Inequality, Growth and Technology

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LOTS OF INEQUALITIES!

• Inequality a major topic of economic research, especially in last 3 decades, which has seen large increase in income inequality
  – Occupy Movement
  – Thomas Piketty “Capital in 21st Century”
  – CEP video, https://www.youtube.com/watch?v=tvN8zvovDrY

• Types of Inequality
  – Income & wealth (especially in work: earnings)
  – Labour vs. Capital
  – Gender, race
  – Wellbeing more than just money
1. Recent trends in inequality

2. Causes of these changes

3. Polarization

4. Conclusions
Top income shares. United States. 1913-2012
Sources: The World Top Incomes Database. http://topincomes.g-mond.parisschoolofeconomics.eu/
Piketty & Saez (2007)

Collecting data: 24%

Top 1% income share

Top 1% income share-including capital gains
TOP 1% SHARE OF ALL INCOME IN SELECTED COUNTRIES, 1910-2007

IT’S NOT JUST THE 1% US MALE WAGE INEQUALITY, 1937-2005

PERCENTAGE DIFFERENCE IN PAY BETWEEN TOP AND BOTTOM 10% OF EARNERS, UK

Notes: UK data, 1968-96 (NES) 1997-2012 (ASHE); (90-10 log weekly earnings ratios, full-time, 1975-2012)
Real Wage Trends, UK
CHANGE IN MALE WAGE INEQUALITY (90-10) ACROSS OECD COUNTRIES IN THE 1980s

Source: Machin and Van Reenen (2010), OECD
CHANGE IN MALE WAGE INEQUALITY (90-10) ACROSS OECD COUNTRIES IN THE 1990’s & 2000’s

Source: Machin and Van Reenen (2010), OECD
Note: Netherlands has a break in series in 1993
BUT INEQUALITY ACROSS THE WORLD IS FALLING

Between all citizens of world

Between countries weighted by population (ignores within country changes in inequality)

Between all countries unweighted by population

Source: Milanovic (2013)
OUTLINE

1. Recent trends in inequality

2. Causes of the rise in inequality

3. Polarization

4. Conclusions
WHAT IS THE CAUSE OF RISING INEQUALITY IN UK & OTHER COUNTRIES?

• **Technology**
• **Globalisation**
  – Trade with low-wage countries like China
• **Institutions**
  – Trade unions, minimum wages, deregulation
• **Norms**
• **Corporate Governance**
  – CEOs
TECHNOLOGICAL CHANGE

• Technology increases demand for skills. Coping with uncertainty, complements analytical tasks
  – “skill biased technical change”

• Computers/Information & Communication Technology (ICT) leading example
  – Labour cost of performing a standardized set of computational tasks fell by 1.7 trillion fold 1850-2006 (Nordhaus, 2007), mostly in last 30 years (Moore’s Law)

• Increases demand for human capital & supply side not keeping up

• May also foster “market for superstars” – soccer players
TWO CENTURIES OF PRODUCTIVITY GROWTH IN COMPUTING:
2+ TRILLION FOLD DECLINE IN COST OF COMPUTING V. LABOUR

Figure 2. The cost of computer power for different technologies

Nordhaus 2007
RISING GRADUATE WAGE DIFFERENTIALS IN UK: DEGREE PREMIUM RISES FROM 39% TO 56% 1980-2011

Rising Graduate Wage Differentials (Full-Timers)

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<td>49</td>
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<td>56</td>
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<td>51</td>
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INCREASING RETURN TO SKILLS: COLLEGE DEGREE VS. HIGH SCHOOL GRAD WAGE RATIO (COMPOSITION ADJUSTED) 1963-2008, US, ALL WORKERS

Source: Acemoglu & Autor (2010), March CPS, log(weekly wages) for full-time full year workers.

