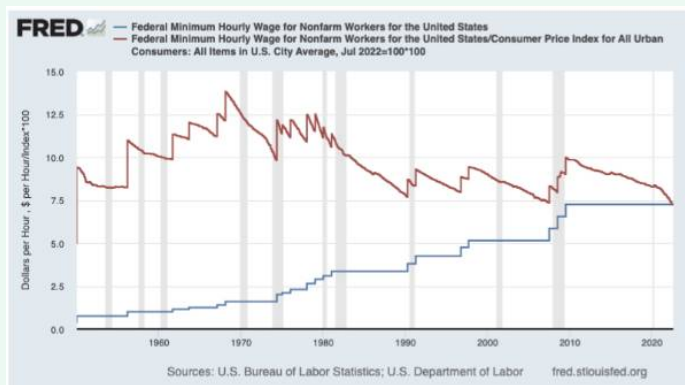


# Real vs Nominal Wage



Fill in the blanks. In the above chart, the red line is the \_\_\_\_ value and the blue line is the \_\_\_\_ value of the federal minimum wage.

- A. real; nominal
- B. nominal; real



The correct answer is:

**A. real; nominal**

In the chart:

- The **red line** represents the **real value** of the federal minimum wage, adjusted for inflation using the Consumer Price Index (CPI). This reflects the purchasing power of the minimum wage over time.
- The **blue line** represents the **nominal value** of the federal minimum wage, showing the wage in unadjusted dollars as set by legislation.



True or False? The study design of Card and Krueger (1994) was a randomized controlled trial that randomizes minimum wages between Pennsylvania and New Jersey.



**False.**

The study design of Card and Krueger (1994) was **not** a randomized controlled trial. Instead, it was a **natural experiment** that exploited a policy change in New Jersey's minimum wage to study its effect on employment.

New Jersey increased its minimum wage, while neighboring Pennsylvania did not, allowing the authors to compare employment outcomes in fast-food restaurants between the two states using a **difference-**

**in-differences (DiD)** methodology. This method relies on the assumption that, in the absence of the policy change, the employment trends in New Jersey and Pennsylvania would have been similar, serving as a quasi-experimental approach rather than a randomized controlled trial.



Which of the following best describes Difference-in-Difference estimation?

- A. Compare the differences before and after treatment between treatment and control groups.
- B. Compare the difference before and after treatment for the same group.
- C. Compare the difference between treatment and control groups after treatment.
- D. None of the above.



The correct answer is:

**A. Compare the differences before and after treatment between treatment and control groups.**

**Explanation:** Difference-in-Differences (DiD) estimation compares the **change** in an outcome (e.g., employment) **over time** (before and after treatment) **between a treatment group** (e.g., a group affected by a policy) and a **control group** (e.g., a group not affected by the policy). The key idea is to account for time trends and isolate the causal effect of the treatment by assuming that, absent the treatment, the two groups would have followed parallel trends.



Based on all of the problems above, please construct an engaging explanation that explains the fancy concepts from scratch behind them. In the explanation, please include the following:

- all necessary fancy math tools and symbols (if any),
- some tangible or quantitative examples,
- some humor.



Alright, let's break down these fancy concepts step-by-step, with a touch of math, some relatable examples, and a sprinkle of humor. We'll tackle **real vs. nominal values**, **Card and Krueger's study** methodology, and **Difference-in-Differences estimation**—because understanding economics doesn't have to feel like deciphering a cryptic treasure map!

## 1. Real vs. Nominal: Why "Real" Wages Are Like Ice Cream on a Hot Day

**Concept:**

- The **nominal value** is the dollar amount as stated—simple, no strings attached.
- The **real value** adjusts for inflation, reflecting what those dollars can *actually buy* (a.k.a. the purchasing power).

**Math Tool:** Real value =  $\frac{\text{Nominal Value}}{\text{Price Index}} \times 100$

Think of it like this: Nominal wages are the number of scoops of ice cream you have, while real wages are how much ice cream is left after it starts melting in the inflation sun.

### Example:

- In 1970, the minimum wage was \$1.60. It could buy you about 10 Big Macs.
- Today, \$7.25 might not even get you one Big Mac (ouch!).

Inflation melted your wage's purchasing power. So while the nominal wage increased, the real wage—your ice cream—shrank!

**Humor:** Inflation is like that one sneaky friend who always “borrows” a few fries from your plate. You still *have* your fries, but suddenly, they don’t go as far.

