Automation v Procreation

Hal Varian
Sept 2018

These are the author’s personal views and do not necessarily reflect the views of his employer.
Automation v Procreation

Hal Varian
August 2018

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Bots v Tots

Hal Varian
Economics of the labor market

A diagram showing the intersection of the demand and supply curves for labor, with the equilibrium wage $w^*$ and labor $L^*$. The axes are labeled "wage" on the vertical axis and "labor" on the horizontal axis.
Economics of the labor market

Automation reduces demand

New demand
New wage
New L*

L*

Wage
Supply
Demand
Economics of the labor market

new wage = \( w^* \)

Demography reduces supply

new supply

new demand

new \( L^* \)
Economics of the labor market

new wage = $w^*$

new demand = $BOTS$

new supply = $TOTS$

wage

supply

demand

new L*  L*
labor
2016: job stealing

Smart robots could soon steal your job

by Ivana Kottasova  @ivankottasova

January 15, 2016; 1:03 PM ET

Robots are taking over China’s factory floors

Think you are too smart to be replaced by a robot in your job?
Think again.

Jason Furman
1980: job stealing

DETROIT — Technological innovation is widely billed as a miracle cure for the United States’ economic ills. Its aftereffects, however, may be far from benign. The introduction of revolutionary new technologies such as robots — versatile computer-controlled mechanical arms — raise two painful possibilities: sizable losses of jobs and a deteriorated quality of working life.

The threat of lost jobs, although also dependent on social and economic factors, is especially critical. Auto makers are already buying robots in record numbers, despite a downturn that has resulted in 250,000 indefinite layoffs. Even the faltering Chrysler Corporation has added 133 of these new “recruits” to its work force for the 1981-model year.

But the robot is only one part of a larger computerization that is affecting virtually every productive activity in society from the office to the machine shop. In fact, many white-collar occupations that promised jobs to displaced blue-collar workers in the past are themselves being automated.

In the case of robots, relatively conservative estimates predict that sales in this country will grow at a compound rate of 35 percent a year for the next decade, culminating in annual sales of $600 million and production of 17,000 robots by 1990. This hardly seems threatening to a manufacturing work force of 20 million people, robots are only one of the labor-displacing technologies being introduced. Moreover, the employment effects are cumulative and have a dis

A Robot Is After Your Job

By Harley Shallen

proportionate impact on a few key industries. Robots that begin work tomorrow will still be on the job in 1990, giving us a robot population of about 80,000. If 40 percent wind up in the auto industry (compared to 55 percent worldwide today), 32,000 robots could displace more than 100,000 auto workers. In fact, the potential loss of jobs is more serious than these figures indicate. New breakthroughs in robot technology such as “sight” and “feel” mean that each robot could displace far more workers in a decade. In addition, some industry observers feel that companies that sell computers may enter the market, resulting in a robot-population explosion in the hundreds of thousands, not tens of thousands.

The quality of working life will also change. While the first generation of robots primarily did such hazardous and hot jobs as welding and foundry work, robots are now being created for jobs where workers have the most control over the pace of work: machine loading and light assembly, among the more desirable production tasks.

management is not prepared to assume that enough jobs will automatically be created for the number of people displaced. Economic revitalization no longer means re-employment. And the devastating social cost of unemployment is not reckoned in the savings that technology promises.

Such a socially destructive use of technology need not be inevitable. Jobs for workers displaced and improved working conditions for those who remain ought to be a condition of the introduction of robots. Productivity gains, for example, could translate into a shorter work week at the same pay rather than into fewer jobs.

Technology could be designed to enhance human skill and experience rather than make people “interchangeable” with machines. Realistically, these alternatives require worker-union participation in the design and deployment of technology.

The goal, after all, should be a technology that benefits people — not one that destroys them.

Harley Shallen, a research fellow at the Massachusetts Institute of Technology, is completing a book on automation.

