

LECTURE 8: GROWTH THEORY IV: WHY ARE THERE STILL SO MANY JOBS?

See Autor 2015

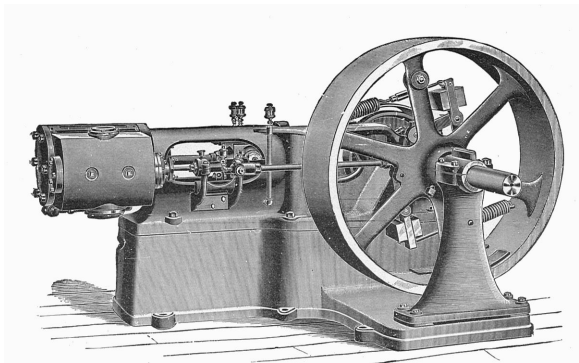
Trevor Gallen

Spring, 2016

MOTIVATION THREE STORIES

- ▶ Technological progress is why most of us are still alive and more than 10x wealthier than our great-grandfathers.
- ▶ Core elements of the industrial revolution
- ▶ Three stories from Acemoglu and Robinson
 - ▶ Steamboat (Papin)
 - ▶ Textile Automation I (William Lee)
 - ▶ Textile Automation II (Luddites)

THE STEAM ENGINE



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- ▶ Jules Verne on the greatest discoveries of humanity
 - ▶ Gravity
 - ▶ Compass
 - ▶ Printing Press
 - ▶ Steam Engine
 - ▶ Electric Telegraph

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- ▶ Papin dies a pauper in an unmarked grave

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- ▶ Scotland in 1800: 100,000 weavers (6.25% of pop)
- ▶ Scotland in 1850: 25,000 weavers (<1% of pop)

MOTIVATION (ACEMOGLU & ROBINSON-II)

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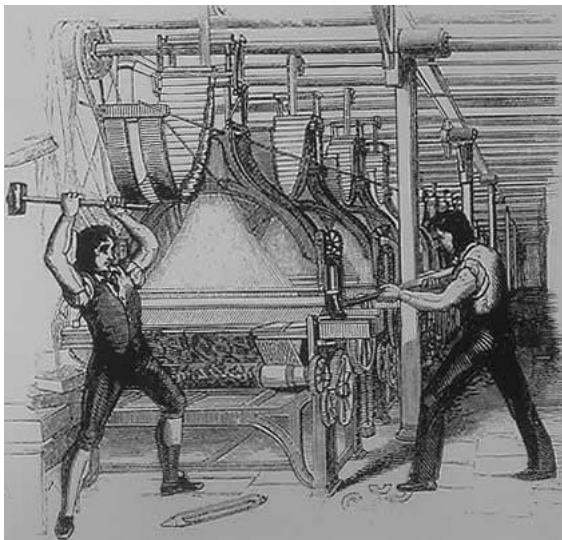
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- ▶ Invented the stocking frame
- ▶ Brought it to the queen “Thou aimest high, Master Lee. Consider thou what the invention could do to my poor subjects. It would assuredly bring to them ruin by depriving them of employment, thus making them beggars.”

MOTIVATION (ACEMOGLU & ROBINSON-III)



Luddites!

MOTIVATION (ACEMOGLU & ROBINSON-III)

- ▶ When the power loom (and other frames) were invented, strong substitute for labor
- ▶ Strong displeasure at (potentially) falling wages
- ▶ Smash the machines!
- ▶ Militia-like behavior, clashes with police and army
- ▶ Machine-breaking becomes a capital offense (never used)