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## 2. Card and Krueger: The Fast-Food Showdown

**Concept:** Card and Krueger (1994) investigated whether raising the minimum wage causes job losses. They compared fast-food restaurants in **New Jersey** (which raised wages) and **Pennsylvania** (which didn’t). Spoiler: New Jersey didn’t lose jobs—cue shocked economists dropping their monocles.

**Method:** This wasn’t a **randomized controlled trial** (RCT), where people are randomly assigned to treatments. Instead, it was a **natural experiment**, like when life randomly hands you a double scoop of chaos, and you analyze what happens.

**Tangible Example:** Imagine you’re running two lemonade stands. One in New Jersey raises the price of lemonade (minimum wage increase), while the other in Pennsylvania doesn’t. You’d track:

1. How many cups you sell before and after the price hike.
2. Compare this with the unchanged stand in Pennsylvania.

If sales don’t drop at the pricier stand, you might say, “Hmm, maybe raising prices isn’t so bad after all.”

**Humor:** Economists had bet on jobs vanishing faster than donuts at an office meeting. Card and Krueger showed that maybe raising the minimum wage doesn’t scare employers as much as economists thought. (Turns out, workers buying more donuts helps too!)

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## 3. Difference-in-Differences (DiD): The Sherlock Holmes of Causation

**Concept:** Difference-in-Differences is a statistical tool to figure out **causal effects** when you can’t run an RCT. It’s like having two timelines: one where a policy (treatment) happened and one where it didn’t, and you’re comparing what changed.

**Fancy Math:** Let’s say:

- $Y_{NJ, \text{After}}$ : Outcome in the treated group (New Jersey) after treatment
- $Y_{NJ, \text{Before}}$ : Outcome in the treated group before treatment
- $Y_{PA, \text{After}}$ : Outcome in the control group (Pennsylvania) after treatment
- $Y_{PA, \text{Before}}$ : Outcome in the control group before treatment

The DiD estimator is:

$$\text{DiD} = (Y_{NJ, \text{After}} - Y_{NJ, \text{Before}}) - (Y_{PA, \text{After}} - Y_{PA, \text{Before}})$$

**Tangible Example:** Suppose the number of burgers sold in New Jersey fast-food restaurants goes from **200 (before)** to **220 (after)**, while Pennsylvania's sales go from **200 (before)** to **210 (after)**.

The DiD estimate would be:

$$\text{DiD} = (220 - 200) - (210 - 200) = 10$$

This means New Jersey saw a net increase of 10 burgers sold, suggesting the wage hike didn't hurt business and may have helped!

**Humor:** DiD is basically asking, "What would have happened if New Jersey stayed burger-flipping boring like Pennsylvania?" It's like your "What if?" daydreams, but with math.

## Bringing It All Together

Imagine you're at a fancy restaurant called "EconoBistro." The menu has:

- **Real vs. Nominal:** Explains why that \$20 dessert doesn't taste as sweet as it used to. Blame inflation!
- **Card and Krueger:** Shows that raising the cost of fries (minimum wage) doesn't make McDonald's shut down.
- **DiD:** Helps figure out whether the restaurant's new free breadsticks policy (treatment) really caused that spike in Yelp reviews, or if it's just because the chef finally learned how to cook.

Economics isn't just about graphs and formulas; it's about telling stories with numbers. And sometimes, those stories involve melting ice cream, burger wars, and sneaky inflation stealing your fries. Now go impress your friends at the next dinner party with your new econ knowledge—and maybe offer to pay in Big Macs, just to make a point.



To reinforce the understanding, please generate some similar problems and show the solutions.



Here are a few similar problems to reinforce understanding of **real vs. nominal values**, **natural experiments**, and **Difference-in-Differences estimation**, along with step-by-step solutions.

### Problem 1: Real vs. Nominal Wages

Suppose the nominal minimum wage in 1980 was \$3.10, and the Consumer Price Index (CPI) was 80. In 2020, the nominal minimum wage was \$7.25, and the CPI was 260.

**Question:** What was the **real value** of the minimum wage in 1980 and 2020 (using 1980 as the base year)? Which year had a higher purchasing power for the minimum wage?

