Month:	November 2015	December 2015	January 2016
New Orders: *(in millions)*	$237,380	$226,399	$237,465
Change:	**- 0.5 %**	**-4.6%**	**4.9 %**

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US Census Bureau, released February 25, 2016

1 Data: U.S. Census Report - New Shipments Increased

- **Shipments of manufactured durable goods increased $4.6 billion, or 1.9% to $241.9 billion.** Up 2 of the last 3 months
  - **Transportation equipment**, led the increase, $4.3 billion or 5.7% to $80.0 billion. Also up 2 of the last 3 months.

Month:	November 2015	December 2015	January 2016
New Shipments: *(in millions)*	$241,186	$237,309	$241,912
Change:	**0.6 %**	**-1.6 %**	**1.9 %**

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US Census Bureau, released February 25, 2016

1 Data: U.S. Census Report – Unfilled Orders Increased

- **Unfilled orders for manufactured durable goods increased $0.6 million or 0.1 % to $1,187.7 billion in January.** This followed a 0.5 % December 2015 decrease.
  - The increase was driven by **computers and electronic products**, up $0.7 billion, or 0.5% to $137.2 billion. Unfilled orders for computers and electronic products have been up twenty-five consecutive months.

Month:	November 2015	December 2015	January 2016
Unfilled orders: *(in millions)*	$1,193,154	$1,187,110	$1,187,714
Change:	**0.1 %**	**-0.5 %**	**0.1 %**

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US Census Bureau, released February 25, 2016

1 Data: U.S. Census Report – Inventories Decreased

- **Inventories of manufactured durable goods in January decreased $0.4 billion or 0.1% to $4396.3 billion. This followed a 0.2 % December 2015 increase.**
  - The decrease was driven by Primary Metals, down $0.7 billion of 2.0 % to $33.8 billion. Primary metals have been down 12 consecutive months.

Month:	November 2015	December 2015	January 2016
Inventories: *(in millions)*	$395,663	$396,639	$396,255
Change:	**- 0.3 %**	**0.2 %**	**- 0.1 %**

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US Census Bureau, released February 25, 2016

1 Data: Industrial & Manufacturing Production: Capacity Utilization Increased

- **Industrial production increased 0.9% in January**, after decreasing 0.7 % in December 2015.
  - A storm in late January held down production by a small amount
- **Indexes for consumer goods business supplies and materials all rose nearly 1% or more in January**
  - Rise in utilities output contributed significantly
- Manufacturing output increased 0.5% in January **and was 1.2% above its year-earlier level.**
- **Capacity utilization for manufacturing increased 0.3% in January to 76.1 %**

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Federal Reserve Statistical Release, February 17, 2016

2 Trends: China's impact on Global manufacturing

- Slowdown in China's economic grown is impacting manufacturing globally
- China's demand for raw materials during the 2000s led to increased mining production and shipping expansion. Chinese investment in the steel industry led to overcapacity and reduced prices.
  - Dropping Chinese demand has hit these industries
  - Chinese imports have by value have fallen 18.8% over the past year
- China is also impacted by weak global demand.
  - The value of exports has fallen 11.2 over the past year.
- Global trade volumes grew only 2% last year (OECD)

In December 2015 Industrial Production fell by:

- 0.7% in Italy
- 1.1% in Britain
- 1.2% in Germany
- 1.6% in France

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The Economist, February 20, 2016

2 Trends: Merchandise trade with China

The map above indicates the importance of merchandise trade with China: over 40% of total trade for many countries (2014)