GROWING PAINS

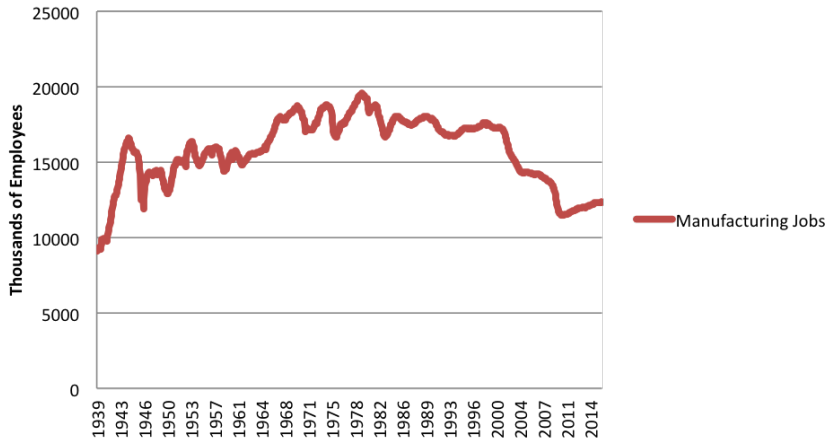
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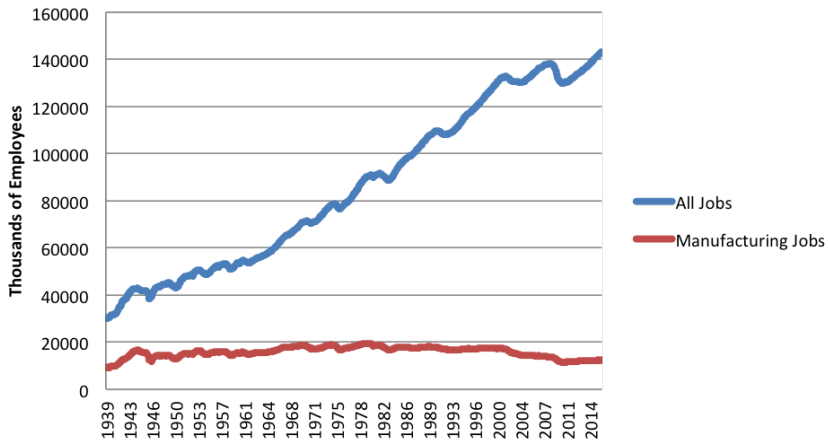
MANUFACTURING EMPLOYMENT

Manufacturing jobs



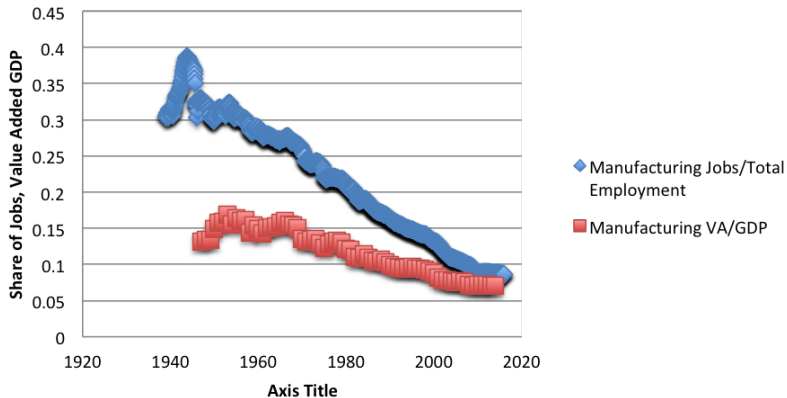
MANUFACTURING EMPLOYMENT AND TOTAL EMPLOYMENT

All jobs vs. manufacturing jobs



MANUFACTURING GDP AND TOTAL GDP

Manufacturing's Share of the Economy



THE AUTOMATION JOBLESS

“The number of jobs lost to more efficient machines is only part of the problem. What worries many job experts more is that automation may prevent the economy from creating enough new jobs. . . . Throughout industry, the trend has been to bigger production with a smaller work force. . . . Many of the losses in factory jobs have been countered by an increase in the service industries or in office jobs. But automation is beginning to move in and eliminate office jobs too. . . . In the past, new industries hired far more people than those they put out of business. But this is not true of many of today’s new industries. . . . Today’s new industries have comparatively few jobs for the unskilled or semiskilled, just the class of workers whose jobs are being eliminated by automation.”

