Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania

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https://github.com/Fomalhaut647/Econometrics-Replication

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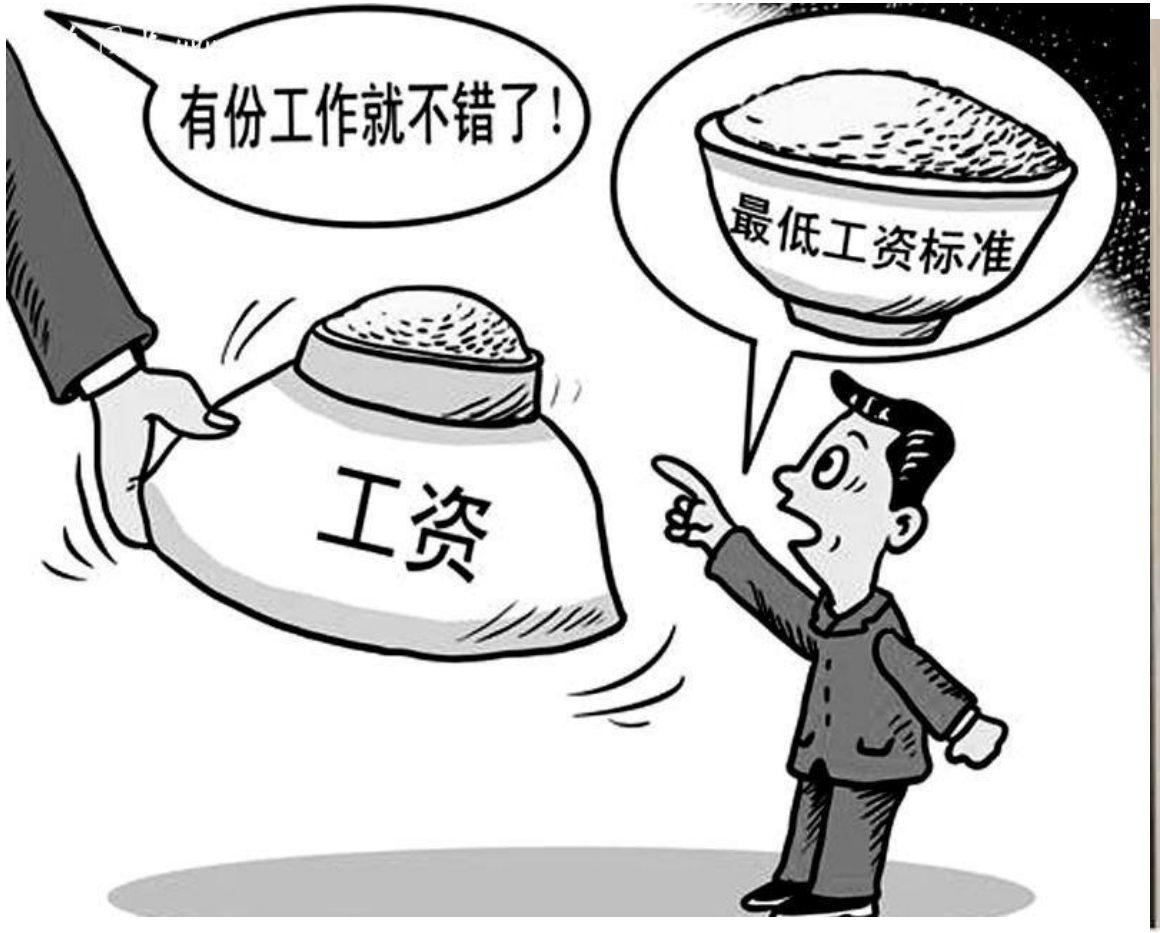
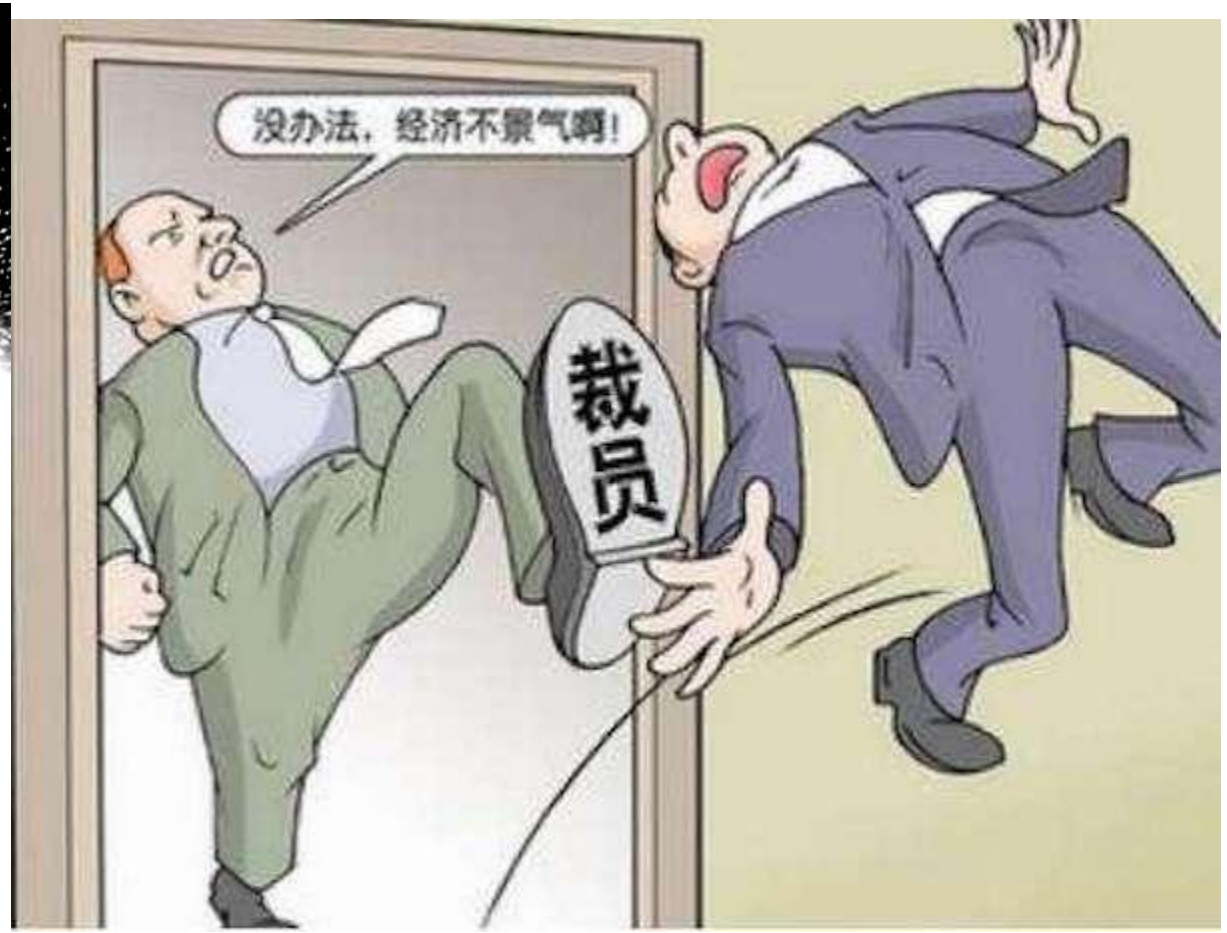
PART 01

研究背景

Background Information

Is This True ?





Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania

By DAVID CARD AND ALAN B. KRUEGER*

On April 1, 1992, New Jersey's minimum wage rose from $4.25 to $5.05 per hour. To evaluate the impact of the law we surveyed 410 fast-food restaurants in New Jersey and eastern Pennsylvania before and after the rise. Comparisons of employment growth at stores in New Jersey and Pennsylvania (where the minimum wage was constant) provide simple estimates of the effect of the higher minimum wage. We also compare employment changes at stores in New Jersey that were initially paying high wages (above $5) to the changes at lower-wage stores. We find no indication that the rise in the minimum wage reduced employment. (*JEL* J30, J23)

1991年4月1日，联邦最低工资为每小时4.25美元（全国）
1990年初，新泽西州决定从1992年4月1日起将工资提高到每小时5.05美元

研究者在1992年2月、1992年11月对新泽西州、宾夕法尼亚州内的410家快餐店进行了调查，统计了包括员工数、起薪等一系列数据。

研究特点

1992年美国处于经济下行期，最低工资提高对员工数量的影响不易被经济上行掩盖。

新泽西州的经济与周边州密切相关，因此宾夕法尼亚州可以作为标准对照组。

回访覆盖率较高，数据具有可靠性。

选择快餐店

低薪员工群体

严格遵守最低工资标准

没有小费，工资明确

信息容易获取

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PART 02

数据分析

Data Analysis

Difference-In-Differences

TABLE 3—AVERAGE EMPLOYMENT PER STORE BEFORE AND AFTER THE RISE IN NEW JERSEY MINIMUM WAGE

Variable	Stores by state			Stores in New Jersey[a]			Differences within NJ[b]	
	PA (i)	NJ (ii)	Difference, NJ − PA (iii)	Wage = $4.25 (iv)	Wage = $4.26–$4.99 (v)	Wage ≥ $5.00 (vi)	Low–high (vii)	Midrange–high (viii)
1. FTE employment before, all available observations	23.33 (1.35)	20.44 (0.51)	−2.89 (1.44)	19.56 (0.77)	20.08 (0.84)	22.25 (1.14)	−2.69 (1.37)	−2.17 (1.41)
2. FTE employment after, all available observations	21.17 (0.94)	21.03 (0.52)	−0.14 (1.07)	20.88 (1.01)	20.96 (0.76)	20.21 (1.03)	0.67 (1.44)	0.75 (1.27)
3. Change in mean FTE employment	−2.16 (1.25)	0.59 (0.54)	2.76 (1.36)	1.32 (0.95)	0.87 (0.84)	−2.04 (1.14)	3.36 (1.48)	2.91 (1.41)
4. Change in mean FTE employment, balanced sample of stores[c]	−2.28 (1.25)	0.47 (0.48)	2.75 (1.34)	1.21 (0.82)	0.71 (0.69)	−2.16 (1.01)	3.36 (1.30)	2.87 (1.22)
5. Change in mean FTE employment, setting FTE at temporarily closed stores to 0[d]	−2.28 (1.25)	0.23 (0.49)	2.51 (1.35)	0.90 (0.87)	0.49 (0.69)	−2.39 (1.02)	3.29 (1.34)	2.88 (1.23)

Notes: Standard errors are shown in parentheses. The sample consists of all stores with available data on employment. FTE (full-time-equivalent) employment counts each part-time worker as half a full-time worker. Employment at six closed stores is set to zero. Employment at four temporarily closed stores is treated as missing.

[a]Stores in New Jersey were classified by whether starting wage in wave 1 equals $4.25 per hour ($N = 101$), is between $4.26 and $4.99 per hour ($N = 140$), or is $5.00 per hour or higher ($N = 73$).

[b]Difference in employment between low-wage ($4.25 per hour) and high-wage (≥ $5.00 per hour) stores; and difference in employment between midrange ($4.26–$4.99 per hour) and high-wage stores.

[c]Subset of stores with available employment data in wave 1 and wave 2.

[d]In this row only, wave-2 employment at four temporarily closed stores is set to 0. Employment changes are based on the subset of stores with available employment data in wave 1 and wave 2.

FTE =
Full-time employees +
0.5 * Part-time employees

Difference-In-Differences

TABLE 4—REDUCED-FORM MODELS FOR CHANGE IN EMPLOYMENT

Independent variable	Model (i)	(ii)	(iii)	(iv)	(v)
1. New Jersey dummy	2.33 (1.19)	2.30 (1.20)	—	—	—
2. Initial wage gap[a]	—	—	15.65 (6.08)	14.92 (6.21)	11.91 (7.39)
3. Controls for chain and ownership[b]	no	yes	no	yes	yes
4. Controls for region[c]	no	no	no	no	yes
5. Standard error of regression	8.79	8.78	8.76	8.76	8.75
6. Probability value for controls[d]	—	0.34	—	0.44	0.40

Notes: Standard errors are given in parentheses. The sample consists of 357 stores with available data on employment and starting wages in waves 1 and 2. The dependent variable in all models is change in FTE employment. The mean and standard deviation of the dependent variable are −0.237 and 8.825, respectively. All models include an unrestricted constant (not reported).

[a]Proportional increase in starting wage necessary to raise starting wage to new minimum rate. For stores in Pennsylvania the wage gap is 0.

[b]Three dummy variables for chain type and whether or not the store is company-owned are included.

[c]Dummy variables for two regions of New Jersey and two regions of eastern Pennsylvania are included.

[d]Probability value of joint F test for exclusion of all control variables.

$$(1a) \qquad \Delta E_i = a + \mathbf{b}\mathbf{X}_i + c\mathrm{NJ}_i + \varepsilon_i$$

$$(1b) \qquad \Delta E_i = a' + \mathbf{b}'\mathbf{X}_i + c'\mathrm{GAP}_i + \varepsilon_i'$$

$$\mathrm{GAP}_i = 0 \quad \text{for stores in Pennsylvania}$$

$$= 0 \quad \text{for stores in New Jersey with } W_{1i} \geq \$5.05$$

$$= (5.05 - W_{1i}) / W_{1i} \quad \text{for other stores in New Jersey.}$$

Where did the cost go ?