Jason Furman
1960: job stealing

Robots' Rise

They Bid for Big Jobs
Both in Outer Space
And in U.S. Factories

A.M.F. Designs Robot to Send
To Moon; G.E. Works on
One to Paint New Autos

Beetle's Hazardous Mission

BY THOMAS O'TOOLE

Staff Reporter of The Wall Street Journal

GREENWICH, Conn.—America's first a-
s-tronaut to reach another planet may have
long spidery arms and a bell-shaped head with
a window in it.

Such an inhuman-appearing space traveler
is not as far-fetched as it seems. Even now the
creature—a robot—is taking shape here at the
Greenwich Engineering division laboratories of
American Machine & Foundry Co. A.M.F. en-
geineers believe their robot, remotely controlled
from earth, would be far more useful than a
human in exploring outer space—at least until
rockets can be made powerful enough to be
readily capable of returning home from trips to
the Moon, Mars, Venus of even more distant
targets.

Elsewhere around the country in laborato-
ries and on drawing boards, increasing atten-
tion is being paid to robots, once regarded as
science-fiction characters with little or no prac-
tical value. Indeed, most of the robots in use
development today bear little resemblance
to the mechanical legs popularized by movie
makers and cartoonists. But these machines,
nevertheless, are true robots—automatic de-
vices that perform human functions, or oper-
ate with seemingly human intelligence.

Jason Furman
1935: job stealing

Robot Brains Outdo Man’s Mind in Speed and Accuracy of Results

‘Thinking Machines’ Replace the Thinker

They Predict Tides, Pick Criminals’ Fingerprints, Calculate Mathematical Problems, and Perform Amazing Tasks.

Jason Furman
1812: job stealing

One Thousand POUNDS REWARD.

WHEREAS on the Night of Sunday the 19th of January, 1812, the Mill belonging to Messrs. Oates, Wood and Smithson, Situate at Oakland, near Leeds, was maliciously set on Fire.—And on the Morning of the Twenty-fourth of March, 1812, several Persons entered the MILL of MESSRS. WM. THOMPSON & BROTHERS, Of Herdon, destroyed the MACHINERY and MACHINES therein.—And on the Morning of the 22d, some Persons broke into the Bonny Shop of Messrs. Dickinson, Carr and Co. Situate in Water Lane, Leeds, and Wantonly destroyed Cloth, to a Considerable Amount.

1000 POUNDS REWARD

a hereby offered to any Person or Persons who will give such Information as shall lead to the Conviction of any of the Offenders, on Application at the Town Clerk's Office, or to any of the above-mentioned Sufferers.

March 22, 1812.

Printed by the Meggitt Brothers, Leeds, in Cheapside, Wigan, June.
2017: Huh?

America’s Growing Labor Shortage

Lack of workers in ag and construction is hurting the economy.

Construction, agriculture, truck drivers, forklift drivers, dairy farms, meat packing...
The economy can absorb large shocks to labor market
Baby boomers

1. Live births by year, 1920–2010

Bureau of Labor Statistics
Women entering the (paid) labor force

Civilian labor force by sex
1948-2015 annual averages

Dept of Labor
Spreadsheet apocalypse

The Spreadsheet Apocalypse, Revisited

Jobs in bookkeeping plummeted after the introduction of spreadsheet software, but jobs in accounting and analysis took off.

1979
Release of VisiCalc

1983
Release of Lotus 1-2-3

1987
Release of Microsoft Excel for Windows

- Management analysts & financial managers
- Accountants and auditors
- Bookkeepers, accounting and auditing clerks

Notes: There is no data for 1992. Changes in occupational definitions in 1983, 2000 and 2011 mean that data is not strictly comparable across time. There was no category for management analysts or financial managers prior to 1983. Source: Bureau of Labor Statistics

THE WALL STREET JOURNAL
Video rental clerks

Employment, Hours, and Earnings from the Current Employment Statistics survey (National)

Series Id: CES5553223001 (I)
Seasonally Adjusted
Series Title: All employees, thousands, video tape and disc rental, seasonally adjusted
Super Sector: Financial activities
Industry: Video tape and disc rental
NAICS Code: 53223
Data Type: ALL EMPLOYEES, THOUSANDS
Jobs and tasks
Automation, jobs and tasks

Automation doesn’t generally eliminate jobs. Automation generally eliminates dull, tedious, and repetitive tasks.