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When was this written? 1961!

THE PROBLEM

- ▶ Productivity rising so fast it outstrips the demand for labor
- ▶ “The basic fact is that technology eliminates jobs, not work.”
- ▶ Blue Ribbon Commission recommends: “a guaranteed minimum income for each family; using the government as the employer of last resort for the hard core jobless; two years of free education in either community or vocational colleges; a fully administered federal employment service, and individual Federal Reserve Bank sponsorship in area economic development free from the Fed’s national headquarters.”
- ▶ Autor: There is no fundamental economic law that guarantees every adult will be able to earn a living solely on the basis of sound mind and good character.

THE PROBLEM(?)

- ▶ But employment/population rose over the 20th century
- ▶ No secular increase in the unemployment rate

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- ▶ Big business crushed by disruptive auto industry

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- ▶ Now, computers replacing repetitive, error-prone, & labor-intensive activities

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- ▶ The O-Ring Model

THE O-RING MODEL-I

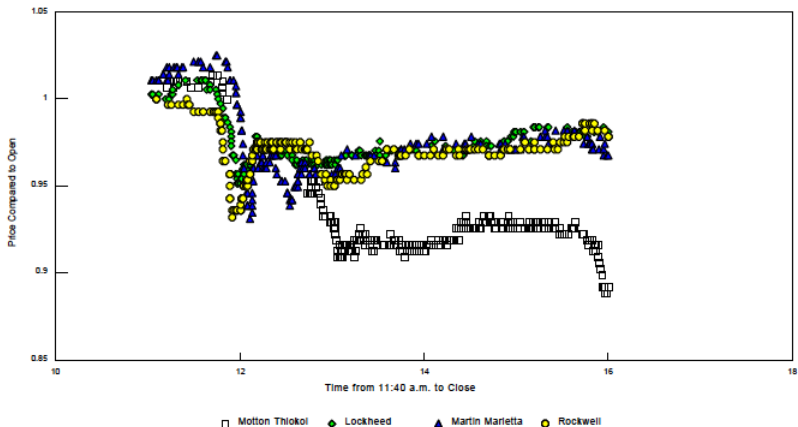
- ▶ In January 1986, Space Shuttle *Challenger* broke apart a little more than a minute into flight
- ▶ Rogers Commission Investigated, and found that tiny rubber O-ring failure at low pressures caused the disaster
- ▶ Thousands of moving parts, and each one needs to work: complementarity

ASIDE ON THE CHALLENGER DISASTER: MALONEY & MULHERIN

- ▶ Challenger explosion occurred at 11:39 a.m.
- ▶ Four main private firms involved & focused on in press:
 - ▶ Rockwell International: Maker of shuttle
 - ▶ Lockheed: Ground support
 - ▶ Martin Marietta: external fuel tank manufacturer
 - ▶ Morton Thiokol: solid fuel rocket booster maker
- ▶ NYTimes & FT
 - ▶ “How could it happen?”
 - ▶ “No Ideas Yet to Cause”
 - ▶ “it will be months rather than weeks...”

ASIDE ON THE CHALLENGER DISASTER: M&M

Intraday Stock Price Movements Following the Challenger Disaster



Maloney & Mulherin (1998)

ASIDE ON THE CHALLENGER DISASTER: M&M

- ▶ Two year delay imposed: all firms suffer a little, and by same proportion
- ▶ But one stood out in particular: Morton Thiokol: 12% loss that stuck
- ▶ Worth about \$200 million
 - ▶ Direct loss of \$7 million to families of astronauts
 - ▶ \$10 million to NASA
 - ▶ \$40 million in repair profits
 - ▶ Dropped out of \$1.5 billion contract, etc.
- ▶ Not unreasonable to say the market got it right!

