The Future is Weird...

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Redlands





The Future is Wired!

(Even with Section 232 Tariffs)

Johannes Moenius, Ph.D. Institute for Spatial Economic Analysis



Redlands







About ISEA

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At the University of Redlands

www.iseapublish.com



But Before We Get Started ...

- All views presented are solely the author's and do not represent official positions neither of the University of Redlands, ISEApublish, SEIconsult, nor any of our sponsors
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Steel Tariffs ...

- ... hurt some, helped some wire producers in the short run
- ... will likely hurt steel and some wire producers in the long run
- ... could improve the strategic position of the currently hurt wire industry





Outline

- Where We Stand
- The Tariffs and Their Effects
- International Competitiveness
- Threats and Opportunities Ahead (Automation)
- What Does it All Mean?





Key Figures for Steel and Wire (2016/18, in 1000 tons)

	Steel 16	Steel 18	Wire 16	Wire 18	
Production	86,500	95,300	3,186	3,635	
Imports	26,300	25,700	4,343	4,785	
Exports	9,300	8,800	1,290	1,320	
Domestic Demand	103,600	112,200	6,240	7,100	
Imports to Production	30.4%	27.0%	136.3%	131.6%	
Imports to Consumption	25.4%	22.9%	69.6%	67.4%	
Export share	10.8%	9.2%	40.5%	36.3%	
Import Export Ratio	2.83	2.92	3.37	3.63	
SEI CONSUIL					

spatial Source: AISI Profile 2017, AWPA, author's calculations

Key Figures for Steel and Rod (2016/18, in 1000 tons)

	Steel 16	Steel 18	Rod 16	Rod 18	
Production	86,500	95,300	2,097	2,958	
Imports	26,300	25,700	1,350	944	
Exports	9,300	8,800	95	76	
Domestic Demand	103,600	112,200	3,353	3,825	
Imports to Production	30.4%	27.0%	64.4%	31.9%	
Imports to Consumption	25.4%	22.9%	40.3%	24.7%	
Export share	10.8%	9.2%	4.5%	2.6%	
Import Export Ratio	2.83	2.92	14.21	12.42	
SEI CONSUIL					

spatial Source: AISI Profile 2019, AWPA, author's calculations

Quantity Effects: Wire Imports





Unit Value Effects: Wire Imports



2016 Steel Shipments* by Market Classification



*Estimated percentages

2018 Steel Shipments by Market Classification





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The Trump Tariffs

- March 1st 2018: 25% steel, 10% aluminum
- Exemptions for Mexico, Canada, EU, Argentina, Brazil first granted, then withdrawn
- First Permanent Exemptions for South Korea, Australia, later Canada, Mexico, Argentina, Brazil (steel only)
- Quantitative restrictions for Argentina, Brazil, South Korea







The Trump Tariffs

• Wilbur Ross: goal in the cases of both aluminum and steel was to lift the domestic industry's capacity utilization and that would create additional jobs





Current Status (January 2020)

- Aluminum: Tariffs effective March 23, 2018. Effective February 8, 2020 for aluminum derivatives.
- Steel: Tariffs effective March 23, 2018. Effective February 8, 2020 for steel derivatives.
- Autos and Parts: National security threat declared, but no import restrictions imposed within 180 days raising questions over possible expiration of tariff authority under this investigation.
- Uranium: President determined imports are not a national security threat.
- Titanium Sponge: Investigation completed. Determination on national security threat pending. (Retaliation also in effect, see CRS Insight IN10971, Escalating U.S. Tariffs: Affected Trade.)
 SEL Consult

Spatial Economic Intelligence



Countries Affected (Jan 2020)

- Aluminum: Argentina,* Australia, Canada, and Mexico exempted. All other countries included.
- Steel: Argentina,* Australia, Brazil,* Canada, Mexico, and South Korea* exempted. All other countries included.
- Autos and Parts: EU, Japan, and other countries "deemed necessary" targeted for negotiations.