Notes: Series is adjusted for experience, race and gender (not unobservables).
SKILL DIFFERENTIALS

• Higher education/skill differentials in wages are an important part of the reason for increased inequality
  – Note that even if all wage inequality was due to human capital (which it isn’t) this
    • Does not justify the level of inequality
    • Does not mean that there is nothing policy makers can do to change this (e.g. changes in schools to help disadvantaged as recommended by LSE Growth Commission)
SUPPLY OF SKILLS HAS NOT BEEN KEEPING UP: MEAN YEARS OF SCHOOLING BY BIRTH COHORT, 1900-2010

Source: Goldin & Katz (2010), IPUMs, MORG
COUNTRIES WITH FASTEST INCREASE IN ICT USAGE HAD FASTEST INCREASES IN SKILL DEMAND, 1980-2004

Figure 1A: High-Skilled Wage Bill Share

COUNTRIES WITH FASTEST INCREASE IN ICT USAGE HAD FASTEST INCREASES IN SKILL DEMAND, 1980-2004

Note: Figure plots the growth of wage bill share of workers with degree against the growth of Information & Communication Technology spend over value added (ICT/VA). EU KLEMs data
CROSS INDUSTRY GROWTH IN COLLEGE WAGE BILL SHARE & ICT INTENSITY, AVERAGE ACROSS COUNTRIES


Note: Figure plots the growth from 1980-2004 of high-skilled wage bill shares against the growth of ICT intensity (ICT/VA), by industry, averaged across countries. Lines show fitted values from regressions weighted by the cross-country average of each industry’s share in 1980 employment (solid line for entire economy, dashed line for non-trade industries only).
Note: Figure plots the growth from 1980-2004 of high-skilled wage bill shares against the growth of ICT intensity (ICT/VA), by industry, averaged across countries. Lines show fitted values from regressions weighted by the cross-country average of each industry’s share in 1980 employment.
OUTLINE

1. Recent trends in inequality
2. Causes of the rise in inequality
3. Polarization
4. Conclusions
LOVELY AND LOUSY JOBS: EMPLOYMENT SHARE GROWTH 1979-2008 BY JOB QUALITY (OCCUPATIONAL WAGE), UK

Source: Mieske (2009), updates Goos and Manning (2007), % changes for entire period
POLARIZATION & SQUEEZED MIDDLE: CHANGE IN JOB SHARES BY OCCUPATION IN EU; 1993-2010

Source: Goos, Manning & Salomons (2014)
POLARIZATION AND THE EFFECT OF ICT (INFORMATION AND COMMUNICATION TECHNOLOGY) ON TASKS

• Extension of technological explanation for changing skill demand. Developed to explain “polarization”: middle skilled group losing demand to both high and low skilled

• Routinization is the key
ARE ROBOTS RUBBISH?

Dyson
360
Eye

Robo-One annual ROBOT competition in Tokyo
EXAMPLES OF “AMAZING” THINGS ROBOTS CAN DO

• [http://www.youtube.com/watch?v=CsS1jnIx4s&feature=related](http://www.youtube.com/watch?v=CsS1jnIx4s&feature=related)
• Osaka Robocup tournament
## A TAXONOMY OF TASKS: CLASSIC

<table>
<thead>
<tr>
<th>Task type</th>
<th>Task description</th>
<th>Example of occupations</th>
<th>Effect of ICT</th>
<th>Education Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine</td>
<td>Rules based; repetitive; procedural</td>
<td>Assembly line workers;</td>
<td>Direct substitution</td>
<td>Low</td>
</tr>
<tr>
<td>Manual</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Routine</td>
<td>Non- Manual</td>
<td>Managers; doctors; lawyers; scientists</td>
<td>Strongly complementary</td>
<td>High</td>
</tr>
<tr>
<td>Non-</td>
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<td></td>
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</tr>
<tr>
<td>Routine</td>
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</tbody>
</table>

- **Routine**
  - **Manual**: Rules based; repetitive; procedural
  - **Example of occupations**: Assembly line workers;
  - **Effect of ICT**: Direct substitution
  - **Education Levels**: Low