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TABLE 6—EFFECTS OF MINIMUM-WAGE INCREASE ON OTHER OUTCOMES

Outcome measure	Mean change in outcome: NJ (i)	PA (ii)	NJ − PA (iii)	Regression of change in outcome variable on: NJ dummy (iv)	Wage gap[a] (v)	Wage gap[b] (vi)
Store Characteristics:						
1. Fraction full-time workers[c] (percentage)	2.64 (1.71)	−4.65 (3.80)	7.29 (4.17)	7.30 (3.96)	33.64 (20.95)	20.28 (24.34)
2. Number of hours open per weekday	−0.00 (0.06)	0.11 (0.08)	−0.11 (0.10)	−0.11 (0.12)	−0.24 (0.65)	0.04 (0.76)
3. Number of cash registers	−0.04 (0.04)	0.13 (0.10)	−0.17 (0.11)	−0.18 (0.10)	−0.31 (0.53)	0.29 (0.62)
4. Number of cash registers open at 11:00 A.M.	−0.03 (0.05)	−0.20 (0.08)	0.17 (0.10)	0.17 (0.12)	0.15 (0.62)	−0.47 (0.74)
Employee Meal Programs:						
5. Low-price meal program (percentage)	−4.67 (2.65)	−1.28 (3.86)	−3.39 (4.68)	−2.01 (5.63)	−30.31 (29.80)	−33.15 (35.04)
6. Free meal program (percentage)	8.41 (2.17)	6.41 (3.33)	2.00 (3.97)	0.49 (4.50)	29.90 (23.75)	36.91 (27.90)
7. Combination of low-price and free meals (percentage)	−4.04 (1.98)	−5.13 (3.11)	1.09 (3.69)	1.20 (4.32)	−11.87 (22.87)	−19.19 (26.81)
Wage Profile:						
8. Time to first raise (weeks)	3.77 (0.89)	1.26 (1.97)	2.51 (2.16)	2.21 (2.03)	4.02 (10.81)	−5.10 (12.74)
9. Usual amount of first raise (cents)	−0.01 (0.01)	−0.02 (0.02)	0.01 (0.02)	0.01 (0.02)	0.03 (0.11)	0.03 (0.11)
10. Slope of wage profile (percent per week)	−0.10 (0.04)	−0.11 (0.09)	0.01 (0.10)	0.01 (0.10)	−0.09 (0.56)	−0.08 (0.57)

Notes: Entries in columns (i) and (ii) represent mean changes in the outcome variable indicated by the row heading for stores with available data on the outcome in waves 1 and 2. Entries in columns (iv)–(vi) represent estimated regression coefficients of indicated variable (NJ dummy or initial wage gap) in models for the change in the outcome variable. Regression models include chain dummies and an indicator for company-owned stores.

[a]The wage gap is the proportional increase in starting wage necessary to raise the wage to the new minimum rate. For stores in Pennsylvania, the wage gap is zero.

[b]Models in column (vi) include dummies for two regions of New Jersey and two regions of eastern Pennsylvania.

[c]Fraction of part-time employees in total full-time-equivalent employment.

TABLE 7—REDUCED-FORM MODELS FOR CHANGE IN THE PRICE OF A FULL MEAL

Independent variable	Dependent variable: change in the log price of a full meal (i)	(ii)	(iii)	(iv)	(v)
1. New Jersey dummy	0.033 (0.014)	0.037 (0.014)	—	—	—
2. Initial wage gap[a]	—	—	0.077 (0.075)	0.146 (0.074)	0.063 (0.089)
3. Controls for chain and ownership[b]	no	yes	no	yes	yes
4. Controls for region[c]	no	no	no	no	yes
5. Standard error of regression	0.101	0.097	0.102	0.098	0.097

Notes: Standard errors are given in parentheses. Entries are estimated regression coefficients for models fit to the change in the log price of a full meal (entrée, medium soda, small fries). The sample contains 315 stores with valid data on prices, wages, and employment for waves 1 and 2. The mean and standard deviation of the dependent variable are 0.0173 and 0.1017, respectively.

[a]Proportional increase in starting wage necessary to raise the wage to the new minimum-wage rate. For stores in Pennsylvania the wage gap is 0.

[b]Three dummy variables for chain type and whether or not the store is company-owned are included.

[c]Dummy variables for two regions of New Jersey and two regions of eastern Pennsylvania are included.

Restrictions

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时间跨度小，不一定能体现长期效应

调查未记录营业额

统计结果的显著性

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PART 03

新增分析

Additional Analysis

Non-Linearity in GAP effect

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TABLE 9-EXTENDED MODELS FOR CHANGE IN EMPLOYMENT

Independent variable	Model (i)	Model (ii)	Model (iii)
1. Initial wage gap[a]	14.92 (6.21)	19.73 (10.26)	52.69 (24.75)
2. NJ dummy for $4.25 starting wage[b]		-1.05 (1.79)	
3. Initial wage gap squared[c]			-204.02 (129.43)
4. Controls for chain and ownership[d]	yes	yes	yes
5. R-squared	0.029	0.030	0.036
6. Standard error of regression	8.76	8.77	8.74
7. Probability value for controls[e]	0.44	0.41	0.36
8. Probability value for additional variable[f]		0.56	0.12

TURNING POINT ANALYSIS FOR MODEL (III)

Turning point of quadratic function: 0.1291 Benchmark comparison value [(5.05-4.25)/4.25]: 0.1882

Gap coefficient: 52.6869 Gap squared coefficient: -204.024766

Interpretation:

- The quadratic relationship peaks/troughs at a wage gap of 0.1291
- This turning point (0.1291) is LOWER than the benchmark (0.1882)
- Difference: 0.0591

$$(1b) \quad \Delta E_i = a' + \mathbf{b}'\mathbf{X}_i + c'\mathrm{GAP}_i + \varepsilon_i'$$

$$\Delta E_i = a' + b'^{X_i} + c'GAP_i + \varepsilon'_i$$

$$\Delta E_i = a' + b'^{X_i} + c'GAP_i + d'Low_i + \varepsilon'_i$$

$$\mathrm{Low_i} = 1 \text{ if } \mathrm{Nj_i} = 1 \text{ and } \mathrm{Wage_i^{wave1}} = 4.25$$

$$\Delta E_i = a' + b'^{X_i} + c'GAP_i + d'GAP_i^2 + \varepsilon'_i$$

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PART 04

复现结果

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Econometrics-Replication

Public

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Fomalhaut647 add PPT 93e0697 · 1 minute ago 25 Commits

data	fix dir bug in data	2 days ago
table_10	new tables	6 hours ago
table_2	repair scripts	yesterday
table_3	new tables	6 hours ago
table_4	repair scripts	yesterday
table_5	repair scripts	yesterday
table_6	repair scripts	yesterday
table_7	add utility.py and refactor	yesterday
table_8	repair scripts	yesterday
table_9	new tables	6 hours ago
.gitignore	Init	2 days ago
Gemini's guidance.pdf	Init	2 days ago
Paper.pdf	rename	2 days ago
README.md	add PPT	1 minute ago