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Retaliation



Requirements for Section 232

- National security jeopardized
 - Would expect: substantial production for military and homeland security





What We See

• Share of Military and Homeland Security: 3%

- Spike in steel prices in the US 2018
- Stable 25% mark-up of US steel over international steel





SteelBenchmarkerTM HRB Price

USA, China, Western Europe and World Export

(WSD's PriceTrack data, Jan. 2002 - March 2006; SteelBenchmarker data begins April 2006)



Military Equipment Use

Use	Tons of Steel
Aircraft carriers	550,000
submarines	1,000,000
guided missile destroyers	227,500
Landing platform docks	144,000
Tanks	187,000
Light armored vehicles	30,000
Total	2,138,500

Share Annual Steel Production

Sel Consult Spatial **Source**, AISI, Author's Calculations 2.5%



Academic Literature on Tariffs

- Tariffs can rarely be good for the economy overall
- Specifically damaging if tariffs on upstream products
- Consumers always worse off
- Data: Technology more important than trade





Precedence: Bush Steel Tariffs

- Peterson Institute for International Economics
- Jobs saved: 3,000-4,000
- Jobs lost in steel using industries (like the wire industry): 26,000
- Expected a moderate price increase





Ex Post Analysis Claims Harsher Effect



Source: Trade Partnership Worldwide, LLC

Anticipated Effect on Jobs

- "The 'Joint Remedy', which calls for tariffs of 15-20 percent on most products, would slash affected imports by 20 percent. Domestic prices and output would increase slightly, resulting in somewhat larger revenues for the steel industry. About 3,500 actual and potential jobs could be "saved" but at an annual cost of \$2 billion to the steel users-or \$584,000 per job saved."
- (Peterson Institute of Economics on the 2002 steel tariffs)





Results from Recent Studies

- JEP: \$3.2 billion tax on consumers monthly
- FRB economists: 0.6% job loss, 75k jobs
- CPI increase in tariffed goods
- Offset of tax cut for many consumers
- \$900 k per job saved in steel and aluminum
- CBO: about 1% income drop





The Long Run Effects

- Complacency of US steel mills
- Increased competitiveness of foreign steel mills
- Partial destruction of domestic customer base
- Political fallout





Will China forget?





Source: The Economist Intelligence Unit.

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China Depends Less on Us

China has been reducing its exposure to the world, while the world's exposure to China has risen



Source: McKinsey Global Institute









The Yen from 1959 till 2000





33



円高 New Car Sales in the US, 79-94 (thousands of cars)

Exhibit 10 New Car Sales in the United States, 1979-1994 (thousands of vehicles)

	Total	Import Sales	% Total	Transplant Sales	% Total	Big 3 Sales	% Total
1979	10,600	2,332	22	-	-	8 ,2 68	7 8
19 80	8,976	2,397	27	-	-	6,579	73
1981	8,619	2,327	27	-	-	6,292	73
1982	7,939	2,223	2 8	-	-	5,716	72
198 3	9,18 2	2,3 87	26	43	0. 5	6,752	74
1984	10,39 0	2,439	23	293	3	7,658	74
1985	10,978	2,774	25	299	3	7,905	72
1986	11, 404	3,1 89	2 8	5 40	5	7,675	67
1987	10,186	3,1 06	3 0	67 8	7	6,40 2	63
19 88	10,543	3 ,004	2 8	804	8	6,735	64
1989	9,777	2,699	2 8	1,0 3 6	11	6,04 2	62
1990	9,3 00	2,403	2 6	1,415	15	5, 48 2	59
1991	8,174	2, 0 3 8	25	1,461	18	4,675	57
199 2	8 ,213	1,944	24	1,460	18	4,816	5 8
199 3	8 ,51 8	1,784	21	1,5 84	19	5,151	60
1994	8,991	1,75 0	19	1,841	21	5,414	60