- **Manual**: washing clothes, drying dishes, mowing lawn, digging holes, chopping wood
- **Cognitive**: making change for purchase, memorizing maps, adding columns of numbers

If you eliminate *all* the tasks associated with a job, you have eliminated a job. But this is rare.
Tasks and jobs

There were 270 detailed occupations listed in the 1950 US Census. Only 1 has been eliminated due to automation.

Quartz article based on Jim Bessen’s work
Tasks or jobs?

There were 270 detailed occupations listed in the 1950 US Census. Only 1 has been eliminated due to automation.

Elevator operator

Quartz article based on Jim Bessen's work
Even elevator operators had other tasks...

- **Operation**
  - Safety monitor
  - Security monitor
  - Greeter
  - Provide answers to questions
  - Provide services to residents
  - Announced special prices or offers
- Many such tasks were folded into other jobs (reception, security)
- Most jobs are more complicated than we think...
Groundskeeper tasks:  O*NET

- Gather and remove litter.
- Use hand tools, such as shovels, rakes, pruning saws, saws, hedge or brush trimmers, or axes.
- Operate vehicles or powered equipment, such as mowers, tractors, twin-axle vehicles, snow blowers, chain-saws, electric clippers, sod cutters, or pruning saws.
- Water lawns, trees, or plants, using portable sprinkler systems, hoses, or watering cans.
- Prune or trim trees, shrubs, or hedges, using shears, pruners, or chain saws.
- Mix and spray or spread fertilizers, herbicides, or insecticides onto grass, shrubs, or trees, using hand or automatic sprayers or spreaders.
- Care for established lawns by mulching, aerating, weeding, grubbing, removing thatch, or trimming or edging around flower beds, walks, or walls.
- Follow planned landscaping designs to determine where to lay sod, sow grass, or plant flowers or foliage.
Groundskeeper tasks, continued

- Trim or pick flowers and clean flower beds.
- Attach wires from planted trees to support stakes.
- Plant seeds, bulbs, foliage, flowering plants, grass, ground covers, trees, or shrubs and apply mulch for protection, using gardening tools.
- Mow or edge lawns, using power mowers or edgers.
- Rake, mulch, and compost leaves.
- Decorate gardens with stones or plants.
- Provide proper upkeep of sidewalks, driveways, parking lots, fountains, planters, burial sites, or other grounds features.
- Shovel snow from walks, driveways, or parking lots and spread salt in those areas.
- Maintain irrigation systems, including winterizing the systems and starting them up in spring.
- Plan or cultivate lawns or gardens.
- Install rock gardens, ponds, decks, drainage systems, irrigation systems, retaining walls, fences, planters, or playground equipment.
Robots and tasks

Could we build a robotic groundskeeper?

- You could likely automate any single task with enough money and time
- But automating them all would be very challenging

Robots work best with standardized environment and repetitive tasks.

- We have been optimizing the assembly line with humans for 100 years
- It’s not surprising that this environment is (relatively) easy to automate
- Half of all industrial robots are in auto plants

A heterogeneous environment is much more difficult, even when each task is relatively simple. Generally, we have seen machines that augment humans, not replaced them.
Ideal environment for robot gardener
Hotel housekeeper O*NET

- Carry linens, towels, toilet items, and cleaning supplies, using wheeled carts.
- Disinfect equipment and supplies, using germicides or steam-operated sterilizers.
- Clean rooms, hallways, lobbies, lounges, restrooms, corridors, elevators, stairways, locker rooms, and other work areas so that health standards are met.
- Empty wastebaskets, empty and clean ashtrays, and transport other trash and waste to disposal areas.
- Observe precautions required to protect hotel and guest property and report damage, theft, and found articles to supervisors.
- Replenish supplies, such as drinking glasses, linens, writing supplies, and bathroom items.
- Clean rugs, carpets, upholstered furniture, and draperies, using vacuum cleaners and shampooers.
- Dust and polish furniture and equipment.
- Keep storage areas and carts well-stocked, clean, and tidy.
- Wash windows, walls, ceilings, and woodwork, waxing and polishing as necessary.
- Move and arrange furniture and turn mattresses.
- Hang draperies and dust window blinds.
Ideal environment for housekeeper robot
Traditional orchard v modern orchard

Make the environment as homogeneous as possible (like the assembly line).

