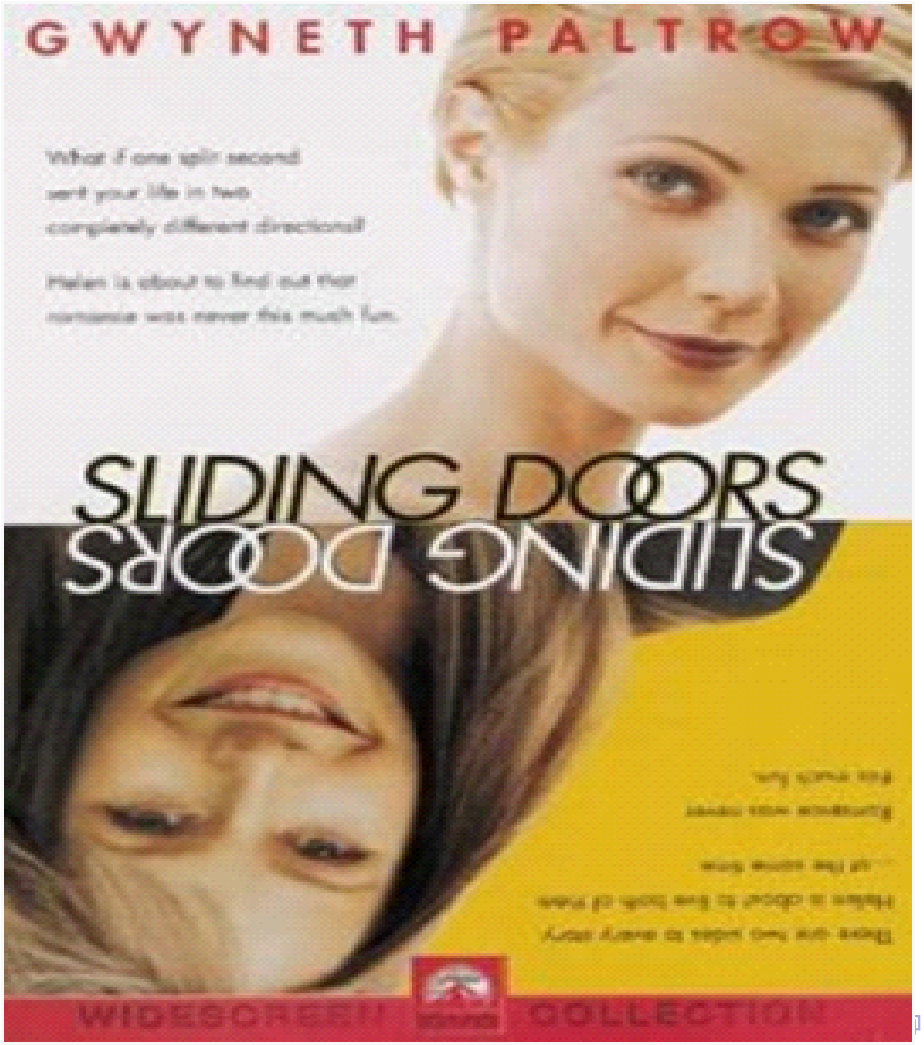
The Experimental Design - Helen's Love Life

Yona Rubinstein

July 2016

Sliding Doors

- A London woman's love life and career both hinge, unknown to her, on whether or not she catches a train. We see it both ways, in parallel.



Helen's Love Life

- In the film we follow Helen (Gwyneth Paltrow), who has just been fired from her public relations job.
- After she misses her train on the London Underground, the plot splits into two *parallel universes*, detailing the separate path her life *would have taken* had she boarded that train.
- Throughout the rest of the film we see what would have happened in each scenario.
- Helen life changes in that *split second*.
- When she catches the train, she meets a charming man called James and gets home to find her boyfriend Gerry in bed with another woman.
- When she misses it, she ends up getting mugged before landing a crummy waitress job.

The Econometrics of Helen's Love Life

- Using our terminology to describe Gwyneth Paltrow's experience:
- Y_i^0 represents "Helen" love life in the timeline in which she boards the train (which she just missed catching by a split second). In this timeline she dies in the arms of her newfound love, James.
- Y_i^1 denotes Helen love life in the timeline in which she misses the train in which she does not board the train which she just missed catching by a split second. In this timeline Helen recovers and tells Gerry to leave for good.
- The effect of just missing catching the tube by a split second on Helen's life can be represented in less than two hours. In fact it is as simple as:

$$\text{the effect of missing the train} = Y_i^1 - Y_i^0.$$

The Econometrics of Real Life: The Selection Bias

- Ideally we would like to mimic the sliding doors *setting*.
- Yet, since we never see **both** *potential outcomes* for any one person, we must infer about the impact of working at the finance industry on wages by comparing the average wage of those who work in the finance industry and all other industries.
- Consider a naive comparison of mean outcomes/wages by industry.
- Comparing means by industry provides us with an idea about potential outcomes and the impact of interest.
- In fact the difference between the mean wages of workers in the finance industry and the mean wages of all other workers can be formally linked to the average causal effect.