Source: Compiled from Ward's Automotive Yearbook, various issues





Trade War with China

- Market access to China essential for many large US companies
- US consumers feel substantial effect
- Chinese consumers feel small effect
- Possible recession trigger for US





China Syndrome

Exports to China fell in most states last year from 2018



Sources: U.S. Commerce Department, U.S.-China Business Council

Bloomberg
Trade Truce with China

- 2020: buy an extra 76.6 billion in excess of 2017
- 2021: buy an extra 123.3 billion in excess of 2017

- Great? No.
 - Not enforceable
 - Coronavirus





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Steel stocks per person & GDP: Not Much Additional Demand in NAFTA

- US: 10.5 t
- Canada 9.8 t
- Mexico 4.8 t

• Japan 13.6 t



Spatial Economic Intelligence Steel Association: Sustainable Steel at the Core of a Green Economy

Huge Potential Outside of the US

• Brazil 3.1 t

• South Africa 3.0 t





Source World Steel Association: Sustainable Steel at the Core of a Green Economy

Measuring International Competitiveness

- Share of US Wire Exports in Total US Exports / Share of Worldwide Wire Exports in World Exports
- Example: Assume 20% of a country's export are wire products, while world average was 10%
 - Average country has 1
 - Below average country <1</p>
 - Competitive country > 1
- For readability: scaled it between -1 and 1







International Competitiveness in Iron and Steel Wire: 2016

High

Trade Value (mil \$)

5



Data Sources: UN Comtrade Database Map created by: The Institute for Spatial Economic Analysis (ISEA), University of Redlands, 2018

Competitiveness 2018



US Wire Competitiveness

(2016 Data, Source: UN Trade Database, SITC 678 Wire of Iron and Steel, in millions of US\$)

Country	Total Exports	Competitiveness	Volume Rank	Compet. Rank
China	1,866.05	0.35	1	22
Rep. of Korea	790.38	0.74	2	10
USA	369.96	-0.71	8	54
India	249.77	0.41	9	20
Malaysia	177.14	0.39	15	21
Turkey	176.09	0.6	16	15
Thailand	149.47	0.12	18	29
Russian Federation	120.23	-0.37	23	39
Viet Nam	97.65	-0.11	25	36
Brazil	51.78	-0.66	30	52
South Africa	49.93	0.08	31	32
Costa Rica	17.59	0.78	39	9
Egypt	13.75	-0.01	44	33

Author's calculations

US Wire Competitiveness

(2018 Data, Source: UN Trade Database, SITC 678 Wire of Iron and Steel, in millions of US\$, South Korea and France Missing)

Country	Total Exports	Competitiveness	Volume Rank	Compet. Rank
China	2398.7	0.40	1	15
Germany	892.2	-0.09	2	27
Italy	748.4	0.65	3	9
Japan	677.9	0.36	4	17
Czechia	625.1	0.92	5	4
USA	373.8	-0.77	6	41
India	363.3	0.53	7	11
Slovakia	311.3	0.93	8	3
Belgium	271.1	-0.08	9	26
Netherlands	268.0	-0.26	10	32
Sweden	254.4	0.71	11	7
Taiwan, Province of China	249.3	0.17	12	21
Spain	244.5	0.17	13	20

Author's calculations

US Wire Import Competition- Top 10

(2016 Data, Source: UN Trade Database, SITC 678 Wire of Iron and Steel, in millions of US\$)

Partner	Trade Volume (1000 US\$)	volume share	volume rank	Value/Weight
China	201,878	19.6%	1	1.17
Canada	196,285	19.1%	2	1.04
Rep. of Korea	133,885	13.0%	3	1.58
Japan	127,354	12.4%	4	1.41
Mexico	119,989	11.7%	5	0.96
India	48,519	4.7%	6	4.10
Germany	38,034	3.7%	7	1.43
Other Asia, nes	26,595	2.6%	8	1.58
Italy	25,991	2.5%	9	1.42
Viet Nam	16,555	1.6%	10	1.30