Source: Goodfruit
Easier for humans and robots
Can we replace humans with humanoid robots?

First invasion of the machines (1880s)

- Washing machines, dryers, dishwashers, vacuum cleaners, sewing machines
- None of these work like humans
- Key to eliminating routine labor is to standardize environment and eliminate routine work
- Airplanes don’t fly by flapping their wings, cars don’t walk, boats don’t swim
Can we replace humans with humanoid robots?

First invasion of the machines (1880s)

- Washing machines, dryers, dishwashers, vacuum cleaners, sewing machines
- None of these work like humans
- Key to eliminating routine labor is to standardize environment and eliminate routine work
- Airplanes don’t fly by flapping their wings, cars don’t walk, boats don’t swim
- With a few exceptions...
Routine v Nonroutine work

Jobs Involving Routine Tasks Aren't Growing
“In mass production there are no fitters.”  
*Henry Ford 1929*

“Yes, excessive automation at Tesla was a mistake. To be precise, my mistake. **Humans are underrated.**”  
*Elon Musk 2018*

“In final assembly, robots can apply torque consistently—but they don’t detect and account for threads that aren’t straight, bolts that don’t quite fit, fasteners that don’t align or seals that have a defect. Humans are really good at this. Have you wondered why Teslas have wind-noise problems, squeaks and rattles, and bits of trim that fall off? Now you have your answer.”  
*Bernstein 2018*

Heterogeneity is still a problem....
Tasks and jobs

- What tasks can be automated?
- How will tasks associated with jobs change?
- What jobs can be automated?
- What fraction does it make economic sense to automate?
- Depends what and who you ask...

Estimated job loss from automation
## Other estimates

<table>
<thead>
<tr>
<th>Year</th>
<th>Region</th>
<th>Jobs Destroyed</th>
<th>Jobs Created</th>
<th>Predictor</th>
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<tbody>
<tr>
<td>2016</td>
<td>worldwide</td>
<td>900,000 to 1,500,000</td>
<td></td>
<td>Metra Martech</td>
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<tr>
<td>2018</td>
<td>US jobs</td>
<td>13,852,530</td>
<td>3,078,340</td>
<td>Forrester</td>
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<tr>
<td>2020</td>
<td>worldwide</td>
<td>1,000,000 to 2,000,000</td>
<td></td>
<td>Metra Martech</td>
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<tr>
<td>2020</td>
<td>worldwide</td>
<td>1,800,000</td>
<td>2,300,000</td>
<td>Gartner</td>
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<tr>
<td>2020</td>
<td>sampling of 15 countries</td>
<td>7,100,000</td>
<td>2,000,000</td>
<td>World Economic Forum (WEF)</td>
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<tr>
<td>2021</td>
<td>worldwide</td>
<td>1,900,000 to 3,500,000</td>
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<td>The International Federation of Robotics</td>
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<td></td>
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<td>2022</td>
<td>worldwide</td>
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<td>Thomas Frey</td>
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<tr>
<td>2025</td>
<td>US jobs</td>
<td>24,186,240</td>
<td>13,604,760</td>
<td>Forrester</td>
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<td>2025</td>
<td>US jobs</td>
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<td></td>
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<td>2027</td>
<td>US jobs</td>
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<td>14,900,000</td>
<td>Forrester</td>
</tr>
<tr>
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<td>worldwide</td>
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<td></td>
<td>Thomas Frey</td>
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<tr>
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<td>worldwide</td>
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<td></td>
<td>McKinsey</td>
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<td>2030</td>
<td>US jobs</td>
<td>58,164,320</td>
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<td>PWC</td>
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<td>2033</td>
<td>US jobs</td>
<td>67,876,460</td>
<td></td>
<td>Oxford University</td>
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<td>US jobs</td>
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<td>2035</td>
<td>UK jobs</td>
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<td>Bank of England</td>
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<td>OECD</td>
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<td>No Date</td>
<td>UK jobs</td>
<td>13,700,000</td>
<td></td>
<td>IPPR</td>
</tr>
</tbody>
</table>

*Technology Review*
Ten largest occupations in US

Retail salesperson, cashier, food preparation, office clerk, registered nurse, customer service representative, waiter/waitress, laborer, administrative assistant, and janitor.