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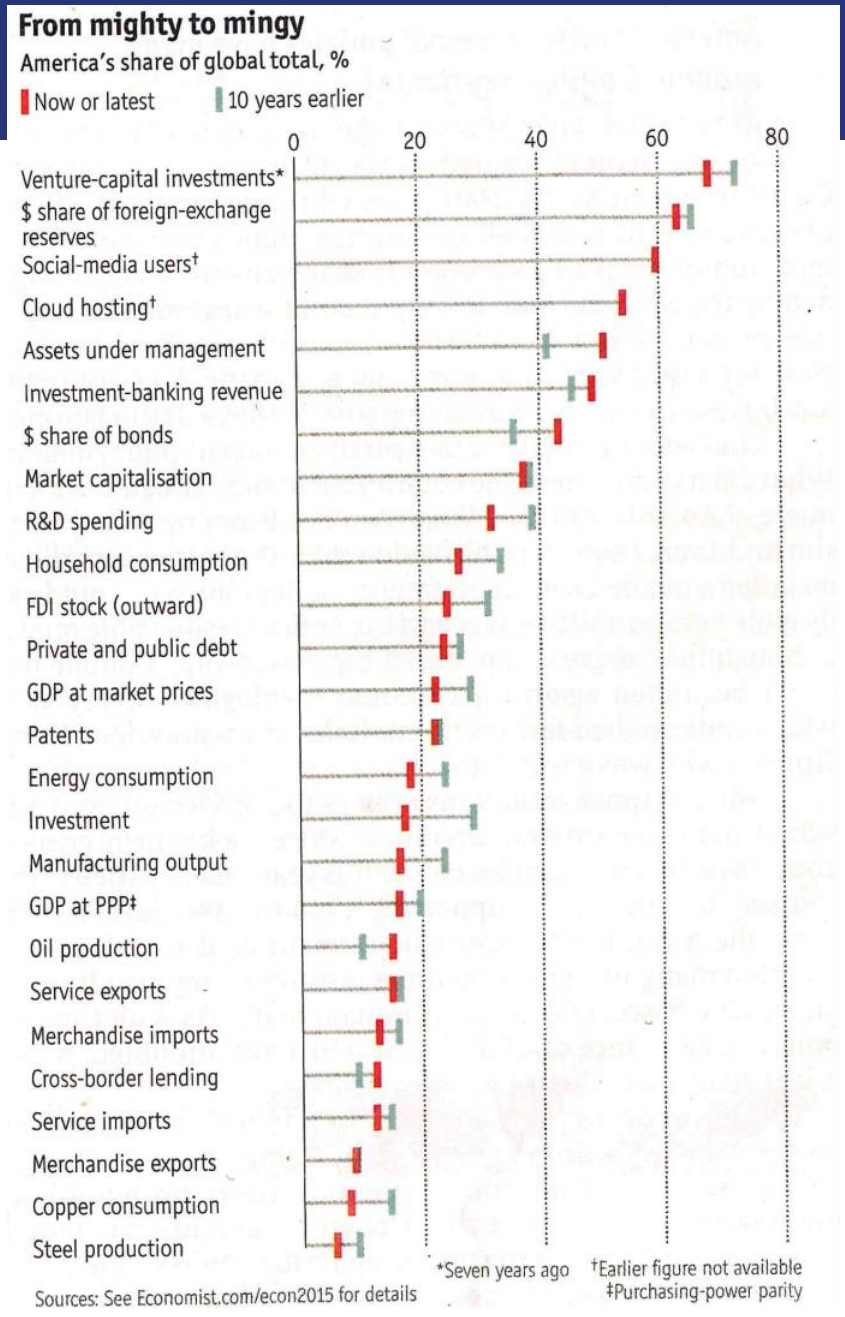
The Economist, October 3, 2015

2 Trends: US global share

The diagram indicates the change in US global share across a variety of industries over the last 10 years (both demand and supply).

Key points include:

- Decline in manufacturing output and production of steel
- Increased role in finance industries:
  - Investment banking revenue
- Rise in new markets and industries:
  - Social media users
  - Cloud hosting
- Reduction in R&D spend



The Economist, October 3, 2015

3 Opportunities: Smart Manufacturing

- Use of real-time data and technology when, where and in the forms that are needed by people and machines
- Developing factory "**internet of things**" – machines and products include sensors and are connected to the internet
- New **Platforms** are being developed that link all the machines, collect data from customers and use to organize production (e.g. know when a customer is going to run out and start production). Greater efficiency, utilization and quality through real-time measurement
- **Build products** incorporating data capture. Use the data to develop new offers/ services for users
- Firms are competing for development and control of 'smart home', 'smart car' platforms

Success Factors:

- Platforms thrive when other firms, customers and developers make use of them
- 'Open' platforms: encourage firms, including competitors to build applications that work run on them
- Share data: combing data from different sources is powerful
- Start up/ risk taking development phase: need to try out ideas.