US Wire Import Competition- Top 10

(2018 Data, Source: UN Trade Database, SITC 678 Wire of Iron and Steel, in millions of US\$)

Partner	Trade Volume (1000 US\$)	volume share	volume rank	Value/Weight
World	1,093,703	100.0%		1.55
China	211,321	19.3%	1	1.36
Canada	194,664	17.8%	2	1.30
Mexico	125,425	11.5%	3	0.84
Japan	123,634	11.3%	4	2.69
Rep. of Korea	100,076	9.2%	5	2.16
India	73,263	6.7%	6	3.18
Germany	52,850	4.8%	7	2.60
Italy	42,414	3.9%	8	2.22
Viet Nam	28,804	2.6%	9	1.16
Other Asia, nes	23,080	2.1%	10	2.11







US Wire Export Competitiveness – Top 12

(2016 Data, Source: UN Trade Database, SITC 678 Wire of Iron and Steel)

Partner	Trade Volume (1,000 US\$)	volume share	volume rank	Value/Weight
Mexico	140,885	38.1%	1	1.49
Canada	104,909	28.4%	2	1.19
Ireland	14,353	3.9%	3	3.49
Costa Rica	11,550	3.1%	4	3.68
Brazil	10,980	3.0%	5	0.84
United Kingdom	10,057	2.7%	6	1.04
China	9,594	2.6%	7	1.89
Germany	6,921	1.9%	8	1.31
Denmark	4,866	1.3%	9	3.36
Belgium	4,371	1.2%	10	1.14
Rep. of Korea	3,806	1.0%	11	1.60
Japan	3,604	1.0%	12	1.77

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US Wire Export Competitiveness – Top 12

(2018 Data, Source: UN Trade Database, SITC 678 Wire of Iron and Steel)

	Trade Volume			
Partner	(1,000 US\$)	volume share	volume rank	Value/Weight
World	373,845	100.0%		N/A
Mexico	147,391	39.4%	1	N/A
Canada	107,319	28.7%	2	2.31
Ireland	16,613	4.4%	3	N/A
China	13,081	3.5%	4	8.08
Costa Rica	9,575	2.6%	5	N/A
Germany	8,222	2.2%	6	7.56
United Kingdom	6,914	1.8%	7	3.18
Denmark	5,855	1.6%	8	N/A
Belgium	5,037	1.3%	9	2.47
Ecuador	4,407	1.2%	10	3.27

SEI Consult SAuthor's calculations



Questions to Ask:

- Which segments will most competitive countries (in wire) that are now facing tariffs attack?
- Which segments within Wire and Steel have we been successfully exporting? Why?
- Which other markets look like those? Who is serving them right now?





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Welcome, Flippy!

























UNIQLO's Warehouse Cuts Labor by 90%









Wire and Steel Needed Everywhere



The RP-VITA is a combination of iRobot's Robot Ava mobile robotics platform and the InTouch Telemedicine System. This produces what the partners refer to as a an "expandable telemedicine technology platform." Gizmag, July 2012.

Ttp://www.lgizmag.com/irobot-rp-vita-telepresence-doctor/23440/



Where Are the Cloth Hangers?







http://youtu.be/FaA3zoyXftA



Is American Wire Ready for 3D Printed Houses?



Metal 3D Printing



The Future Is Wired!

For those who are ready.





