# What do you humans want?

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UCL

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## ANXIETY ABOUT TECHNOLOGY

"What worries many job experts more is that automation may prevent the economy from creating enough new jobs..."

The Automation Jobless. TIME magazine story dated February 24, 1961.

"The basic fact is that technology eliminates jobs, not work."

Bowen, 1966. Report of the National Commission on Technology, Automation, and Economic Progress.

## QUESTION ABOUT FOOD FROM 1950S PERSPECTIVE.





## OUESTION ABOUT FOOD FROM 1950S PERSPECTIVE.





A consumer can perceive goods to be substitutes or complement Choosing between goods:

Substitutes: very sensitive to price

Complements: less sensitive to price change

#### SUBSTITUTES AND COMPLEMENTS

Choosing between goods:

Substitutes: very sensitive to price

Complements: less sensitive to price change

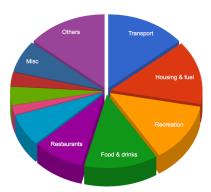
Can bundle *substitutes* into a category, but not *complements*.

Do consumers perceive automated goods to be substitutes or complements?

Does price and market power matter?

## UK Expenditure Data 2016

#### Average UK household expenditure, 2016



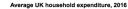
TransportHousing & fuelRecreation

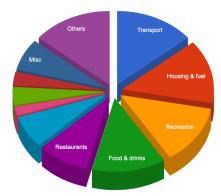
Food & drinks
Restaurants

Clothing & footwearCommunicationMiscOthers

Household goods & services
 Health & Education

## UK Expenditure Data 2016





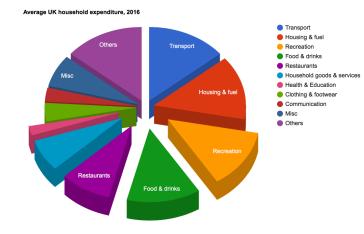
TransportHousing & fuel

RecreationFood & drinksRestaurants

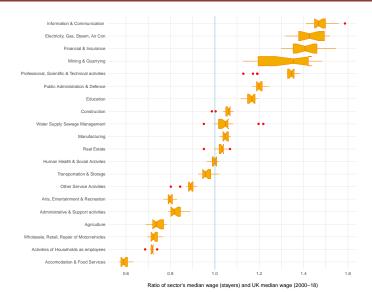
Household goods & services
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Clothing & footwearCommunicationMiscOthers

## UK Expenditure Data 2016



## SECTOR-WISE RELATIVE WAGE IN UK, 2000-2018



## PRODUCTION: MACHINES VERSUS HUMANS

Machines	Humans
Repetitive tasks	Copycats
Require explicit pathways	Contrarians
Problem interfacing humans	

substitutes or complements

does skill-adjusted wage play a role

## KASPAROV VERSUS IBM'S DEEP BLUE



## KISSINGER'S CONSTRUCTIVE AMBIGUITY



Perpetual Anxiety O	Demand 000000	Producti 0000	on	Technology ●00		Human Capital	Markup 000000	000000	End O
					1642		Adding machine invented by Blaise Pascal		
	Various pany invested by Otto was Garriele				1820	Charles Habbage designs his first mechanical computer	Arithmometer, the first mass-produced calculator invented by Charles Xavier Thomas		
	Pressure cooker invested by Deals Papla		Newton, Principle: Newton's physics formed the foundation of modern science		1835 1837 1843	Morse code invented by Samuel Morse  Typewriter invented by Charles Thurber	Electric telegraph invented by Charles Wheatstone & Samuel Morse		
	Seiler Tell invests mechanical (seed) never	į.	Beam piston engine invented by Thomas Newtonen Newtones Newtones Beam engine invented by James Wats						
	Oliver Evans insunts the	First steam powered mills antomate the wearing process			1873	Christopher Sholes invents the Remington typewriter	Microphone invented by Emile Berliner		
	Enough for the principle of the principle of the principle of the electric mater		Incometive invented by Richard Trevishirle Braze Lecomotive (Hiselar) invented by George Stephenson		1888	Hertz produces radio waves  Radio signals were invested by Guglielmo Marconi	Wireless communication invented by Nikola Tesla		
	Laws moreor invented by Edwin Beard Hubbing	Matrigorator invested by Jacob Porkins	Paraday diaconva electro magnetic current, making possible generators and electric engines		1907		Radio amplifier invented by Lee DeForest  James Smathers develops the first electric typewriter		
	Reving markine inscented by Blue Here Inner Einger commercializes the sewing markine	Halisty pin invented by Walter Basis			1923 1924 1927	Sound film invented by Lee DeForest  Philo Farneworth invents video camera tube	Electro Mechanical television system invented by John Logic Baird  Alan Turing develops the		
1473 1479 1479	Edison invents the incandescent lamp	by Daimler	James Clerk Manwell states the laws of electro-magnetic resiliation.  Cathorie ray tube invested by William Cruskes.  Brux develops first automabile to you on internal-numbustion engine.		1937	Adolf Hitler uses the Enigma encryption machine	concept of a theoretical computing machine Alan Turing develops the the code-breaking machine Colossus		
	Finded Direct invents direct  Planck develops quantum cherry  cherry  Beary Ford mana-produces the Model T		Direct engine invented by Budolf Direct Various eleaner invented by Habert Bookh Einstein writes the Theory of Belativity		1958	First silicon chip produced by Jack Kilby & Robert Noyce  Computer mouse invented by Douglas Engelbart	Optical disc invented by David Paul Gregg		
	Model T  Robort Goddard experiments with Equid-Indeed reviers		Jet ougine increated by Frank Whittle and Hass von Ohain		1971	Floppy Disk invented by David Noble with IBM Personal computer invented by Xerox PARC	E-mail invented by Ray Tomlinson Ethernet invented by Bob Metcalfe and David Boggs		
	The atomic bomb	Aqua-Lung invented by Jurgan-Yess Counters and Emile Gagnan	Whitele and Hare you Obain		1990		World Wide Web invented by Tim Berners-Lee		