1. These 10 jobs account for 21% of total employment.
2. All are in services (which is 80% of private US employment.)
4. Most of these jobs are too difficult for robots, but many of the tasks could be automated to a degree.
Work week across time and space
What happens if we do become ultra productive?

If automation increases productivity by 25%, we can accomplish in 4 days what now takes 5. How does work change?

- Work less each (day, week, lifetime)
- Consume more each (day, week, lifetime)
# Workweek

<table>
<thead>
<tr>
<th>Year</th>
<th>Hours</th>
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<tbody>
<tr>
<td>1850</td>
<td>66</td>
</tr>
<tr>
<td>1870</td>
<td>62</td>
</tr>
<tr>
<td>1890</td>
<td>60.0</td>
</tr>
<tr>
<td>1900</td>
<td>59.6</td>
</tr>
<tr>
<td>1910</td>
<td>57.3</td>
</tr>
<tr>
<td>1920</td>
<td>51.2</td>
</tr>
<tr>
<td>1930</td>
<td>50.6</td>
</tr>
<tr>
<td>1940</td>
<td>37.6</td>
</tr>
<tr>
<td>1955</td>
<td>38.5</td>
</tr>
</tbody>
</table>

## Country Hours

<table>
<thead>
<tr>
<th>Country</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>35.2</td>
</tr>
<tr>
<td>Denmark</td>
<td>32.1</td>
</tr>
<tr>
<td>France</td>
<td>36.1</td>
</tr>
<tr>
<td>Germany</td>
<td>34.5</td>
</tr>
<tr>
<td>Italy</td>
<td>35.5</td>
</tr>
<tr>
<td>Mexico</td>
<td>45.2</td>
</tr>
<tr>
<td>Netherlands</td>
<td>29.1</td>
</tr>
<tr>
<td>Spain</td>
<td>36.5</td>
</tr>
<tr>
<td>Sweden</td>
<td>35.9</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>36.5</td>
</tr>
<tr>
<td>United States</td>
<td>38.6</td>
</tr>
</tbody>
</table>

*Economic History Assoc* and *OECD*
What do people want?
What do people want?

“More jobs and less work”
What do people want?

“More jobs and less work”

And that’s exactly what technology can deliver.
What do people want?

“More jobs and less work”

And that’s exactly what technology can deliver.

Everybody loves a 3 day weekend!
What do people want?

“More jobs and less work”

And that’s exactly what technology can deliver.

Everybody loves a 3 day weekend!

So why not make it permanent...
Education and training
Unemployment rates and earnings by educational attainment, 2016

<table>
<thead>
<tr>
<th>Educational Attainment</th>
<th>Unemployment Rate (%)</th>
<th>Median Usual Weekly Earnings ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctoral degree</td>
<td>1.6</td>
<td>1,664</td>
</tr>
<tr>
<td>Professional degree</td>
<td>1.6</td>
<td>1,745</td>
</tr>
<tr>
<td>Master’s degree</td>
<td>2.4</td>
<td>1,380</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>2.7</td>
<td>1,156</td>
</tr>
<tr>
<td>Associate’s degree</td>
<td>3.6</td>
<td>819</td>
</tr>
<tr>
<td>Some college, no degree</td>
<td>4.4</td>
<td>756</td>
</tr>
<tr>
<td>High school diploma</td>
<td>5.2</td>
<td>692</td>
</tr>
<tr>
<td>Less than a high school diploma</td>
<td>7.4</td>
<td>504</td>
</tr>
</tbody>
</table>

Total: 4%  All workers: $885

Note: Data are for persons age 25 and over. Earnings are for full-time wage and salary workers.
Fallacy of composition for education

It’s good for any individual to be more educated, but it is good for everyone to become more educated? Who will do the jobs that don’t require much education? There will still be jobs for groundskeepers and hotel maids. However, some tasks will be automated and training will be necessary.