- **Non-Routine**
  - **Non-Manual**: Abstract problem solving; mental flexibility
  - **Example of occupations**: Managers; doctors; lawyers; scientists
  - **Effect of ICT**: Strongly complementary
  - **Education Levels**: High
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<td>Rules based; repetitive; procedural</td>
<td>Assembly line workers;</td>
<td>Direct substitution</td>
</tr>
<tr>
<td></td>
<td>Non-Manual</td>
<td>Clerical; Book-keepers</td>
<td>Direct substitution</td>
<td>Middle</td>
</tr>
<tr>
<td>Non-Routine</td>
<td>Non-Manual</td>
<td>Abstract problem solving (analytic); mental flexibility</td>
<td>Managers; doctors; lawyers; scientists</td>
<td>Strongly complementary</td>
</tr>
<tr>
<td></td>
<td>Manual</td>
<td>Environmental adaptability; Interpersonal adaptability</td>
<td>Maids/Janitors; security guards; waiters; drivers</td>
<td>Broadly Neutral</td>
</tr>
</tbody>
</table>
DEMAND FOR NON-ROUTINE TASKS INCREASING OVER TIME (TRACKS OCCUPATIONAL CHANGE)

Source: Autor & Price (2013)
IMPLICATIONS OF ICT AND TASK-BASED DEMAND

• Computers a substitute for **routine** tasks, complements **analytical** tasks, but is neutral with respect to **non-routine manual tasks**

• **Implies that technology**
  – increases demand for most educated (**analytical**)
  – reduces demand for middle educated (**routine non-manual**),
  – little effect on the least educated (**now, manual non-routine**)
CROSS INDUSTRY GROWTH IN MEDIUM EDUCATED WAGE BILL SHARE & ICT INTENSITY, AVERAGE ACROSS 11 COUNTRIES, ALL SECTORS

Note: Figure plots the growth from 1980-2004 of medium-skilled wage bill shares against the growth of ICT intensity (ICT/VA), by industry, averaged across countries. Lines show fitted values from regressions weighted by the cross-country average of each industry’s share in 1980 employment (solid line for entire economy, dashed line for non-trade industries only).
Note: Figure plots the growth from 1980-2004 of medium-skilled wage bill shares against the growth of ICT intensity (ICT/VA), by industry, averaged across countries. Lines show fitted values from regressions weighted by the cross-country average of each industry’s share in 1980 employment.
Note: Figure plots the growth from 1980-2004 of low-skilled wage bill shares against the growth of ICT intensity (ICT/VA), by industry, averaged across countries. Lines show fitted values from regressions weighted by the cross-country average of each industry’s share in 1980 employment (solid line for entire economy, dashed line for non-trade industries only).
OUTLINE

1. Recent trends in inequality
2. Causes of the rise in inequality
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SUMMARY

• World inequality not rising, but it is rising within almost each country (especially US but also UK)
• Increasing returns to ability & education
• Policy
  – Risk of disenfranchised middle classes turning to populism
  – Building human capital, especially for disadvantaged in early years; intermediate skills
  – Finding policies to support growth (& so improve average wages) and also to redistribute
THANK YOU!

BACK UP
The End of Growth?

“We are passing, so to speak, over a divide which separates the great era of growth and expansion of the [last] century…”
   - Alvin Hansen, 1938 AEA Presidential address on Secular Stagnation

“The basic changes going on since the beginning of the century are not only important in explaining the unprecedented severity and persistence of the Great [Recession] but also in appraising the outlook for the future. The reduced rate of growth, with respect to both population and territory, is likely to be permanent. …. This is the basis on which the stagnation school predicts a long-run deficiency of investing opportunity.“
   - Harris, 1943

Technical advance… has not since early in the century produced anything to equal in scope the development of the railroad, the telephone, electric power or the automobile.