Perpetual Anxiety O	Demand 000000	Production 0000	Technology ○●○	Human Capital	Markup 000000					
1000	m c.				CI.					
1820	The first mass-pro	oduced calculat	or invented by	Charles Xavier	homas					
1822 Charles Babbage designs his first <i>mechanical computer</i>										
1835 Morse code invented by Samuel Morse										
1837 Electric telegraph invented by Charles Wheatstone & Samuel Morse										
1873 Christopher Sholes invents the Remington typewriter										
1877	1877 Microphone invented by Emile Berliner									
1888	1888 Hertz produces <i>radio waves</i>									
1893	Wireless communication invented by Nikola Tesla									
1895 Radio signals were invented by Guglielmo Marconi										
1919	9 James Smathers develops the first electric typewriter									
1923	1923 Sound film invented by Lee DeForest									
1924	Electro Mechanical television system invented by John Logie Baird									
1927	Philo Farnsworth invents video camera tube									
1937	Alan Turing develops the concept of a theoretical computing machine									
1971	E-mail invented by Ray Tomlinson									
1973	Ethernet invented by Bob Metcalfe and David Boggs									
1973	Personal computer invented by Xerox PARC									

End O

## TECHNOLOGICAL PROGRESS

*Dynamic complementarities*: when complementarities between inputs span across time

realising the full benefits from one invention relies on other seemingly unrelated invention

- 1873 Christopher Sholes invents the Remington typewriter
- 1877 Microphone invented by Emile Berliner
- 1919 James Smathers develops the first electric typewriter
- 1923 Sound film invented by Lee DeForest
- 1924 Electro Mechanical television system invented by John Logie Baird
- 1927 Philo Farnsworth invents video camera tube
- 1937 Alan Turing develops the concept of a theoretical computing machine
- 1971 E-mail invented by Ray Tomlinson
- 1973 Personal computer invented by Xerox PARC
- 1990 World Wide Web invented by Tim Berners-Lee

#### HONING THE HUMAN CAPITAL

Chetty (2014)

Duflo (2001)

Heckman and Cunha's framework:

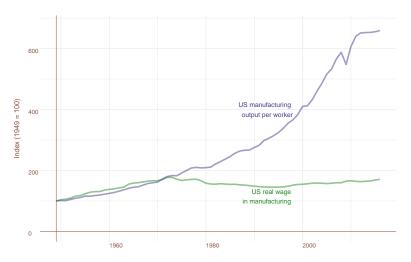
Self-productivity channel

Dynamic complementarity

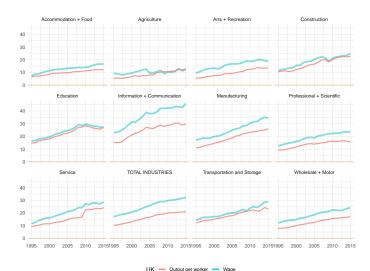
Early broad based education allows workers to be more flexible to move across jobs.