- Routine work: machines
- Exception handling: humans.

The best way to acquire training is on the job.

- Lower opportunity cost
- More relevant
- More focused
- Higher motivation
Delivery of instruction and training

Can technology help deliver on-the-job job skills?

Not only can technology deliver this, it already does!

There are 1 billion views a day of “how to videos” on YouTube

This is unprecedented in human history.
How to videos on YouTube: cognitive

**Math by subject**
- Early math
- Arithmetic
- Pre-algebra
- Algebra
- Geometry
- Trigonometry
- Precalculus
- Statistics & probability
- Calculus
- Differential equations
- Linear algebra
- Math for fun and glory

**CS by subject**
- Intro to algorithms
- Binary search
- Asymptotic notation
- Selection sort
- Insertion sort
- Recursive algorithms
- Towers of Hanoi
- Merge sort
- Quick sort
- Graph representation
- Breadth-first search
- Further learning

Khan Academy
How to videos on You Tube: manual

- how to sweat copper pipe
- how to install a prehung door
- how to care for mums
- how to do planks
- how to weld cast iron
- how to remove a stripped bolt
- how to shorten blinds
- how to clean glass pipe
- how to program a garage door opener
- how to get a stripped screw out
- how to remove a stripped screw
- how to clean a pipe
- how to shingle a roof
- how to tig weld
- how to solder copper pipe
- how to weld aluminum
- how to mig weld
- how to balance a ceiling fan
- how to install a storm door
Cognitive assistance

It used to be that being a...

- cashier required knowing how to make change
- writer required knowing how to spell
- taxi driver meant knowing city streets
- a hospitality worker in an international you know a bit of foreign languages
- gardener, you needed to recognize plants
- veterinarian how to recognize dog breeds

Where there is a skills gap, you can bring the worker’s skills up to the requirement, or bring the job down to workers’ competencies. Cognitive assistances helps people get jobs, by reducing the tasks they need to master.

- In 1880 machines offered manual assistance
- In 2018 machines offer cognitive assistance.
Summary of bots

- Demand for labor and supply of labor are both important
- Automation commonly replaces tasks, rarely replaces jobs
- Historically this has led to more jobs and less work
- Most jobs are more complex than intellectuals recognize
- Job training is ideally provided on the job
- Technology can help deliver training as needed
- Cognitive assistance helps match skills to jobs by 1) educating workers 2) educating machines
  - Training spinners or build a spinning jenny
  - Training taxi drivers or GPS system
Tots: demography
Productivity

output/person = output/hour \times \text{hours/worker} \times \text{workers/person}

= \text{productivity} \times \text{employment} \times \text{participation}
Productivity

output/person = output/hour \times \text{hours/worker} \times \text{workers/person}

= \text{productivity} \times \text{employment} \times \text{participation}

\text{full}
Productivity

output/person = output/hour \times \text{hours/worker} \times \text{workers/person}

= \text{productivity} \times \text{employment} \times \text{participation}

\text{full} \quad \text{declining}
Productivity

output/person = output/hour x hours/worker x workers/person

= productivity x employment x participation

anemic  full  declining
Growth in productivity

Growth in productivity

Growth of the labor force

Chart 1. Labor force growth, by decades, 1950s to 2005 and projected to 2040s

Demography is destiny

1. Live births by year, 1920–2010


Bureau of Labor Statistics
Immigration

Without future immigrants, working-age population in U.S. would decrease by 2035

Working-age population (25-64), in millions

Labor force participation rates
Where will labor shortage be worst?