   - Alvin Hansen, 1941
Productivity Growth by Decade

Average from 2nd Industrial Revolution

1971-80: 1.7
1981-90: 1.5
1991-00: 2.3
2001-10: 2.4

DATA (EU-KLEMS)

- Based on aggregation of Census Bureau production data matched with other sources (e.g. CPS, LFS)
  - ICT capital: depreciated past investments on hardware, software & communication equipment
- Education broken down into three groups
  - High (e.g. College degree or above)
  - Middle (e.g. High school grads, some college)
  - Low (e.g. High school drop outs)
- Since division of middle/low is hardest, important to control for country fixed effects
- Demand measured by wage bill share of a skill group
CROSS INDUSTRY GROWTH IN LOW EDUCATED WAGE BILL SHARE & ICT INTENSITY, AVERAGE ACROSS 11 COUNTRIES, 1980-2004, TRADED SECTORS

Note: Figure plots the growth from 1980-2004 of low-skilled wage bill shares against the growth of ICT intensity (ICT/VA), by industry, averaged across countries. Lines show fitted values from regressions weighted by the cross-country average of each industry’s share in 1980 employment.
CHINA’S SHARE OF ALL EU AND US IMPORTS

We use data from 1996-2007

No trade-effect on inequality consensus formed using data from 1970s to early 1990s

Source: UN Comtrade data
TWO LIMITATIONS OF THE CONCENSUS THAT TRADE DID NOT MATTER

1. Studies mainly conducted using data through early 1990s – before rise of China (over)

2. Technology assumed exogenous (e.g. Acemoglu, 1999, 2002, 2008). In particular trade could induce faster technical change
BUT INEQUALITY ACROSS THE WORLD IS FALLING

- Concept 1
  - Inequality between countries as units

- Concept 2
  - Inequality between countries weighted by population
  - Hypothetical world income distribution if no income inequality in countries

- Concept 3 (cosmopolitan inequality)
  - Inequality between all of the “citizens” of the world
Will we ever invent anything this useful again?

The growing debate about dwindling innovation
Real Wage Trends, Germany

Indexed Wage Growth of the 15th, 50th, 85th Percentiles, West Germany, 1990–2008

Notes: Calculations based on SIAB Sample for West German Full-Time Workers between 20 and 60 years of age. The figure shows the indexed (log) real wage growth of the 15th, 50th, and 85th percentiles of the wage distribution, with 1990 as the base year. Nominal wages are deflated using the consumer price index (1995 = 100) provided by the German Federal Statistical Office.

Notes: From Dustmann, Fitzenberger, Schoenberg and Spitz-Oener (2014).
## Historical Real Wage Falls, UK

### Periods of Real Wage Falls Over Long Term, UK

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<tr>
<th></th>
<th>1865-67</th>
<th>1874-78</th>
<th>1921-23</th>
<th>1976-77</th>
<th>2007-14</th>
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<tr>
<td><strong>Duration (years)</strong></td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>7</td>
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<tr>
<td><strong>Depth (%)</strong></td>
<td>-10</td>
<td>-1.7</td>
<td>-8.2</td>
<td>-6.6</td>
<td>-8.2</td>
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<tr>
<td><strong>Recovery (%)</strong></td>
<td>12.8</td>
<td>0.6</td>
<td>4.5</td>
<td>14.5</td>
<td>n.a.</td>
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<tr>
<td><strong>Total change over seven years (%)</strong></td>
<td>1.2</td>
<td>-1.1</td>
<td>-4.0</td>
<td>6.9</td>
<td>-8.2</td>
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Labour Productivity and Annual Compensation, 1988 to 2013

Growth in Productivity and Total Compensation

Notes: From Gregg, Machin and Fernandez-Salgado (2014).
## Education Supply Increased Rapidly

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<th>Graduate Employment Shares</th>
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<td></td>
<td>1979</td>
<td>1997</td>
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<td>0.047</td>
<td>0.137</td>
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<th>Graduate Hours Shares</th>
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<td>2011</td>
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<td>0.048</td>
<td>0.147</td>
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