Demand 000000 Production 0000 Technology 000 Human Capital ○●○ Markup 000000000000

## OUTPUT PER WORKER AND WAGE



## OUTPUT PER WORKER AND WAGE, UK



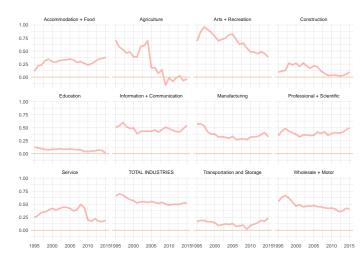
#### MARKUP OVER WAGE

A measure to capture the role *human labour* plays in the production process.

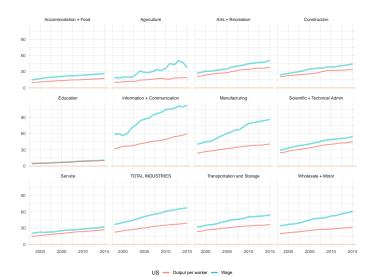
$$Markup \ over \ wage = \frac{Output \ per \ worker - wage}{wage}$$

Easier to compute if firm level data is not available.

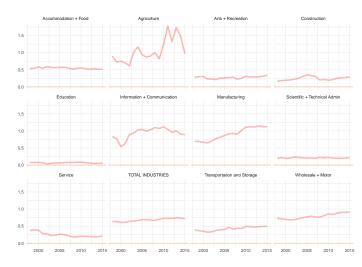
#### MARKUP OVER WAGE FOR UK



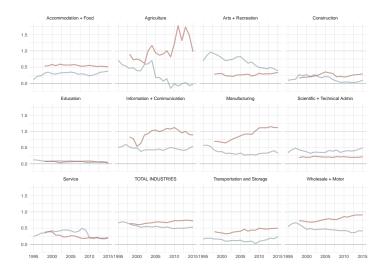
## OUTPUT PER WORKER AND WAGE, US



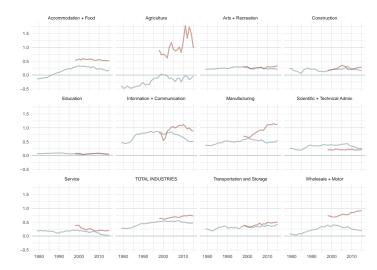
## MARKUP OVER WAGE FOR US



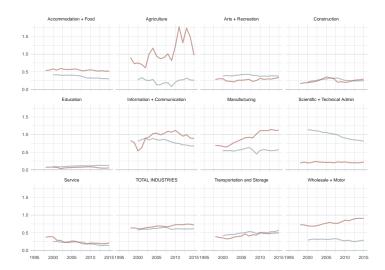
## MARKUP OVER WAGE: US VERSUS UK



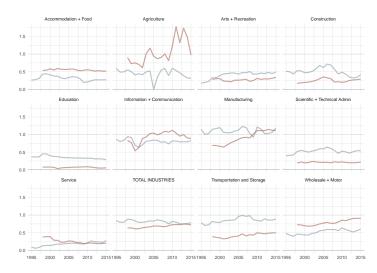
## MARKUP OVER WAGE: US VERSUS FRANCE



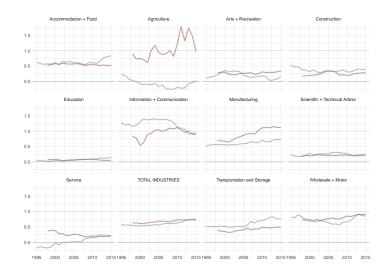
## MARKUP OVER WAGE: US VERSUS EURO AREA



## MARKUP OVER WAGE: US VERSUS SWEDEN



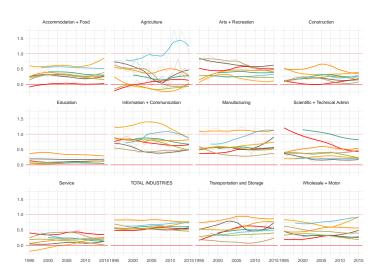
## MARKUP OVER WAGE: US VERSUS PORTUGAL



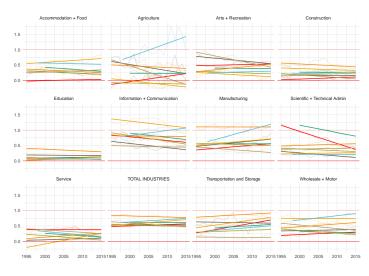
## MARKUP OVER WAGE: WORLD



## MARKUP OVER WAGE: WORLD



## MARKUP OVER WAGE: WORLD



#### END

*Technological progress* comes in waves through micro and macro innovations and build into crescendos

Technology leaders acquire *market power* in period of accelerated change

Human skills and their *self-learning capacity* are set in stone through early education

Consumers choose between human and machine intensive goods Multiple equilibria in the economy