Nutrition, Labor Supply, and Productivity: Evidence from Ramadan in Indonesia

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ASHEcon

Motivation

- Nutrition effects on labor market outcomes lies at the heart of Nutrition Efficiency Wage Hypothesis
  (e.g. Leibenstein, 1957; Stiglitz,1976, 1982)
  - Shortage of empirical evidence to support this Hypothesis

- In 2017, almost 124 million people faced "crisis" levels of acute food insecurity or worse (FAO 2018)

- Just an issue for energy demanding occupations?
  - global shifts towards cognitive rather than physical labor

- Barriers:
  - Detailed daily and hourly labor supply and labor productivity data
  - Exogenous short-term nutrition shock

This Paper

- Administrative data from a cosmetic retail chain in Indonesia
- Daytime fasting during Ramadan as an exogenous nutrition shock
  - Fast between sunrise and sunset in this one month period
- Event study approach
- Salesperson, a non-physical demanding occupation
- Investigate the recovery pattern after breaking their fast.

Preview of Results

- Salespersons have lower productivity during the time of the most energy deficient
  - Immediate recovery of productivity right after breaking their fast
- Low caloric intakes decrease labor supply of salespersons, but only at the intensive margin.
  - No effects on absence
  - About 35 minutes less of working time on each working day
- Rule out other major competing hypothesis:
  - Demand side change
  - Family reunion and religious rituals after sunset
  - Sleep deprivation
  - Dehydration

Contributions

Examine the effects of nutrition deficiency on labor market outcomes using a quasi-experimental approach and high frequency data

- The first to investigate the nutritional effects for a **non-physically demanding occupation**.
- Among the first to use high-frequency data to investigate the **immediate** effects of nutrition deficiency
- Investigate the recovery pattern which shed light on the mechanisms behind the effects of nutrition

Background

Ramadan: the ninth month of the Islamic (Hijri) calendar

- Fasting between sunrise and sunset during Ramadan

Lebaran (Eid al-Fitr): important holiday right after Ramadan.

- Back to hometown for family reunion

Indonesia: 87.2% of population are Muslim. Christians make up almost 10% of the population

Data

- A cosmetics, skin care and perfume company in Indonesia
  - More than 100 stores, located in all major cities
  - More than 1000 salespersons during 2013-2016
- Commission as an important income source for Salespersons
  - Has incentive to sell
  - Important for company to measure productivity correctly
- Two shifts
  - Day shift (9 am - 5 pm)
  - Night shift (2 pm - 10 pm)

Data

- 2013-2016 transaction data
  - 33 million transactions, including item, value, time, client
- 2013 - 2016 employee daily clock-in/out data
  - Can distinguish “not working” or “working with no sale”
- Employee individual information
  - Gender, age, religion, experience, job title and level (No income and education)

Identification Strategy: Labor Supply

A salesperson i in shop s on day t (relative week w) in year y:

$$Y_{it} = \sum_{w=-6}^{w=11} \beta_w Muslim_i \times RelativeWeek_w + \eta_i \times year_t + store_s \times year_t + \gamma_t + \epsilon_{it}$$

Y_{it}: Outcome measurements; $Muslim_i$: Muslim Indicator
$RelativeWeek_w$:

- -1/-6: 1-6 weeks before Ramadan
- 1-4: 1-4 weeks during Ramadan (8 or 9 days in week 4)
- 5: Lebaran holiday after Ramadan (4 days)
- 6-11: 1-6 weeks after Lebaran

Omitted group: 7-12 weeks before Ramadan
Fixed effects: individual-year FE; date FE; store-year FE
S.E.: clustered at individual level