**Solution:** Real wage formula:

$$\text{Real Wage} = \frac{\text{Nominal Wage}}{\text{CPI}} \times \text{Base Year CPI}$$

1. For **1980**:

$$\text{Real Wage} = \frac{3.10}{80} \times 80 = 3.10 \text{ (1980 dollars)}$$

2. For **2020**:

$$\text{Real Wage} = \frac{7.25}{260} \times 80 = 2.23 \text{ (1980 dollars)}$$

### Conclusion:

The **real value** of the minimum wage was higher in 1980 (\$3.10 vs. \$2.23). This means the purchasing power of the minimum wage has decreased over time.

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## Problem 2: Natural Experiment

Imagine there are two neighboring cities, **City A** and **City B**. City A increases its minimum wage from \$8 to \$10, while City B keeps its minimum wage at \$8. After the policy change, employment in City A drops from 500 workers to 490, and in City B, it drops from 400 workers to 395 (likely due to economic trends).

**Question:** Did the minimum wage increase in City A cause a significant decline in employment?

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**Solution:** To isolate the effect of the minimum wage increase, we use the **Difference-in-Differences (DiD)** method:

Let:

- Employment change in **City A** =  $490 - 500 = -10$
- Employment change in **City B** =  $395 - 400 = -5$

DiD estimate:

$$\text{DiD} = (\text{Change in City A}) - (\text{Change in City B}) = (-10) - (-5) = -5$$

### Interpretation:

City A experienced a net decline of 5 workers due to the minimum wage increase. While there was a general trend of employment decline, the additional 5 workers lost in City A might be attributed to the wage increase.

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## Problem 3: Difference-in-Differences and Sales

A company wants to evaluate the impact of a new advertising campaign. It runs the campaign in Region X but not in Region Y (control group). Before the campaign, sales in Region X were 1,000 units and in Region Y were 900 units. After the campaign, sales in Region X increased to 1,200 units, while in Region Y increased to 950 units (likely due to seasonal trends).

**Question:** What is the impact of the advertising campaign on sales in Region X?

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**Solution:** Use the **Difference-in-Differences (DiD)** formula:

$$\text{DiD} = (\text{Change in Region X}) - (\text{Change in Region Y})$$

1. Change in Region X =  $1,200 - 1,000 = 200$
2. Change in Region Y =  $950 - 900 = 50$

DiD estimate:

$$\text{DiD} = 200 - 50 = 150$$

### Interpretation:

The advertising campaign increased sales in Region X by **150 units**, after accounting for general seasonal trends.

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## Problem 4: Inflation and Real Prices

A gallon of milk cost \$1.50 in 1990, when the CPI was 130. In 2022, the same gallon of milk costs \$4.50, and the CPI is 300.

**Question:** What is the real price of milk in 2022, adjusted to 1990 dollars? Has milk become cheaper or more expensive in real terms?

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**Solution:** Real price formula:

$$\text{Real Price} = \frac{\text{Nominal Price}}{\text{CPI in 2022}} \times \text{CPI in 1990}$$

1. For 2022:

$$\text{Real Price} = \frac{4.50}{300} \times 130 = 1.95 \text{ (1990 dollars)}$$

### Comparison:

The real price of milk in 1990 was \$1.50, and in 2022 (adjusted to 1990 dollars), it is \$1.95. This means milk has become **more expensive** in real terms.

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## Problem 5: Policy Effect on Employment (Humorous Context)

The Kingdom of BurgerLand passed a new law: every burger stand must give employees free fries every day. They believe this will make workers happier and more productive. You decide to analyze two cities: **Fry City** (treated group) and **No-Fry City** (control group).

### Data:

- Before the law:
  - Fry City: 500 workers
  - No-Fry City: 480 workers
- After the law:
  - Fry City: 510 workers
  - No-Fry City: 490 workers

**Question:** What is the impact of the free fries law on employment in Fry City?

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**Solution:** Use the **Difference-in-Differences (DiD)** formula:

$$\text{DiD} = (\text{Change in Fry City}) - (\text{Change in No-Fry City})$$

$$1. \text{ Change in Fry City} = 510 - 500 = 10$$

$$2. \text{ Change in No-Fry City} = 490 - 480 = 10$$

DiD estimate:

$$\text{DiD} = 10 - 10 = 0$$

**Interpretation:**

The free fries law had **no measurable impact** on employment. It seems workers liked the fries, but it didn't attract or retain more employees than the general trend.

**Humor:**

Turns out free fries might make workers happy, but it won't make them show up early to flip burgers.

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By practicing these problems, you'll master the ideas of **real vs. nominal**, **natural experiments**, and **Difference-in-Differences** while having fun along the way!