Substitution Technology

- Artificial Intelligence
- Mobile Robotics
- Edge Computing
- Big Data Analytics
- Blockchain
- Nano Technology
- Bio Technology





Size: Robots About to "Escape" Manufacturing



Robots Get Cheaper

Cost of automation

Index of average robot prices and labor compensation in manufacturing in United States, 1990 = 100%



Source: Economist Intelligence Unit; IMB; Institut für Arbeitsmarkt- und Berufsforschung; International Robot Federation; US Social Security data; McKinsey analysis

McKinsey&Company





Robot Deployment



• 2013: 1,000 Robots

• 2017: 45,000 Robots



Annual Growth rate: 260%

Employment and Exposure to Robots (Acemoglu & Restrepo 2017)

Change in private employment (percentage points), 1990-2007



Source: Researchers' calculations using International Federation of Robotics, U.S. Census, and other data

.. And Its Effect on Jobs





of total US employment could be automated in the next decade or two (Frey & Osborne 2017)





Share of Jobs and Wages Automatable by NAICS

- 3312: Steel Product Manufacturing from Purchased Steel: 72% of jobs, 62% of wages
- 3326: Spring and Wire Product Manufacturing: 72% of jobs, 61% of wages
- 3311: Iron and Steel Mills and Ferroalloy Manufacturing: 66% of jobs, 58% of wages




Geographies Most at Risk



Share of Jobs Facing Automation Risk by 2035, by Metropolitan Statistical Area



Data Sources: BLS, Bureau of Labor Statistics Map created by: The Institute for Spatial Economic Analysis (ISEA), University of Redlands, 2017

Sectoral Shift



Questions to Ask

- Which sectors will need the most robots?
- Car electrification? Grid?
- Which geographic markets?





More Generally

- How will these developments change our markets?
- How will this all change our employment needs?
- How will it change our communities?





Success Formula

- Wire + Automation = Cheap Wire → International Competitiveness
- Wire + Future Growth Industries → Product Diversification
- Wire + Protection of Steel and / or Wire = loss of competitiveness





Automation to Solve Core Issues

- Workforce
- Skill upgrading (machine operations, 3d printing)
- Reshoring





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Wire and Steel Are Partners

- Wire needs competitive steel
- Protection of steel hurts wire doubly expensive inputs now, weak domestic partner later
- Tariffs are bad, but smaller in effect as technology
- Tariffs difficult as America less important in world economy







- Found a wire research institute within the AWPA
- Joint research with electric car, robotics, and 3D metal printing / 3D construction printing industry
- Appoint a Chief Automation Officer within AWPA
- Case studies: export and overseas production





Environmental Tariffs, not National Security Tariffs

- Automation \rightarrow level playing field ...
- Except for environmental degradation abroad
- International competitiveness once playing field is leveled





Summary

- Tariffs hurt the US in the short and long run
- Automation to level playing field (a bit more)
- Steel and Wire need to be partners to master the challenges of the future
- In short ...





Technology Trumps Tariffs!





Would You Like More Information?

Please contact us today:



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... and we are happy to help.



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Need to Start Today!





Auf die Frage, was er als Erstes tun wuerde, wenn ihm der Kaiser die Regierung des Staates anvertraute, antwortete im 6. Jahrhundert vor unserer Zeitrechnung der Chinese Weise Konfuzius: "Unbedingt die Worte und Bezeichnungen richtig stelle

Wenn die Worte nicht stimmen, dann ist das Gesagte nicht das Gemeinte. Wenn das, was gesagt wird, nicht stimmt, dann stimmen die Werke nicht. Gedeihen die Werke nicht, so verderben Sitten und Künste. Darum achte man darauf, daß die Worte stimmen. Das ist das Wichtigste von allem. Konfuzius (551-479 v.Chr.), chin. Philosoph, bestimmend für die Gesellschafts- u. Sozialordnung Chinas

Die Beliebigkeit bei der Verwendung des Begriffs macht uns begriffslos.





Correct Use of Terms

When asked in the 6th century BC what he considered the first thing to be done if he were to run the government, the Chinese sage Confucius answered: "definitely rectify the names". Zheng ming, the concept of rectification of names, literally "the correct use of terms", remains a central aspect of Chinese Philosophy today

If language is not correct, then what is said is not what is meant; if what is said is not what is meant, then what must be done remains undone; if this remains undone, morals and art will deteriorate; if justice goes astray, the people will stand about in helpless confusion. Hence there must be no arbitrariness in what is said. This matters above everything. <u>Confucius</u> *Chinese philosopher & reformer (551 BC - 479 BC*

The arbitrariness with which the term is used today leads to conceptual confusion.