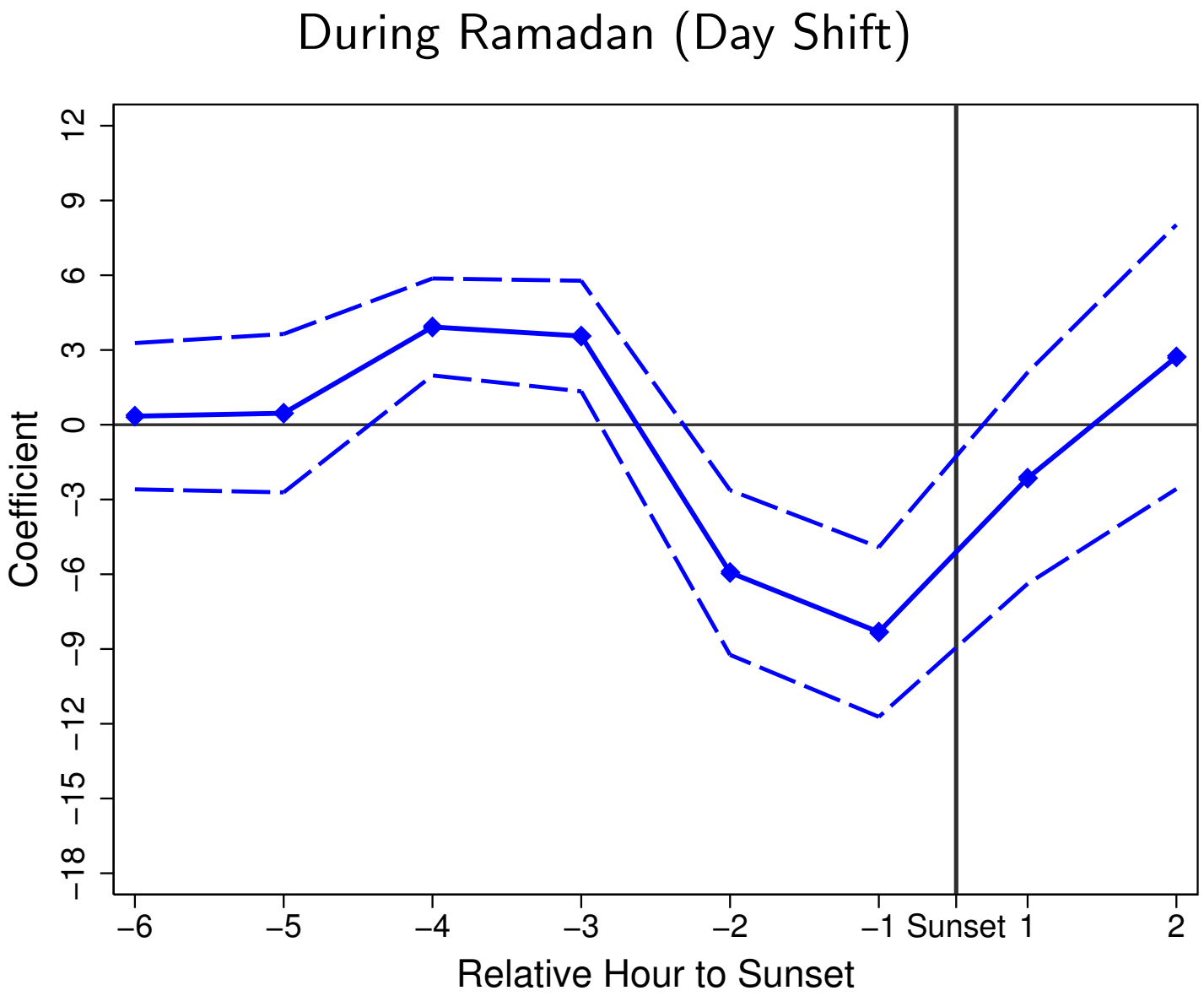
Identification Strategy: Productivity

- **Dependent:** hourly total sales by each salesperson
  - Relative hours to sunset time