About

Replication of Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania

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No packages published
Publish your first package

Contributors 2

Fomalhaut647 Zhiqi Liu
ChenLongPKU

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仓库结构

```
replication/
├── data/
│   ├── public.dat          # 原始调查数据
│   ├── codebook            # 变量定义和代码
│   └── check.py            # 数据验证脚本
├── utility.py              # 通用工具模块（核心重构成果）
├── test_utility.py         # utility模块测试脚本
├── table_2/                # 关键变量的均值
├── table_3/                # 最低工资上涨前后的就业分析
├── table_4/                # 就业变化的简化式模型
├── table_5/                # 规范检验
├── table_6/                # 对其他结果的影响
├── table_7/                # 价格分析
├── table_8/                # McDonald's餐厅分析
└── README.md               # 本文件
```

https://github.com/Fomalhaut647/Econometrics-Replication

codebook | public.dat

data > codebook

```
Dummies for location:
SOUTHJ          11      11      1.0   1 if in southern NJ
CENTRALJ        13      13      1.0   1 if in central NJ
NORTHJ          15      15      1.0   1 if in northern NJ
PA1             17      17      1.0   1 if in PA, northeast suburbs
PA2             19      19      1.0   1 if in PA, Easton etc
SHORE           21      21      1.0   1 if on NJ shore

First Interview
NCALLS          23      24      2.0   number of call-backs*
EMPFT           26      30      5.2   # full-time employees
EMPPT           32      36      5.2   # part-time employees
NMGRS           38      42      5.2   # managers/ass't managers
WAGE_ST         44      48      5.2   starting wage ($/hr)
INCTIME         50      54      5.1   months to usual first raise
FIRSTINC        56      60      5.2   usual amount of first raise (
BONUS           62      62      1.0   1 if cash bounty for new work
PCTAFF          64      68      5.1   % employees affected by new m
MEALS           70      70      1.0   free/reduced price code (See
OPEN            72      76      5.2   hour of opening
HRSOPEN         78      82      5.2   number hrs open per day
PSODA           84      88      5.2   price of medium soda, includi
PFRY            90      94      5.2   price of small fries, includi
PENTREE         96     100      5.2   price of entree, including ta
NREGS          102     103      2.0   number of cash registers in s
NREGS11        105     106      2.0   number of registers open at 1

Second Interview
TYPE2          108     108      1.0   type 2nd interview 1=phone; 2
STATUS2        110     110      1.0   status of second interview: s
DATE2          112     117      6.0   date of second interview MMDD
NCALLS2        119     120      2.0   number of call-backs*
EMPFT2         122     126      5.2   # full-time employees
```

codebook | public.dat

data > public.dat

```
 46 1 0 0 0 0 0 1 0 0  0 30.00 15.00  3.00   .    19.0   .   1    .  2  6.50
 49 2 0 0 0 0 0 1 0 0  0  6.50  6.50  4.00   .    26.0   .   0    .  2 10.00
506 2 1 0 0 0 0 1 0 0  0  3.00  7.00  2.00   .    13.0  0.37 0  30.0 2 11.00
 56 4 1 0 0 0 0 1 0 0  0 20.00 20.00  4.00  5.00  26.0  0.10 1   0.0 2 10.00
 61 4 1 0 0 0 0 1 0 0  0  6.00 26.00  5.00  5.50  52.0  0.15 1   0.0 3 10.00
 62 4 1 0 0 0 0 1 0 0  2  0.00 31.00  5.00  5.00  26.0  0.07 0  45.0 2 10.00
445 1 0 0 0 0 0 0 1 0  0 50.00 35.00  3.00  5.00  26.0  0.10 0   0.0 2  6.00
451 1 0 0 0 0 0 0 1 0  0 10.00 17.00  5.00  5.00  52.0  0.25 0   0.0 2  0.00
455 2 1 0 0 0 0 0 1 0  0  2.00  8.00  5.00  5.25  13.0  0.25 0   0.0 1 11.00
458 2 1 0 0 0 0 1 0 0  2  2.00 10.00  2.00  5.00  19.0  0.15 0   0.0 1 11.00
462 3 1 0 0 0 0 0 1 0  0  2.50 20.00  3.00  5.00  13.0  0.37 1   5.0 2  9.00
468 1 0 0 0 0 0 0 1 0  0 40.00 30.00  3.00  5.00  13.0  0.17 0   0.0 2  6.00
469 1 0 0 0 0 0 0 1 0  0  8.00 27.00  5.00  5.00  39.0  0.25 0  80.0 2  6.00
470 1 0 0 0 0 0 0 1 0  0 10.50 30.00  3.00  5.50   .    0.30 0   0.0 2  6.00
474 1 0 0 0 0 0 0 1 0  2  6.00  9.00  3.00  5.00  26.0  0.37 0   0.0 2  9.00
481 2 1 0 0 0 0 0 1 0  2  5.00 17.50  3.00  5.25  26.0  0.25 1   0.0 3 11.00
483 2 1 0 0 0 0 0 1 0  0  1.00 15.00  1.00  5.00  13.0  0.07 1   0.0 2 11.00
487 3 1 0 0 0 0 0 1 0  0 10.00  6.00  2.00  5.00  13.0  0.17 1   0.0 2 10.00
488 3 0 0 0 0 0 0 1 0  1 20.00 13.00  3.00  5.00  13.0  0.25 1   0.0 2  6.00
489 3 0 0 0 0 0 0 1 0  2  5.00 23.00  2.00  5.00  13.0  0.37 1   6.0 2  7.00
490 3 1 0 0 0 0 0 1 0  0 10.00 12.50  4.00  5.00  13.0  0.12 0   0.0 2  6.00
493 3 1 0 0 0 0 1 0 0  0 27.00 12.00  3.00  5.00  26.0  0.25 0   0.0 2  6.00
495 3 0 0 0 0 0 0 1 0  2  4.00 28.00  3.00  5.00  26.0  0.25 0   2.0 2  7.00
496 3 1 0 0 0 0 0 1 0  0 10.00 15.00  3.00  5.00  13.0  0.17 1   0.0 2  6.00
499 4 1 0 0 0 0 0 1 0  0  0.00 28.00  5.00  5.00  26.0  0.07 1  11.0 2 10.00
509 3 1 0 0 0 0 0 1 0  2  3.00 16.00  3.00  5.00  13.0  0.25 0  30.0 2  6.00
515 3 1 0 0 0 0 0 1 0  0  7.00 16.00  4.00  5.00  13.0  0.20 0  33.0 2  6.00
 37 1 0 0 0 0 0 1 0 0  2 21.00  9.00  7.00  4.25   4.0  0.25 0  33.0 2  6.50
 39 1 0 0 0 0 0 1 0 0  0  1.00 32.00  2.00  4.25   8.0   .   0 100.0 2  6.50
 40 1 0 0 0 0 0 1 0 0  0 10.00 20.00  7.00  4.25   4.0  0.15 0 100.0 2  6.50
 41 1 0 0 0 0 0 1 0 0  0  0.00 27.00  6.00  4.25  18.0  0.20 0 100.0 2  6.50
 42 1 0 0 0 0 0 1 0 0  2 17.00  4.00  5.00  4.50   .    .   0 100.0 2  6.50
 45 1 0 0 0 0 0 1 0 0  0  0.00 24.00  6.00  4.25   2.0  0.25 0  25.0 2  7.00
```