ASIDE ON THE CHALLENGER DISASTER: M&M

- ▶ Where did the information come from?
- ▶ Possible sources from Maloney & Mulherin
 - ▶ Testimony the year before about problems in seals of shuttle booster rockets
 - ▶ It was known the O-ring had problems (but there were also other problems)
- ▶ No one in financial media mentioned it before or after
- ▶ Indeed, claims of an “overreaction.”
- ▶ No evidence of insider trading
- ▶ Dark magiks? Efficient Markets(?!)

O-RING MODEL-II

- ▶ Production function:

$$Y = (q_1 q_2) B$$

- ▶ q_i is quality of unit i . B is what we get if both end up being good. If either fails, we get zero.
- ▶ When q_i goes up, what happens to the value of a little q_2 ?

$$\frac{\partial^2 Y}{\partial q_1 \partial q_2} = \frac{\partial}{\partial q_1} \left(q_1 B \frac{\partial q_2}{\partial q_2} \right) = B \frac{\partial q_1}{\partial q_1} = B > 0$$

- ▶ When q_1 improves, a slight improvement in q_2 is worth more.
- ▶ If $q_1 = 0.1$, then q_2 moving from 0.5 to 0.51 gives $0.001B$.
- ▶ If $q_1 = 0.5$, then q_2 moving from 0.5 to 0.51 gives $0.005B$.
- ▶ Small improvements worth more when other things improve

O-RING MODEL-III

- ▶ O-ring type models might explain a lot
- ▶ Firms at tail end of productivity (“superteams”)
- ▶ Potentially, same with countries & development
- ▶ In our case, workers & capital: better capital increases demand for workers

EXAMPLE

- ▶ ATMs introduced in 1970's
- ▶ From 1995-2010, ATMs go from 100,000 → 400,000
- ▶ In 1995, about 500,000 bank tellers
- ▶ How many in 2010? 550,000
- ▶ What are bank tellers doing?
- ▶ ATMS increased the demand for tellers: bank tellers/branch fell, but more urban bank branches
- ▶ More personal “relationship banking”

THREE IMPORTANT FACTORS

- ▶ Complement, or substitute?
- ▶ Elasticity of labor supply
- ▶ Output elasticity of demand vs. income elasticity of demand

FACTOR 1: COMPLEMENT, OR SUBSTITUTE?

- ▶ Capital is typically a complement for labor in the aggregate
- ▶ Even when capital substitutes for some kinds of labor, it likely complements others

FACTOR 2: ELASTICITY OF LABOR SUPPLY

- ▶ The degree to which technology impacts wages and quantity partially depends on the elasticity of labor supply
- ▶ Imagine, for instance, technology for food service jobs comes to replace workers, costs \$10/hour
- ▶ If labor is fairly inelastically supplied, then wages go down but quantity of hours worked don't change

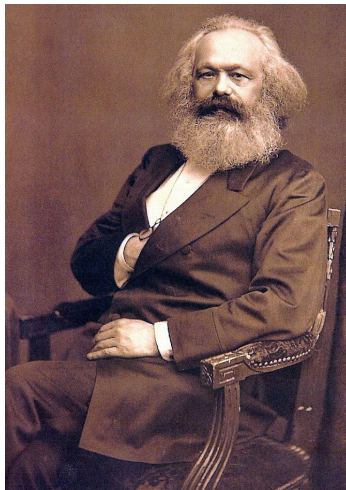
FACTOR 3: OUTPUT ELASTICITY & INCOME ELASTICITY

- ▶ When productivity increases, more of the good
- ▶ When productivity increases, we're also richer
- ▶ Where do we spend the money?
 - ▶ Agriculture: better technology, less money
 - ▶ Health care: better technology, more money
- ▶ Also, spillover effects: cars & diners, motels

GAINS IN PRODUCTIVITY & DEMAND

- ▶ Gain in productivity haven't meant a fall in demand
- ▶ Average worker now could get income level of average worker in 1915 by working 17 weeks a year.
- ▶ But they don't: consumption & leisure seem to be complements

WHAT ABOUT THE RICH GETTING RICHER?