The Mean Gap in Wages: the Compound Effect

- Consider the naive experiment of comparing the mean log hourly wages in finance to the mean log hourly wages elsewhere:

$$\begin{aligned} E\left(Y_i | F_i = 1\right) &= Y_1; \\ E\left(Y_i | F_i = 0\right) &= Y_0. \end{aligned}$$

  where Y_i stands for the log hourly wage of worker i and F_i indicates her sector, categorical, two values: 1 finance; 0 other.
- We observe only the actual outcomes, that is Y_0 and Y_1.
- Using the above let us formulate the link between average wages *conditional* on industry choices and the average causal effect:

$$\begin{array}{ccccc} Y_1 - Y_0 & = & \left(Y_1^1 - Y_1^0\right) & + & \left(Y_1^0 - Y_0^0\right) \\ & & \shortparallel & & \shortparallel \\ & & ATET & + & \text{Selection Bias} \end{array} \tag{1}$$

- Is it possible to solve the problem above in reality?

The Ideal Experiment: Randomization as Sliding Doors

- Ideally we would like to mimic the sliding doors *setting*. This is limited to Hollowed.
- Yet, if we could *randomize* workers to these **sectors** we could mimic the sliding doors *ideal setting*.
- Specifically, *random assignment* of F_i **eliminates** the *selection bias* because *random assignment* makes F_i **independent** of *potential outcomes*.
- To see let's assume that the **parameter of interest** is the *ATE*, that is $\left(Y^1 - Y^0\right)$
- The gap in mean log hourly wages equals is:

$$Y_1 - Y_0 = \left(Y_1^1 - Y_0^0\right) \neq \left(Y_1^1 - Y_1^0\right). \tag{2}$$

- where:

$$\begin{aligned} Y_1^1 &= E\left(Y_i^1 | F_i = 1\right) \\ Y_0^0 &= E\left(Y_i^0 | F_i = 0\right) \end{aligned}$$

The Ideal Experiment (cont.)

- When F_i **independent** of *potential outcomes* then:

$$\begin{aligned} Y_1^1 &= E\left(Y_i^1|F_i=1\right) = E\left(Y_i^1|F_i=0\right) = Y_0^1 \\ Y_0^0 &= E\left(Y_i^0|F_i=0\right) = E\left(Y_i^0|F_i=1\right) = Y_1^0 \end{aligned}$$

- Therefore random assignment of F_i allows us to swap:

$$\begin{aligned} Y_1^0 \quad &\text{for} \quad Y_0^0 \\ Y_0^1 \quad &\text{for} \quad Y_1^1 \end{aligned}$$

- In this case the gap in log hourly wages equals the average treatment effect:

$$Y_1 - Y_0 = \left(Y_1^1 - Y_0^0\right). \tag{3}$$

- Yet, since $Y_0^1 = Y_1^1$ and $Y_1^0 = Y_0^0$ then $Y_1^1 = Y^1$ and $Y_0^0 = Y^0$ which means that:

$$Y_1 - Y_0 = \left(Y_1^1 - Y_1^0\right) = \left(Y^1 - Y^0\right) = ATE. \tag{4}$$

Random Assignment and the Selection Bias

Two **key** insights:

1. The *random assignment of treatment*, that is of F_i, **eliminates** the *selection bias*.
2. The *random assignment of treatment*, that is of F_i, **identfies** the average treatment effect (ATE) rather than the average treatment effect on the treated (ATET) by **eliminating** any differences in the **potential returns** to treatment between *treated* and *non-treated*.