utility.py

```python
# 输出和格式化函数
# ============================================================================

def format_coefficient(coef, se, decimal_places=2):...

def format_number(num, decimal_places=2):...

def save_output_to_file(content, output_path):...

def get_output_path(script_file, filename='output.md'):...

# ============================================================================
# 数据子集选择函数
# ============================================================================

def filter_by_state(df, state='nj'):...

def filter_by_chain(df, chain):...

def create_wage_groups(df):...

# ============================================================================
# 便捷的完整数据处理函数
# ============================================================================

def load_and_prepare_data(method='whitespace', include_temp_closed=False):...

# ============================================================================
# 数据验证函数
# ============================================================================

def validate_data(df, verbose=True):...
```

replicate.py

table_2 > replicate.py > ...

```python
def print_table_2(df, output_file=None):

    if output_file:
        output_content = output_buffer.getvalue()
        sys.stdout = old_stdout
        util.save_output_to_file(output_content, output_file)
        return output_content

    return None

def main():
    """
    主函数
    """
    print("Replication of Card and Krueger (1994) Table 2")
    print("=" * 60)

    # 使用utility模块读取和处理数据
    df = util.read_data()
    print(f"Data loaded successfully: {len(df)} observations")

    # 使用utility模块创建衍生变量
    df = util.create_basic_derived_variables(df)

    # 生成并保存表格到文件
    output_path = util.get_output_path(__file__)

    # 打印 Table 2 并保存到文件
    print_table_2(df, output_path)

if __name__ == "__main__":
    main()
```

复现流程

1. 通读论文，了解论文的目的、结论和用到的工具
2. 查看论文中提到的数据的具体定义和计算方式
3. 查看数据集的格式和码本
4. 以此来编写程序提取分析数据集
5. 如果复现的数据和原始数据不同，分析可能的原因并尝试做出修正

- 使用 pandas 来读取数据
- 使用 scipy 库来做矩阵运算，做 t 检验等
- 使用 statsmodels 提供公式化接口，与 pandas 集成等

难点

缺失值的处理

- 在分析数据的时候，使用了多种缺失值处理方法
- 比如在平衡子样本中，把第二次采访中不营业的店铺视为缺失值，然后不参与计算。之后又把关门的店铺的员工数视为 0，暂停营业的店铺视为缺失值。在最后又把暂停营业的店铺的员工数视为 0

标准差的计算

- 部分表格数据的标准差不知道是怎么计算出来的
- 比如 Table 3 中第三行的标准差，我们使用第一行和第二行的方差之和当作第三行的方差。当然，第三行的标准差并不重要，重要的只是元素值

计算精度的差异

- 不少我们复现得出的数据的最后一位数字与原始表格差 1，这大概率是计算精度导致的
- 少部分数据的最后一位数字的差距大于 1，但是又没有很大的差异，我们检查了计算逻辑，并没有发现问题，不清楚为什么会导致数据不匹配

TABLE 2—MEANS OF KEY VARIABLES

Variable	Stores in: NJ	PA	t^a
1. *Distribution of Store Types (percentages):*			
a. Burger King	41.1	44.3	−0.5
b. KFC	20.5	15.2	1.2
c. Roy Rogers	24.8	21.5	0.6
d. Wendy's	13.6	19.0	−1.1
e. Company-owned	34.1	35.4	−0.2
2. *Means in Wave 1:*			
a. FTE employment	20.4 (0.51)	23.3 (1.35)	−2.0
b. Percentage full-time employees	32.8 (1.3)	35.0 (2.7)	−0.7
c. Starting wage	4.61 (0.02)	4.63 (0.04)	−0.4
d. Wage = $4.25 (percentage)	30.5 (2.5)	32.9 (5.3)	−0.4
e. Price of full meal	3.35 (0.04)	3.04 (0.07)	4.0
f. Hours open (weekday)	14.4 (0.2)	14.5 (0.3)	−0.3
g. Recruiting bonus	23.6 (2.3)	29.1 (5.1)	−1.0
3. *Means in Wave 2:*			
a. FTE employment	21.0 (0.52)	21.2 (0.94)	−0.2
b. Percentage full-time employees	35.9 (1.4)	30.4 (2.8)	1.8
c. Starting wage	5.08 (0.01)	4.62 (0.04)	10.8
d. Wage = $4.25 (percentage)	0.0	25.3 (4.9)	—
e. Wage = $5.05 (percentage)	85.2 (2.0)	1.3 (1.3)	36.1
f. Price of full meal	3.41 (0.04)	3.03 (0.07)	5.0
g. Hours open (weekday)	14.4 (0.2)	14.7 (0.3)	−0.8
h. Recruiting bonus	20.3 (2.3)	23.4 (4.9)	−0.6

Notes: See text for definitions. Standard errors are given in parentheses.
[a]Test of equality of means in New Jersey and Pennsylvania.