Data needed

- In particular, I am interested in information about current and historical shares of AWP trade into NAFTA versus other countries.
- Need list of products that show large (American) wire input.





Idea collection

- What happened to Wire and Steel in the last two decades
- Changes in volume of trade
- Changes in quality levels (unit prices)
- Changes in patterns of trade
- Change in Comparative advantage
- Change in tariff levels

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Trade natterns of wire users



Ideas continued

- What to expect in the future
- Let's take a look at where we stand
 - Politics: 100 1% risk issues lead to likelihood of 37% that none will hit.
 - Trade: short-term wins, long-term losses
 - Global Economy overall slowing down, US slowing down
 - China vs. US
 - Oil
 - Automation
 - Demographics

Spatial Economic Intelligence terest rates



US Wire Import Competition- Tariff Countries

(2016 Data, Source: UN Trade Database, SITC 678 Wire of Iron and Steel, in millions of

Partner	Trade Volume (1000 US\$)	volume share	volume rank	Value/Weight	
China	201,878	19.6%	1	1.17	
Rep. of Korea	133,885	13.0%	3	1.58	
India	48,519	4.7%	6	4.10	
Viet Nam	16,555	1.6%	10	1.30	
Brazil	6,443	0.6%	14	1.04	
Thailand	2,577	0.3%	22	1.78	
Turkey	2,541	0.2%	24	1.05	
Costa Rica	2,380	0.2%	26	4.59	
Malaysia	1,246	0.1%	31	1.03	
Russian Federation	212	0.0%	40	0.90	
Egypt	132	0.0%	43	0.90	
South Africa	42	0.0%	47	1.01	
*Author's calculations					

US Wire Export Competitiveness – Tariff Countries

(2016 Data, Source: UN Trade Database, SITC 678 Wire of Iron and Steel, in millions of

Partner	Trade Volume (1000 US\$)	volume share	volume rank	Value/Weight	
Costa Rica	11,549	3.1%	4	3.68	
Brazil	10,979	3.0%	5	0.84	
China	9,594	2.6%	7	1.89	
Rep. of Korea	3,806	1.0%	11	1.60	
India	2,370	0.6%	18	2.03	
Thailand	1,387	0.4%	22	1.32	
South Africa	1,185	0.3%	26	1.05	
Malaysia	1,137	0.3%	27	2.01	
Turkey	663	0.2%	31	1.37	
Viet Nam	315	0.1%	41	1.02	
Russian					
Federation	291	0.1%	46	1.24	
Egypt	121	0.0%	56	2.06	
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Author's calculations

Environmental challenges

- Monumental tasks:
 - CO2
 - o Transportation
 - Filters
 - Ocean Cleanup
 - Green buildings





Which company?

- 1865: Paper and Pulp, later power generation
- 1960-66: Rubber and Cable
- 1966: Rubber, cable, and electronics
- 1967: data, industrial automation, communication
- 1981: Mobile Phones and Networks
- 1988: Divestiture of basic business

1991-1995: General Divestiture; Keep Mobile / Networks
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2012 Divertiture Mehile Keep Networke

What we can learn from it

• Adaptation required

• Develop side competencies, then shift once the cheese has moved

• Need to experiment







Three Year Average Growth in Employment, 2005: Steel Mills





Three Year Average Growth in Employment, 2005: Wire, Wire Products, and Springs



Technology Has Been Great at Creating New Jobs

- Industrial revolution (1760 1840)
- IT revolution (1980-2000)
- Internet revolution (2000-2015)





But It Increases Income Inequality



Spatial Economic Intelligence

Data Source: BLS, Acemoglu & Autor (2010)



How Conducive Is the Current Environment for Automation?