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The Economist, November 21, 2015

3 Opportunities: Smart Manufacturing

Smart Manufacturing are systems that are ***"fully-integrated, collaborative manufacturing systems that respond in real time to meet changing demands and conditions in the factory, in the supply network, and in customer needs."***

National Institute of Standards and Technology (NIST)

"Smart Manufacturing is the ability to solve existing and future problems via an open infrastructure that allows solutions to be implemented at the speed of business while creating advantaged value."

Smart Manufacturing Leadership Coalition (SMLC)

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http://www.cmtc.com/blog/what-is-smart-manufacturing-part-1a-of-6

3 Opportunities: 'Smart' manufacturing examples

Trumpf:

- German manufacturing firm with roots in hardware and metalwork
- New online offering 'Axoom' connects machines built by Trumpf and others and uses the data to help customers organize production
- Track when running out of material so that it can be ordered
- Annual sales $3.2 billion more than 10,000 employees globally

Ford Michigan Assembly Plant:

- Ford spent $550 million to convert the plant into a flexible engine production
- Focus on getting real-time feedback from the consumers and applying this information quickly to change what is made on the plant floor
- Flexible production, capable of manufacturing a wide variety of 6 different vehicle models

Nimbis Services Inc. (Nimbis), Smart Manufacturing Leadership Coalition (SMLC), and University of California, Los Angeles (UCLA) have partnered to **research a solution for an open Workflow of APPs** under a Phase I grant from the Department of Energy (DOE) Small Business Innovative Research (SBIR) program.

The workflow environment will support the sequential execution of hybrid workflows of APPs, engineering analysis, and manufacturing processes comprised of commercial, open source, and academic applications.

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3 Opportunities: U.S. Textile Manufacturing Awards

- In January 2016 the Walmart Foundation and the U.S Conference of Mayors announced this years **U.S Manufacturing Innovation Fund grant recipients**
- 5 research and academic institutions were awarded a total of $2.84 million in grants for their work focused on innovations in textile manufacturing
- Selected on ability to address two challenges:
  - Reducing cost of textile manufacturing in U.S. by addressing production obstacles
  - Improving manufacturing processes with broad application to many consumer products.

- **Clemson University:** energy and effluent reduction through innovative dyeing of polyester fabrics
- **Oregon State University**: environmentally conscious dyeing of fabrics using continuous digital printing and drying of biopigment inks
- **University of Texas at Austin**: on-loom fabric defect inspection using contact image sensors
- **North Carolina State University:** developing a non-stop tying-in process/approach to improve weaving efficiency
- **Cornell University:** recycling post-consumer textile waste and a raw material substitute for new textiles

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3 Opportunities: 3D Printing: Living tissue

- 3D printing was initially developed to make fast precise models of machinery, vehicles or bridges before building. Used molten plastic to print thin layers which built up the structure based on a computer modeled design.
- Now, scientists are developing **new 'inks': living cells**

Harvard School of Engineering and Applied Science recently assembled tissue using a specially designed 3D printer.

The tissue lived for 6 weeks and developed into a bone-like mass.

- A breakthrough combining metal/plastic and cell printing technology might enable development of living tissue with sensors that can monitor cell health. This might provide opportunities for drug testing on manufactured tissue, or new medical devises.

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The Boston Globe March 16, 2016

4. Calyptus Consulting Group – about us

- Providing Purchasing, Consulting, and Training Services since 1992
- Calyptus specializes in providing consulting and training solutions to clients to improve performance in the areas of procurement, supply chain, customer service, and operations. We assist Fortune 500 companies and government clients by developing custom-made strategies that focus on and improve client capabilities, performance and goals.
- Calyptus prides itself on the ability to provide services across many industries including basic manufacturing, electronics, defense/aerospace, government, education, software, financial services, consumer goods, chemicals and oil industries, and health care.
- Calyptus has full-service capabilities in the training arena. Our training programs have involved needs assessments, course curriculum design, material development, course instruction, and post-program support. We offer over 132 off-the-shelf procurement training programs that can be tailored to the needs of each organization.
- Calyptus has completed over 200 supply chain and manufacturing reports for public organizations, supporting continuous performance improvement




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