TABLE 2-MEANS OF KEY VARIABLES

Variable	NJ	PA	t^{a}
1. Distribution of Store Types (percentages):			
a. Burger King	41.1	44.3	-0.5
b. KFC	20.5	15.2	1.1
c. Roy Rogers	24.8	21.5	0.6
d. Wendy's	13.6	19.0	-1.2
e. Company-owned	34.1	35.4	-0.2
2. Means in Wave 1:			
a. FTE employment	20.4 (0.51)	23.3 (1.35)	-2.4
b. Percentage full-time employees	32.8 (1.3)	35.0 (2.7)	-0.7
c. Starting wage	4.61 (0.02)	4.63 (0.04)	-0.4
d. $Wage=$4.25$ (percentage)	32.6 (1.9)	32.2 (4.1)	0.1
e. Price of full meal	3.35 (0.04)	3.04 (0.07)	3.8
f. Hours open (weekday)	14.4 (0.2)	14.5 (0.3)	-0.3
g. Recruiting bonus	23.6 (2.3)	29.1 (5.1)	-1.0
3. Means in Wave 2:			
a. FTE employment	21.0 (0.52)	21.2 (0.94)	-0.1
b. Percentage full-time employees	35.9 (1.4)	30.4 (2.8)	1.8
c. Starting wage	5.08 (0.01)	4.62 (0.04)	19.7
d. $Wage=$4.25$ (percentage)	0.0	39.0 (4.9)	
e. $Wage=$5.05$ (percentage)	85.7 (1.9)	1.3 (1.3)	21.2
f. Price of full meal	3.41 (0.04)	3.03 (0.07)	4.7
g. Hours open (weekday)	14.4 (0.2)	14.7 (0.3)	-0.7
h. Recruiting bonus	19.3 (2.2)	22.8 (4.7)	-0.7

TABLE 3—AVERAGE EMPLOYMENT PER STORE BEFORE AND AFTER THE RISE IN NEW JERSEY MINIMUM WAGE

Variable	Stores by state			Stores in New Jersey[a]			Differences within NJ[b]	
	PA (i)	NJ (ii)	Difference, NJ − PA (iii)	Wage = $4.25 (iv)	Wage = $4.26–$4.99 (v)	Wage ≥ $5.00 (vi)	Low–high (vii)	Midrange–high (viii)
1. FTE employment before, all available observations	23.33 (1.35)	20.44 (0.51)	−2.89 (1.44)	19.56 (0.77)	20.08 (0.84)	22.25 (1.14)	−2.69 (1.37)	−2.17 (1.41)
2. FTE employment after, all available observations	21.17 (0.94)	21.03 (0.52)	−0.14 (1.07)	20.88 (1.01)	20.96 (0.76)	20.21 (1.03)	0.67 (1.44)	0.75 (1.27)
3. Change in mean FTE employment	−2.16 (1.25)	0.59 (0.54)	2.76 (1.36)	1.32 (0.95)	0.87 (0.84)	−2.04 (1.14)	3.36 (1.48)	2.91 (1.41)
4. Change in mean FTE employment, balanced sample of stores[c]	−2.28 (1.25)	0.47 (0.48)	2.75 (1.34)	1.21 (0.82)	0.71 (0.69)	−2.16 (1.01)	3.36 (1.30)	2.87 (1.22)
5. Change in mean FTE employment, setting FTE at temporarily closed stores to 0[d]	−2.28 (1.25)	0.23 (0.49)	2.51 (1.35)	0.90 (0.87)	0.49 (0.69)	−2.39 (1.02)	3.29 (1.34)	2.88 (1.23)

Notes: Standard errors are shown in parentheses. The sample consists of all stores with available data on employment. FTE (full-time-equivalent) employment counts each part-time worker as half a full-time worker. Employment at six closed stores is set to zero. Employment at four temporarily closed stores is treated as missing.

[a] Stores in New Jersey were classified by whether starting wage in wave 1 equals $4.25 per hour ($N = 101$), is between $4.26 and $4.99 per hour ($N = 140$), or is $5.00 per hour or higher ($N = 73$).

[b] Difference in employment between low-wage ($4.25 per hour) and high-wage (≥ $5.00 per hour) stores; and difference in employment between midrange ($4.26–$4.99 per hour) and high-wage stores.

[c] Subset of stores with available employment data in wave 1 and wave 2.

[d] In this row only, wave-2 employment at four temporarily closed stores is set to 0. Employment changes are based on the subset of stores with available employment data in wave 1 and wave 2.

TABLE 3-AVERAGE EMPLOYMENT PER STORE BEFORE AND AFTER THE RISE IN NEW JERSEY MINIMUM WAGE

Variable	PA (i)	NJ (ii)	Difference, NJ-PA (iii)	NJ Wage = $4.25 (iv)	NJ Wage = $4.26-$4.99 (v)	NJ Wage >= $5.00 (vi)	Diff Low-high (vii)[b]	Diff Midrange-high (viii)[b]
1. FTE employment before, all available observations[a]	23.33 (1.35)	20.44 (0.51)	-2.89 (1.91)	19.56 (0.77)	20.08 (0.84)	22.25 (1.14)	-2.69 (1.61)	-2.17 (1.61)
2. FTE employment after, all available observations[a]	21.17 (0.94)	21.03 (0.52)	-0.14 (1.33)	20.88 (1.01)	20.96 (0.76)	20.21 (1.03)	0.66 (1.45)	0.74 (1.45)
3. Change in mean FTE employment	-2.17 (1.91)	0.59 (0.72)	2.75 (2.70)	1.32 (1.10)	0.87 (1.19)	-2.04 (1.61)	3.36 (2.27)	2.91 (2.27)
4. Change in mean FTE employment, balanced sample of stores[c]	-2.28 (1.25)	0.47 (0.48)	2.75 (1.77)	1.20 (0.82)	0.71 (0.69)	-2.16 (1.01)	3.36 (1.42)	2.87 (1.42)
5. Change in mean FTE employment, setting FTE at temporarily closed stores to 0[d]	-2.28 (1.25)	0.33 (0.49)	2.61 (1.77)	0.90 (0.87)	0.60 (0.69)	-2.16 (1.01)	3.05 (1.42)	2.76 (1.42)

TABLE 4—REDUCED-FORM MODELS FOR CHANGE IN EMPLOYMENT

Independent variable	Model (i)	(ii)	(iii)	(iv)	(v)
1. New Jersey dummy	2.33 (1.19)	2.30 (1.20)	—	—	—
2. Initial wage gap[a]	—	—	15.65 (6.08)	14.92 (6.21)	11.91 (7.39)
3. Controls for chain and ownership[b]	no	yes	no	yes	yes
4. Controls for region[c]	no	no	no	no	yes
5. Standard error of regression	8.79	8.78	8.76	8.76	8.75
6. Probability value for controls[d]	—	0.34	—	0.44	0.40

TABLE 4-REDUCED-FORM MODELS FOR CHANGE IN EMPLOYMENT

Independent variable	(i)	(ii)	(iii)	(iv)	(v)
1. New Jersey dummy	2.33 (1.19)	2.30 (1.20)			
2. Initial wage gap[a]			15.65 (6.08)	14.92 (6.21)	11.98 (7.42)
3. Controls for chain and ownership[b]	no	yes	no	yes	yes
4. Controls for region[c]	no	no	no	no	yes
5. Standard error of regression	8.79	8.78	8.76	8.76	8.75
6. Probability value for controls[d]		0.34		0.44	0.40