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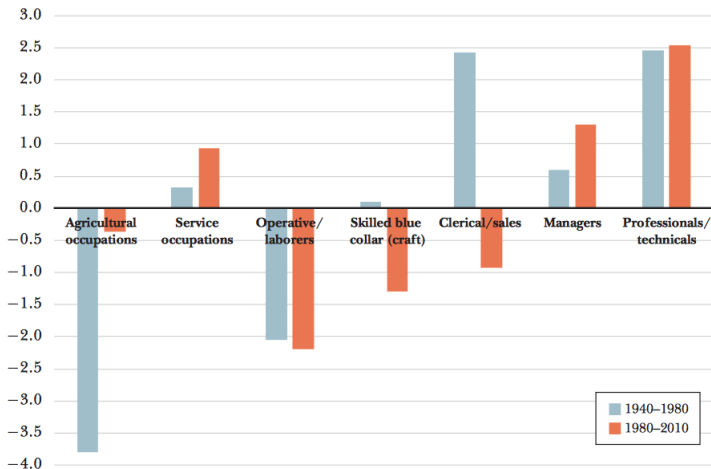
- ▶ Chetty, Hendren, Kline, and Saez: social mobility isn't changing even as income inequality has
- ▶ Given parents in top 1%, probability of child in top 1% is 9.6%
- ▶ Hard for wealth inequality to truly blow up
- ▶ Even then, just a question of taxation & governance

THE CHANGING JOB MARKET

- ▶ Even if we don't lower jobs, might lower *quality* of jobs
- ▶ Are we being pushed into physically demanding, dangerous, menial, and monotonous?
- ▶ Or blue collar & white collar work?

THE CHANGING JOB MARKET

Average Change per Decade in US Occupational Employment Shares for Two Periods: 1940–1980 and 1980–2010



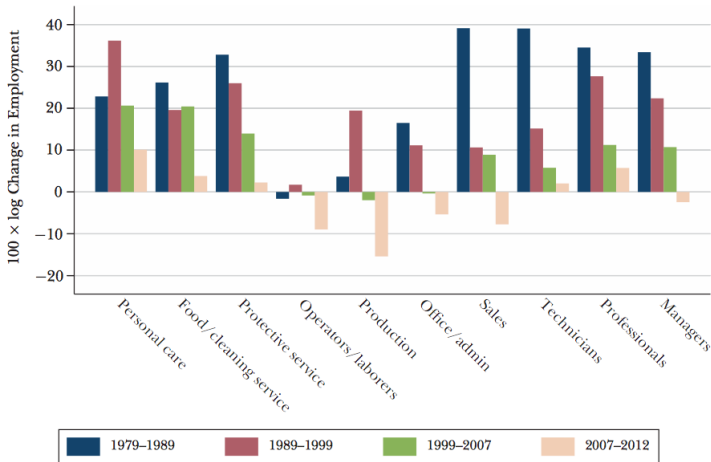
POLANYI'S PARADOX

- ▶ Computers (now) need explicit rules or procedures
- ▶ “We know more than we can tell.”
- ▶ The tasks most vexing to automate need flexibility, judgement, and common sense
- ▶ Hard to automate

THE CHANGING JOB MARKET

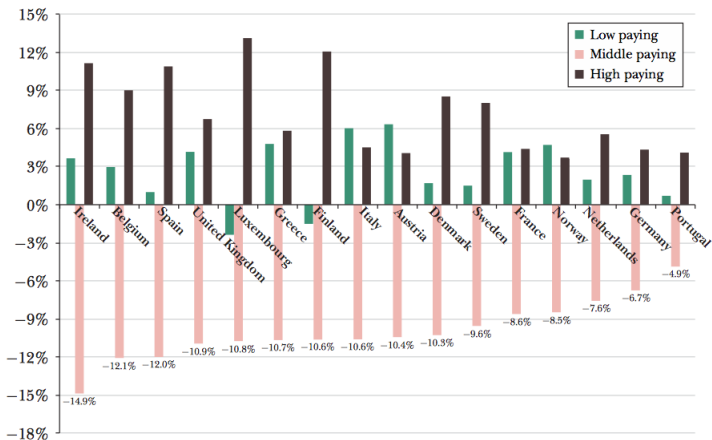
Change in Employment by Major Occupational Category, 1979–2012