The Macro-Picture







The Macro-Picture









Tech Base Expanding Rapidly




The Macro-Picture







Real Minimum Wage Is Low

The erosion of the minimum wage

In inflation-adjusted terms (2018 dollars), the minimum wage peaked in 1968

Nominal minimum wage Inflation-adjusted minimum wage





The Macro-Picture





Federal Income Tax Rates by Income Group Average tax rate (percent) 80-99th percentiles 0-80th percentiles 99-99.9 percentile -Top 0.1 percent Source: Piketty and Saez (2007).

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Average Total Tax Rates By Income Group Federal + State + Local



Source: "Distributional National Accounts: Methods and Estimates for the United States"

U.S. Top and Effective Corporate Tax Rates



Chart: Fortune • SOURCE: Internal Revenue Service and St. Louis Federal Reserve

FORTUNE

Distribution of Worldwide Statutory Corporate Income Tax Rates, 1980-2019



Note: The number of countries included varies by decade as some historic corporate tax rates were not available. Source: Statutory corporate income tax rates were compiled from various sources.

TAX FOUNDATION

@TaxFoundation

Taxes Down – Profits Up





The Macro-Picture





Federal Funds Rate









The Macro-Picture



Multi-Trillion Dollar Question

• How will future automation affect our workforce?

- Which jobs will stay or even grow?
- Which jobs will go?
 Job Churn
- Which new jobs will emerge?

Net Effect: Job Growth or Loss

• Will job growth outpace job losses?



Job Churn Larger than Job











Conditions for Perfect Storm: Great



Automation Illusion

Rate of occupational churn

Job movement between occupations, a measure of technology-driven job change, is the lowest on record, and the fastest-growing sectors are the least productive.



**Through the first four months of 2017

Value added per employee, 2016

*Churn rate from 2010-2015; not strictly comparable to prior decades Sources: Information Technology and Innovation Foundation (jobs); Commerce Department and Labor Department (value added, job growth)

THE WALL STREET JOURNAL.



Where does VC go?

PitchBook Data compiled by Bloomberg:

- Levels 2019
 - Enterprise technologies: 30 bn
 - Consumer technologies: 23 bn

- Growth 2018-2019:
 - Enterprise technologies: roughly 100%
 - Consumer technologies: roughly 25%







Conditions for Perfect Storm: Great



The Technology-Picture









Substitution Technology







Speed

"In the last 5 years or so, we have seen these technologies make more progress than in the last 50 years before, especially the Artificial Intelligence part."

James Manyika Director McKinsey Global Institute

Speed

Farm Jobs, % of Total U.S. Jobs 1790 to 2000



Manufacturing Labor Productivity Growth: 3.2%

Manufacturing output has grown over the past three decades, even as payrolls have shrunk

Manufacturing monthly employment and guarterly real output, 1987–2017



Source: Bureau of Labor Statistics

PEW RESEARCH CENTER

Most Americans know manufacturing jobs have declined, but only about a third know output has increased

% saying the total number of manufacturing iobs in the U.S. has over the last 30 years



% saying the value of goods and products manufactured in the U.S. has ____ over the last 30 years



Note: Don't know responses not shown. Source: Survey conducted May 1-15, 2017.

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Scale: Al from 0% to 84% in 10 years

Worldwide smartphone shipments and year-over-year shipment growth



@StatistaCharts Source: IDC

statista 🗹

Will we be able to transform our economy in as little as two decades?





THE IMPACT OF ROBOTIC GROWTH ON EMPLOYMENT, WITH AND WITHOUT ECONOMIC RECOVERY

AMONG YOUNG, LESS-EDUCATED MINORITIES IN THE MIDWEST, 2009 TO 2017



Source: Calculated by authors from the U.S. Bureau of the Census Current Population Survey's Annual Merged Outgoing Rotation Group files, 2004 to 2017. See William M. Rodgers III and Richard Freeman, "How Robots Are Beginning to Affect Workers and Their Wages," Table 4.