(1a) $$\Delta E_i = a + \mathbf{b}\mathbf{X}_i + c\mathrm{NJ}_i + \varepsilon_i$$

or

(1b) $$\Delta E_i = a' + \mathbf{b}'\mathbf{X}_i + c'\mathrm{GAP}_i + \varepsilon_i'$$

where ΔE_i is the change in employment from wave 1 to wave 2 at store i, $\mathbf{X}_i$ is a set of characteristics of store i, and NJ_i is a dummy variable that equals 1 for stores in New Jersey. GAP_i is an alternative measure of the impact of the minimum wage at store i based on the initial wage at that store (W_{1i}):

$\mathrm{GAP}_i = 0$ for stores in Pennsylvania

$= 0$ for stores in New Jersey with $W_{1i} \geq \$5.05$

$= (5.05 - W_{1i}) / W_{1i}$ for other stores in New Jersey.

TABLE 4—REDUCED-FORM MODELS FOR CHANGE IN EMPLOYMENT

Independent variable	Model (i)	(ii)	(iii)	(iv)	(v)
1. New Jersey dummy	2.33 (1.19)	2.30 (1.20)	—	—	—
2. Initial wage gap[a]	—	—	15.65 (6.08)	14.92 (6.21)	11.91 (7.39)
3. Controls for chain and ownership[b]	no	yes	no	yes	yes
4. Controls for region[c]	no	no	no	no	yes
5. Standard error of regression	8.79	8.78	8.76	8.76	8.75
6. Probability value for controls[d]	—	0.34	—	0.44	0.40

Notes: Standard errors are given in parentheses. The sample consists of 357 stores with available data on employment and starting wages in waves 1 and 2. The dependent variable in all models is change in FTE employment. The mean and standard deviation of the dependent variable are −0.237 and 8.825, respectively. All models include an unrestricted constant (not reported).

[a]Proportional increase in starting wage necessary to raise starting wage to new minimum rate. For stores in Pennsylvania the wage gap is 0.

[b]Three dummy variables for chain type and whether or not the store is company-owned are included.

[c]Dummy variables for two regions of New Jersey and two regions of eastern Pennsylvania are included.

[d]Probability value of joint F test for exclusion of all control variables.

TABLE 5—SPECIFICATION TESTS OF REDUCED-FORM EMPLOYMENT MODELS

Specification	Change in employment		Proportional change in employment	
	NJ dummy (i)	Gap measure (ii)	NJ dummy (iii)	Gap measure (iv)
1. Base specification	2.30 (1.19)	14.92 (6.21)	0.05 (0.05)	0.34 (0.26)
2. Treat four temporarily closed stores as permanently closed[a]	2.20 (1.21)	14.42 (6.31)	0.04 (0.05)	0.34 (0.27)
3. Exclude managers in employment count[b]	2.34 (1.17)	14.69 (6.05)	0.05 (0.07)	0.28 (0.34)
4. Weight part-time as 0.4×full-time[c]	2.34 (1.20)	15.23 (6.23)	0.06 (0.06)	0.30 (0.33)
5. Weight part-time as 0.6×full-time[d]	2.27 (1.21)	14.60 (6.26)	0.04 (0.06)	0.17 (0.29)
6. Exclude stores in NJ shore area[e]	2.58 (1.19)	16.88 (6.36)	0.06 (0.05)	0.42 (0.27)
7. Add controls for wave-2 interview date[f]	2.27 (1.20)	15.79 (6.24)	0.05 (0.05)	0.40 (0.26)
8. Exclude stores called more than twice in wave 1[g]	2.41 (1.28)	14.08 (7.11)	0.05 (0.05)	0.31 (0.29)
9. Weight by initial employment[h]	—	—	0.13 (0.05)	0.81 (0.26)
10. Stores in towns around Newark[i]	—	33.75 (16.75)	—	0.90 (0.74)
11. Stores in towns around Camden[j]	—	10.91 (14.09)	—	0.21 (0.70)
12. Pennsylvania stores only[k]	—	−0.30 (22.00)	—	−0.33 (0.74)

TABLE 5-SPECIFICATION TESTS OF REDUCED-FORM EMPLOYMENT MODELS

Specification	Change in employment		Proportional change in employment	
	NJ dummy (i)	Gap measure (ii)	NJ dummy (iii)	Gap measure (iv)
1. Base specification	2.30 (1.20)	14.92 (6.21)	0.05 (0.05)	0.34 (0.26)
2. Treat four temporarily closed stores as permanently closed[a]	2.15 (1.21)	13.90 (6.29)	0.04 (0.05)	0.31 (0.27)
3. Exclude managers in employment count[b]	2.34 (1.17)	14.69 (6.05)	0.05 (0.06)	0.40 (0.30)
4. Weight part-time as 0.4 x full-time[c]	2.34 (1.20)	15.23 (6.23)	0.05 (0.05)	0.34 (0.26)
5. Weight part-time as 0.6 x full-time[d]	2.27 (1.21)	14.60 (6.26)	0.05 (0.05)	0.34 (0.26)
6. Exclude stores in NJ shore area	2.59 (1.20)	16.88 (6.37)	0.06 (0.05)	0.42 (0.27)
7. Add controls for wave-2 interview date	2.29 (1.20)	15.22 (6.22)	0.05 (0.05)	0.35 (0.26)
8. Exclude stores called more than twice in wave 1[g]	2.42 (1.29)	14.08 (7.11)	0.05 (0.05)	0.31 (0.29)
9. Weight by initial employment[h]			0.13 (0.05)	0.81 (0.26)
10. Stores in towns around Newark[i]		12.26 (8.68)		0.35 (0.38)
11. Stores in towns around Camden[j]		8.92 (10.58)		0.10 (0.57)
12. Pennsylvania stores only[k]		-0.30 (22.00)		-0.33 (0.74)

