14.48, Economics of Education
Prof. Frank Levy
Lecture 10: Why has the rate of return to education increased? What skills are now rewarded in the workplace?

Questions from last lecture:
Q: Why is unemployment higher in Europe than in the US, considering that the two regions have similarly educated populations and technology?
A: We'll look at this later, especially in the context of rigid labor market institutions.

Q: Why are sales jobs to prevalent?
A: We will discuss this later on in this lecture.

Inductive Rules:
How do financial institutions rate mortgage applicants? They use a scoring method to predict how likely it is that an applicant will default.

Independent variables in the model-
Income, years out of school, whether or not it's a first house, credit rating.

Dependent variable-
A dummy variable equal to 1 if the customer defaults within the first 4 years, 0 otherwise.

$$y_i = \alpha_0 + \beta_1(income)_i + \beta_2(YearsOutofSchool)_i + \beta_3(FirstHouse)_i + \beta_4(CreditRating)_i + \varepsilon_i$$

A mortgage officer can apply the calculated coefficients to a mortgage applicant's data to get a probability that the applicant will default.

The regression equation is an inductive rule that simulates what a mortgage application officer used to do in the past.

If we think of wages as a proxy for skill: you'd assume that the greatest substitution of computers for labor would occur for the lowest wage jobs.

However, when you incorporate an understanding of the ease of programming different jobs, the jobs that are the easiest to program follow a set of deductive rules, which are the low to middle skilled jobs. Why? Computers don't substitute for the lowest wage/skilled jobs like janitorial work and other very low skilled jobs that are often trivial for humans because these tasks are outside the bounds of computerization (for now).

What does this story imply for human interaction jobs such as sales positions?
Sales people are good at persuasion and marketing. Say a sales person tells you: "You look *great* in those lime green pants you're wearing." Is this true? Maybe, but the sales person wants you to buy the pants and has little incentive to tell you the truth.

All information is inherently ambiguous. Humans need to put information into context to understand it.

For example, cars salesmen usually don't have a set desk in the showrooms they work in. However, the salesman always puts a picture of a wife and children on his desk. Why? To make customers trust him more by portraying himself as a family man.

Words themselves must be understood in context. Example: bill. What does it mean? A piece of legislation? A man's name? A part of a duck? It all depends on the context.

What is the relationship between the computerization and off-shoring of work? Jobs that can be easily computerized can be easily offshored. Why? Because the process of off-shoring and computerizing are similar: a job is broken down into small, routine, and repeatable tasks.

Examples of off-shoring:
-Simple tax returns are sent to overseas accountants
-Call centers

Examples of computerization:
-TurboTax and other tax preparation software
-Speech recognition software such as the MIT general number speech interface

What about software work? The rules of computer programming allow overseas workers to perform these tasks.

Overall, there has been growth in high skilled jobs and very low skilled jobs but loss of jobs in low to middle skilled jobs.

What does this say about education?

Do we still need basic skills?

What about reading?
Definitely. People need reading more now than ever before. Even the lower skilled jobs require people to be able to read instruction manuals that explain the tasks that they need to perform.

Ted Schultz: A Chicago economists who worked on human capital theory. He studied 2 sets of agrarian villages in India during the Green Revolution.
Set 1: Results showed that literacy and basic math skills lead to much higher crop yields
Set 2: Results showed that literacy and basic math skills lead to no difference in crop yields

What account for these results? Perhaps access to information and technology. Perhaps soil quality.

In reality, Set 1 had access to new Green Revolution seeds whereas Set 2 did not. These needs required farmers to use a new set of farming techniques. There were only a few farm agents traveling around India to explain and show these new techniques so being literate and math able allowed certain farmers in Set 1 to use

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the new seeds effectively by reading the instructions. For Set 2, since they were working with the old seeds, traditional farming techniques were used by all. Math or readings skills didn't give any farmers an advantage because traditional skills could be learned by watching other farmers.

When workers are in an environment where technology is changing quickly, the ability to read makes the transition to a new technology much easier.

The digital divide today:
Is there still a gap between those who have access to and are familiar with computers and those who don't? Perhaps this is more of an intergenerational issue in the US. Access to computers is also much greater in the US compared to access in developing countries.

1993:
Kruger attempted to estimate the impact of using a computer at work on your pay.

Model 1:
$$\ln(w)_i = \alpha_0 + \beta_1(c)_i + \varepsilon_i$$
Where c=1 if an individual used a computer at work, 0 otherwise.

	1984	**1989**
Beta	0.276	0.325
SE	(.01)	(.009)
R^2	0.05	0.08

This was a very simple model that doesn't account for the fact that jobs that use computers are the higher skilled, higher paid jobs. This problem is known as omitted variable bias. We may be worried that β_1 is actually picking up the effect of computers and many other variables that affect wages.

Model 2:

$\ln(w)_i = \alpha_0 + \beta_1(c)_i + \varepsilon_i$ plus variables for race, years of education, age, age^2, gender, and a dummy variable for whether or not the individual works part-time. We would expect β_1 to be lower now that we have included other relevant independent variables in our regression.

	1984	**1989**
Beta	0.15	0.17
SE	significant	significant

However, model 2 doesn't control for ability or account at all for which kind of people actually work with computers on the job.

Model 3:
$$c_i^w = (UsesComputersAtWork)$$
Takes model 2 and adds 3 computer variables: $c_i^H = (UsesComputersAtHome)$
$$c_i^w * c_i^H = (InteractionTerm)$$

	1984	**1989**
C,h	0.056	0.070
C,wh	0.006	0.017

Another paper used the following approach with survey data from Germany:

	Answered Yes	**Effect on wages**
Do you use a computer at work?	35%	0.171
Do you use a cauculator at work?	44%	0.054
Do you use a pen/pencil at work?	66%	0.127
Do you use a telephone at work?	55%	0.136
Do you use a handtool at work?	30%	-0.091

Problem: The effect of pen/pencil and a telephone at work are almost as high as the effects of using a computer at work. The regressions are just picking up the effects of the nature of the work and ability on wages.

Expert Thinking:

There are many problems that require only routine thinking. On the other hand, there are problems that require creative thinking and that do not have an obvious solution.

Experiment:
Show a chess board with a certain positioning of 20 chess pieces on the board for 5 seconds.
Ask the test subjects to reproduce the positioning of the 20 pieces. Chess grandmasters typically reproduced 16 pieces correctly, while good players reproduced 7 pieces correctly and novice players only 4.

There are two possible explanations for these differences.
1) Grand masters have terrific memories and good eyes
2) Pattern recognition is easier for the better players

How would you distinguish between these two scenarios? You would have the 3 types of players memorize something else, such as 20 chess pieces placed on the board in a pattern very unlikely to occur in a game. In this case, the results collapse and the grand masters do no better than novices or good players in reproducing the game board configuration. This implies that 2) is the correct explanation for the results of the first experiment.

Is chess a rules based task? Yes, because there are lots of chess computer games.

Experiment:
Grand master chess players are pitted against good chess players in a 5 second speed chase. There is a 3rd person in the room readings digits out loud. To win the game, the grandmaster not only has to win the chess game but also keep a running total of the digits being read out loud. In most cases, the grandmasters were successful, but how? Adding up numbers would be very difficult if playing chess were

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really a rules based task for Grandmasters. Instead, they often recognize patterns of game scenarios and apply them effortlessly to games they are playing. They are not running through a conscious set of rules when playing chess, though they may be subconsciously.

What about a mechanic confronting a new problem?