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of total US employment could be automated in the next decade or two (Frey & Osborne 2017)





Future Automation Risk is High

Major Occupational Group	Employment*	% at Risk
Food Preparation and Serving Related Occupations	135,630	88
Office and Administrative Support Occupations	135,280	78
Sales and Related Occupations	96,680	83
Transportation and Material Moving Occupations	61,080	76
Building and Grounds Cleaning and Maintenance Occupations	59,480	72
Personal Care and Service Occupations	55,550	66
Management Occupations	42,120	17
Construction and Extraction Occupations	40,520	63
Healthcare Practitioners and Technical Occupations	38,600	19
Installation, Maintenance, and Repair Occupations	30,170	59
Protective Service Occupations	29,440	66
Business and Financial Operations Occupations	27,910	50
Education, Training, and Library Occupations	25,550	14
Production Occupations	22,340	79
Healthcare Support Occupations	12,150	44
Computer and Mathematical Occupations	12,070	24
Arts, Design, Entertainment, Sports, and Media Occupations	12,000	25
Community and Social Services Occupations	7,400	5
Architecture and Engineering Occupations	7,320	31
Legal Occupations	6,150	33
Life, Physical, and Social Science Occupations	2,560	28
Farming, Fishing, and Forestry Occupations	100	87 -

*Among covered occupations

Spatial

Examples of at-Risk Jobs in Vegas

Occupational Group	% at Risk	Examples of Jobs
Food Preparation and		Cooks
Serving Related	0.88	Restaurant hosts/hostesses
Occupations		Counter attendants
		Office clerks
Office and Administrative	0.78	Administrative assistants
Support Occupations		Bookkeeping, accounting and
		auditing clerks
Sales and Related Occupations		Cashiers
	0.83	Counter clerks
		Telemarketers





Las Vegas Job Automation by Sector

Sector	Employment Share in %	% at Risk
Leisure and Hospitality	30	82
Trade, Transportation, and Utilities	17	75
Financial Activities	5	67
Manufacturing	2	65
Professional and Business Services	14	63
Construction	7	62
Other Services	3	59
Mining and Logging	<1	58
Information	1	48
Government	10	47
Education and Health Services	10	42



At the Industry Level

NAICS	Description	Employment Risk	Wage Risk	
7132	Gambling Industries	74%	66%	
7211	Hotels	73%	67%	
7225	Restaurants	87%	83%	





IT Jobs Least at Risk

Spatial Economic Intelligence

SOC	Description	Probability
15-1121	Computer systems analysts	0.7%
15-1111	Computer and information research scientists	1.5%
15-1141	Database administrators	3.0%
15-1142	Network and computer systems administrators	3.0%
11-3021	Computer and information systems managers	3.5%
15-1132	Software developers, applications	4.2%
15-1133	Software developers, systems software	13%
43-9031	Desktop publishers	16%
15-1122	Information security analysts	21%
15-1134	Web developers	21%
15-1143	Computer network support specialists	21%
15-1199	Computer occupations, all other	22%
17-2061	Computer hardware engineers	22%
SEI Consult		I



IT Jobs Most at Risk

SOC	Description	Probability
51-4012	Computer numerically controlled machine tool programmers, metal and plastic	36%
15-1131	Computer programmers	48%
15-1151	Computer user support specialists	65%
49-2011	Computer, automated teller, and office machine repairers	74%
43-9011	Computer operators	78%
43-9022	Word processors and typists	81%
51-4011	Computer-controlled machine tool operators, metal and plastic	86%
43-9021	Data entry keyers	99%







Lower Wage Workers more Vulnerable


Demographics Most at Risk

• Race / Ethnicity:

Hispanics African-Americans

• Age:

Young

• Education level:

Less educated





Main Driver: Education



Source: US Census Bureau

Spatial Economic Intelligence



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Sectoral Shift