The Finance Wage Premium

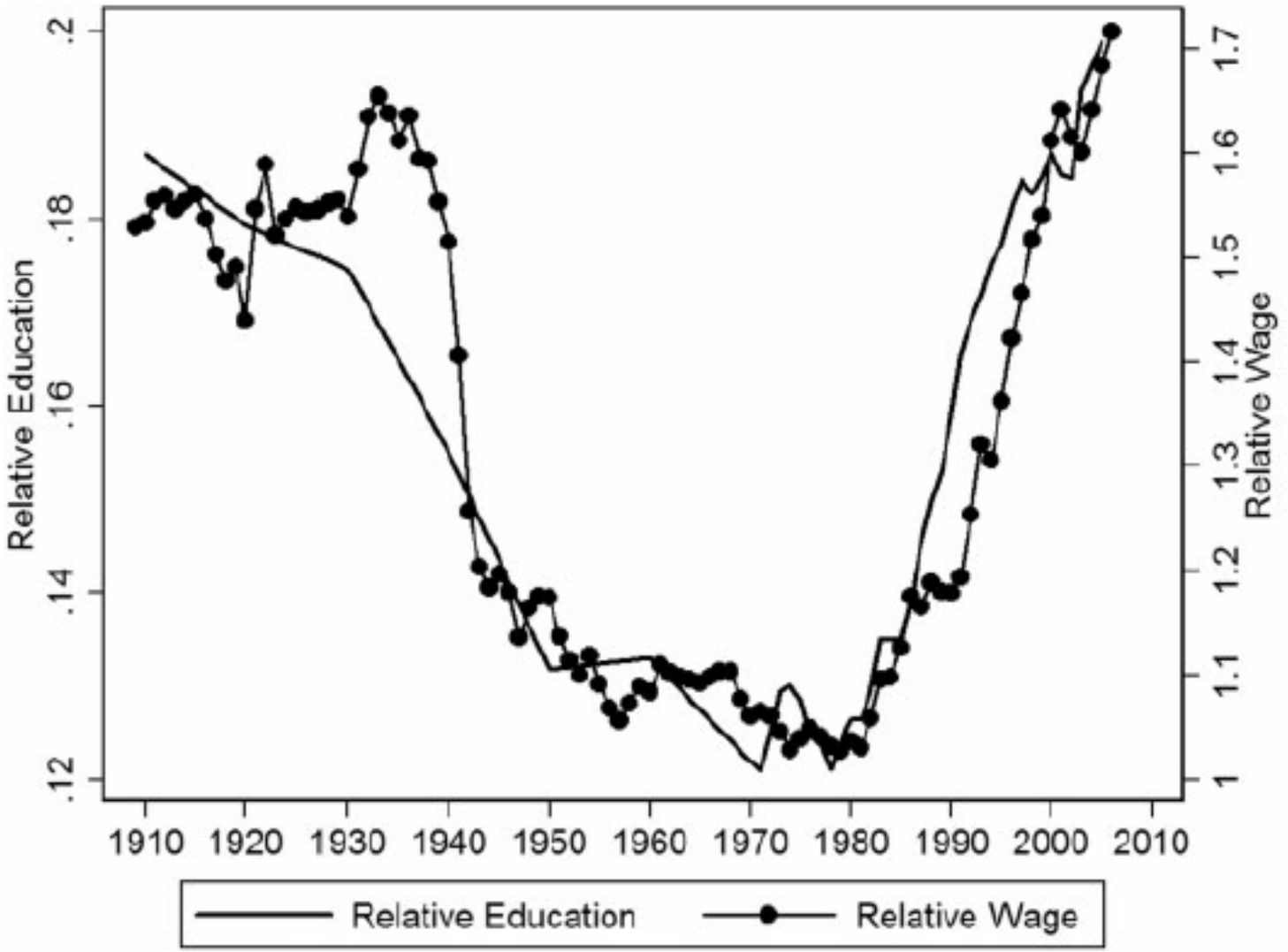
- Recently (2012), the economists Philippon and Reshef published, at the *Quarterly Journal of Economics* a paper that could have been titled, according to Nobel prize winner Paul Krugman as "The Rise and Fall of Boring Banking" (it's actually titled "Wages and Human Capital in the U.S. Financial Industry, 1909-2006").
- In this paper they show that banking in the USA has gone through three eras over the past century.

1. Before 1930
2. Between the *Great Depression* and the early 1980s: the regulated era.
3. Since deregulation of the financial sector and the *Great Recession*

The Finance Wage Premium (cont.)

- Before 1930: a rapid increase in debt: household debt as a percentage of GDP almost doubled between World War I and 1929.
- The regulated era: tightly regulated; household debt, which had fallen sharply as a percentage of GDP during the Depression and World War II, stayed far below pre-1930s levels.
- the deregulated era: after 1980 many of the regulations on banks were lifted; debt began rising rapidly, eventually reaching just about the same level relative to GDP as in 1929; the financial industry exploded in size – accounted for a third of corporate profits.
- The figure in the next slide, taken from Philippon and Reshef published QJE 2012, depicts the relative pay in finance during these periods.

Finance Relative Wage and Relative Education (Philippon and Reshef, 2012)



Does the Financial Sector Pay Above Market Wage Rates?

- Does the financial sector pay its employees wages above market rates?
- In other words, what is the *treatment effect* of the financial sector on their workers' wage rates?
- Skim Philippon and Reshef published QJE 2012.
- Describe their empirical strategy in terms of treatment and selection effects assuming constant treatment effect.
- What are their main findings?
- What is their *interpretation* of their **findings**?
- Do you agree? Explain briefly.