Chart 1: Change in ratio of people aged 20 to 64 over total population, 2015 to 2030 (Click to expand).
Growth in population and labor force

<table>
<thead>
<tr>
<th>Decade</th>
<th>Population growth</th>
<th>Labor Force growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>18.4%</td>
<td>7.7%</td>
</tr>
<tr>
<td>2020</td>
<td>10.5%</td>
<td>6.5%</td>
</tr>
<tr>
<td>2030</td>
<td>10.3%</td>
<td>5.5%</td>
</tr>
<tr>
<td>2040</td>
<td>9.3%</td>
<td>7.5%</td>
</tr>
<tr>
<td>2050</td>
<td>8.2%</td>
<td>8.1%</td>
</tr>
</tbody>
</table>

- US labor market is already beginning to tighten
- Expect a tight labor market for the next 15-25 years
- Retirees continue to consume
- Labor supply is growing more slowly than labor demand.
- Old intuitions no longer helpful
- Countervailing forces
  - 2000: 3% of 65+ working
  - 2016: 12.4% of 65+ working

Gad Levanon, Conference Board
US is in good shape compared to many countries.

Dependency ratio

OECD
Korea
Japan
China
Canada
US
UK
Spain
Italy
Germany
France

People over 65 for every 100 people of working age. Source: OECD
And the US birth rate is at an all-time low!

“This dearth of births could exacerbate the problems of America’s aging population. Many baby boomers are in or are near retirement, leaving a smaller share of young workers to pay into Social Security and Medicare.

That is creating a funding imbalance that strains the social safety net that supports the elderly.”

Source: WSJ, May 17, 2018
Why is US birth rate low?

<table>
<thead>
<tr>
<th>Reason</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child care is too expensive</td>
<td>64%</td>
</tr>
<tr>
<td>Want more time for the children I have</td>
<td>54%</td>
</tr>
<tr>
<td>Worried about the economy</td>
<td>49%</td>
</tr>
<tr>
<td>Can’t afford more children</td>
<td>44%</td>
</tr>
<tr>
<td>Waited because of financial instability</td>
<td>43%</td>
</tr>
<tr>
<td>Want more leisure time</td>
<td>42%</td>
</tr>
<tr>
<td>Not enough paid family leave</td>
<td>39%</td>
</tr>
<tr>
<td>No paid family leave</td>
<td>38%</td>
</tr>
<tr>
<td>Worried about global instability</td>
<td>37%</td>
</tr>
<tr>
<td>Struggle with work-life balance</td>
<td>36%</td>
</tr>
<tr>
<td>Worried about domestic politics</td>
<td>36%</td>
</tr>
</tbody>
</table>

Robots per 10,000 workers

Countries with bad demographics are investing in robots. See Acemoglu and Restrepo [2017, 2018] for detailed analysis.
Workforce aging and increased industrial automation

Source: Acemoglu and Restrepo (2018)
Bots v Tots: which is bigger effect?

- **Boston Consulting Group (2015)** aggressive scenario + **Acemoglu-Restrepo (2017)**: employment/population ratio declines by 1.76% in next decade
- **Bureau of Labor Statistics (2006)**: employment/population ratio declines by 2.7% based on demography in next decade
- Net: demographic effect is 53% larger than than the automation effect!
  - Tight labor markets
  - Rising wages
  - Increased incentive for employers to economize on labor
  - Increase incentive workers to provide more labor (part time, flexwork, delayed retirement)

- **Suggestion**
  - Estimated impact of automation should be compared to demographic realistic baseline, not a zero baseline
  - Both demand *and* supply matter!
As retirees age, they become more costly

Fact sheet: Aging in the United States

- People over 65 in US today: 46 million, 15 percent
- People over 65 in US in 2060: 98 million, 24 percent
- People with Alzheimer’s today: 5 million
- People with Alzheimer’s 2050: 14 million

Productivity growth in 2015:

- 1.3% productivity growth implies GDP will be 78% larger in 2060 than today
- Population over 65 doubles, Alzheimer’s triples, and GDP only goes up by 78%
- If productivity growth were 1.6% we would could cover the doubling of the elderly

Harnassing automation for a future that works, McKinsey
THE END