TABLE 6—EFFECTS OF MINIMUM-WAGE INCREASE ON OTHER OUTCOMES

Outcome measure	Mean change in outcome			Regression of change in outcome variable on:		
	NJ (i)	PA (ii)	NJ − PA (iii)	NJ dummy (iv)	Wage gap[a] (v)	Wage gap[b] (vi)
Store Characteristics:						
1. Fraction full-time workers[c] (percentage)	2.64 (1.71)	−4.65 (3.80)	7.29 (4.17)	7.30 (3.96)	33.64 (20.95)	20.28 (24.34)
2. Number of hours open per weekday	−0.00 (0.06)	0.11 (0.08)	−0.11 (0.10)	−0.11 (0.12)	−0.24 (0.65)	0.04 (0.76)
3. Number of cash registers	−0.04 (0.04)	0.13 (0.10)	−0.17 (0.11)	−0.18 (0.10)	−0.31 (0.53)	0.29 (0.62)
4. Number of cash registers open at 11:00 A.M.	−0.03 (0.05)	−0.20 (0.08)	0.17 (0.10)	0.17 (0.12)	0.15 (0.62)	−0.47 (0.74)
Employee Meal Programs:						
5. Low-price meal program (percentage)	−4.67 (2.65)	−1.28 (3.86)	−3.39 (4.68)	−2.01 (5.63)	−30.31 (29.80)	−33.15 (35.04)
6. Free meal program (percentage)	8.41 (2.17)	6.41 (3.33)	2.00 (3.97)	0.49 (4.50)	29.90 (23.75)	36.91 (27.90)
7. Combination of low-price and free meals (percentage)	−4.04 (1.98)	−5.13 (3.11)	1.09 (3.69)	1.20 (4.32)	−11.87 (22.87)	−19.19 (26.81)
Wage Profile:						
8. Time to first raise (weeks)	3.77 (0.89)	1.26 (1.97)	2.51 (2.16)	2.21 (2.03)	4.02 (10.81)	−5.10 (12.74)
9. Usual amount of first raise (cents)	−0.01 (0.01)	−0.02 (0.02)	0.01 (0.02)	0.01 (0.02)	0.03 (0.11)	0.03 (0.11)
10. Slope of wage profile (percent per week)	−0.10 (0.04)	−0.11 (0.09)	0.01 (0.10)	0.01 (0.10)	−0.09 (0.56)	−0.08 (0.57)

Notes: Entries in columns (i) and (ii) represent mean changes in the outcome variable indicated by the row heading for stores with available data on the outcome in waves 1 and 2. Entries in columns (iv)–(vi) represent estimated regression coefficients of indicated variable (NJ dummy or initial wage gap) in models for the change in the outcome variable. Regression models include chain dummies and an indicator for company-owned stores.

[a]The wage gap is the proportional increase in starting wage necessary to raise the wage to the new minimum rate. For stores in Pennsylvania, the wage gap is zero.

[b]Models in column (vi) include dummies for two regions of New Jersey and two regions of eastern Pennsylvania.

[c]Fraction of part-time employees in total full-time-equivalent employment.

Outcome measure	Mean change in outcome			Regression of change in outcome variable on:		
	NJ (i)	PA (ii)	NJ-PA (iii)	NJ dummy (iv)	Wage gap[a] (v)	Wage gap[b] (vi)
Store Characteristics:						
1. Fraction full-time workers (percentage)[c]	2.65 (1.71)	-4.65 (3.80)	7.30 (4.17)	7.30 (3.95)	33.64 (20.95)	20.28 (24.35)
2. Number of hours open per weekday	-0.00 (0.06)	0.11 (0.08)	-0.11 (0.10)	-0.11 (0.12)	0.04 (0.76)	-0.24 (0.65)
3. Number of cash registers	-0.04 (0.04)	0.13 (0.10)	-0.17 (0.11)	-0.18 (0.10)	0.29 (0.62)	-0.31 (0.53)
4. Number of cash registers open at 11:00 A.M.	-0.04 (0.05)	-0.22 (0.09)	0.18 (0.10)	0.18 (0.12)	0.20 (0.63)	-0.44 (0.74)
Employee Meal Programs:						
5. Low-price meal program (percentage)	-4.67 (2.65)	-1.28 (3.86)	-3.39 (4.68)	-2.01 (5.63)	-30.31 (29.80)	-33.15 (35.04)
6. Free meal program (percentage)	8.41 (2.17)	6.41 (3.33)	2.00 (3.97)	0.49 (4.50)	29.90 (23.75)	36.91 (27.90)
7. Combination of low-price and free meals (percentage)	-4.04 (1.98)	-5.13 (3.11)	1.09 (3.69)	1.20 (4.32)	-11.87 (22.87)	-19.19 (26.81)
Wage Profile:						
8. Time to first raise (weeks)	3.77 (0.89)	1.26 (1.97)	2.51 (2.16)	2.21 (2.03)	-5.10 (12.74)	4.02 (10.81)
9. Usual amount of first raise (cents)	-0.01 (0.01)	-0.02 (0.02)	0.01 (0.02)	0.01 (0.02)	0.03 (0.11)	0.03 (0.11)
10. Slope of wage profile (percent per week)	-0.10 (0.04)	-0.11 (0.09)	0.01 (0.10)	0.01 (0.10)	-0.09 (0.56)	-0.08 (0.57)

TABLE 7—REDUCED-FORM MODELS FOR CHANGE IN THE PRICE OF A FULL MEAL

Independent variable	Dependent variable: change in the log price of a full meal (i)	(ii)	(iii)	(iv)	(v)
1. New Jersey dummy	0.033 (0.014)	0.037 (0.014)	—	—	—
2. Initial wage gap[a]	—	—	0.077 (0.075)	0.146 (0.074)	0.063 (0.089)
3. Controls for chain and[b] ownership	no	yes	no	yes	yes
4. Controls for region[c]	no	no	no	no	yes
5. Standard error of regression	0.101	0.097	0.102	0.098	0.097

Notes: Standard errors are given in parentheses. Entries are estimated regression coefficients for models fit to the change in the log price of a full meal (entrée, medium soda, small fries). The sample contains 315 stores with valid data on prices, wages, and employment for waves 1 and 2. The mean and standard deviation of the dependent variable are 0.0173 and 0.1017, respectively.

[a]Proportional increase in starting wage necessary to raise the wage to the new minimum-wage rate. For stores in Pennsylvania the wage gap is 0.

[b]Three dummy variables for chain type and whether or not the store is company-owned are included.

[c]Dummy variables for two regions of New Jersey and two regions of eastern Pennsylvania are included.

Independent variable	(i)	(ii)	(iii)	(iv)	(v)
1. New Jersey dummy	0.031	0.036			
	(0.015)	(0.014)			
2. Initial wage gap			0.072	0.143	0.067
			(0.075)	(0.075)	(0.090)
3. Controls for chain and	no	yes	no	yes	yes
ownership					
4. Controls for region	no	no	no	no	yes
5. Standard error of regression	0.101	0.098	0.102	0.098	0.098

北京大学
PEKING UNIVERSITY

PART 05

Q&A

Tasks

刘智琦：论文及资料获取、复现、debug

陈龙：PPT制作、介绍、新增分析

谢谢观看

北京大学信息科学技术学院

刘智琦　陈龙