(the y-axis plots 100 times log changes in employment, which is nearly equivalent to percentage points for small changes)



THE CHANGING JOB MARKET

Change in Occupational Employment Shares in Low, Middle, and High-Wage Occupations in 16 EU Countries, 1993–2010



Source: Goos, Manning, and Salomons (2014, table 9)

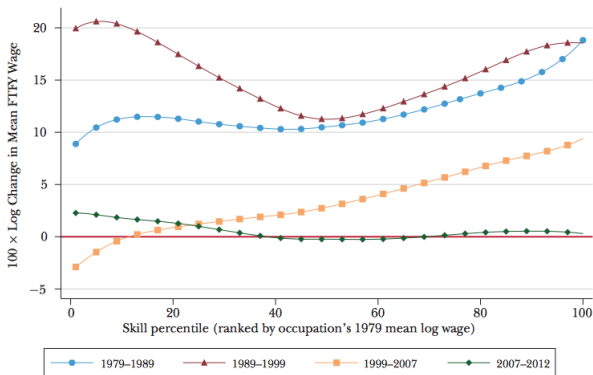
GOOD NEWS, BAD NEWS

- ▶ Bad news: final demand for manual task-intensive work is relatively inelastic with respect to price
- ▶ Consequently, reducing price per unit probably reduces expenditures
- ▶ Good news: final demand for manual task-intensive work is relatively elastic with respect to income
- ▶ Consequently, as we get richer, we purchase more of these goods
- ▶ Bad(?) news: labor supply for manual task-intensive tasks is relatively labor elastic
- ▶ Consequently, it's hard to ever increase the wage (though it must increase! why?)

THE CHANGING JOB MARKET

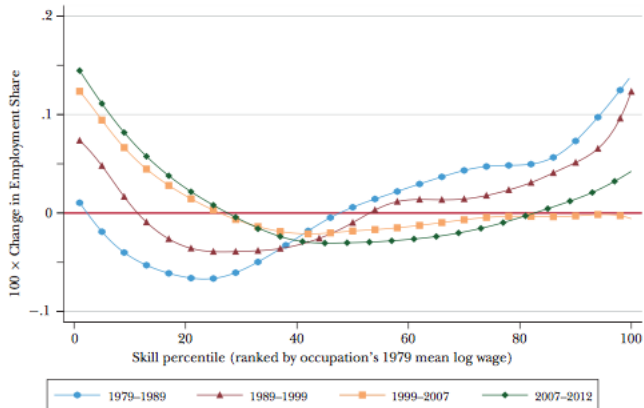
Changes in Mean Wages by Occupational Skill Percentile among Full-Time, Full-Year (FTFY) Workers, 1979–2012

(the y-axis plots 100 times log changes in employment, which is nearly equivalent to percentage points for small changes)



THE CHANGING JOB MARKET

Smoothed Employment Changes by Occupational Skill Percentile, 1979–2012



POLANYI, REVISITED

- ▶ Two shots:
 - ▶ Control the environment, so machines don't need to learn
 - ▶ Learning machines

CONCLUSION

- ▶ Autor: Middle-skill *tasks* are likely to be automated, *jobs* less so.
- ▶ Many mitigating factors: labor supply, complementarity, income elasticities
- ▶ Tasks that combine technical and interpersonal, creative skills grow rapidly
- ▶ What human capital is valuable?
 - ▶ How to think
 - ▶ How to be creative, clever, thoughtful