- Hour by hour regressions
  - Omitted group: 7-12 weeks before Ramadan

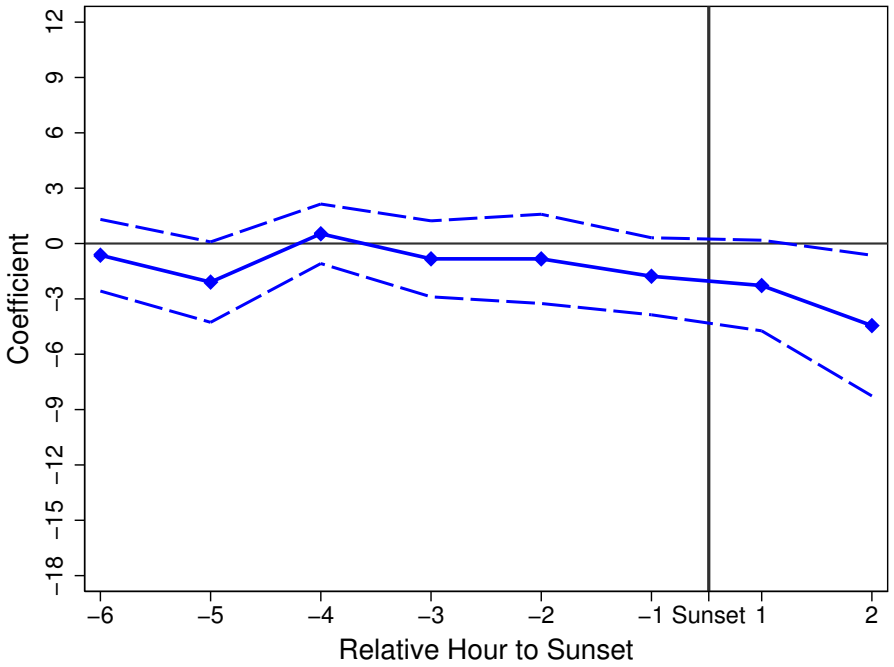
Hourly Sales	-6	-5	-4	-3	-2	-1	.....
Muslim X Before Ramadan (1-6 weeks)							.....
Muslim X Ramadan							.....
Muslim X After Ramadan (1-6 weeks)							.....
City Hourly Total Sales X Muslim							.....
City Hourly Total Sales (Value)							.....
Branch-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	.....
Year-Date FE	Yes	Yes	Yes	Yes	Yes	Yes	.....
Individual-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	.....

Productivity: Relative Hours to Sunset (Day Shift)

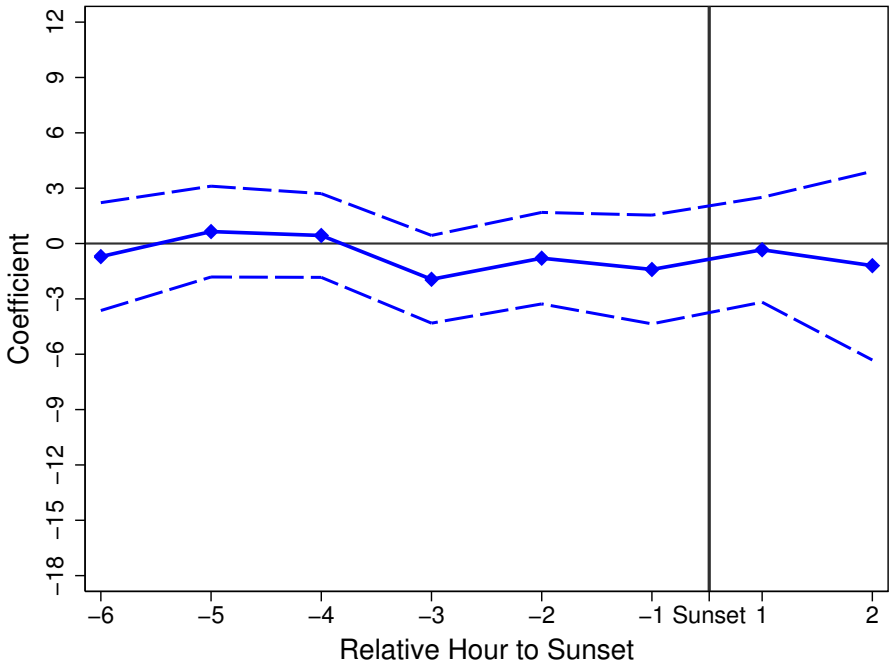


Productivity: Relative Hours to Sunset (Day Shift)

Before Ramadan



After Ramadan

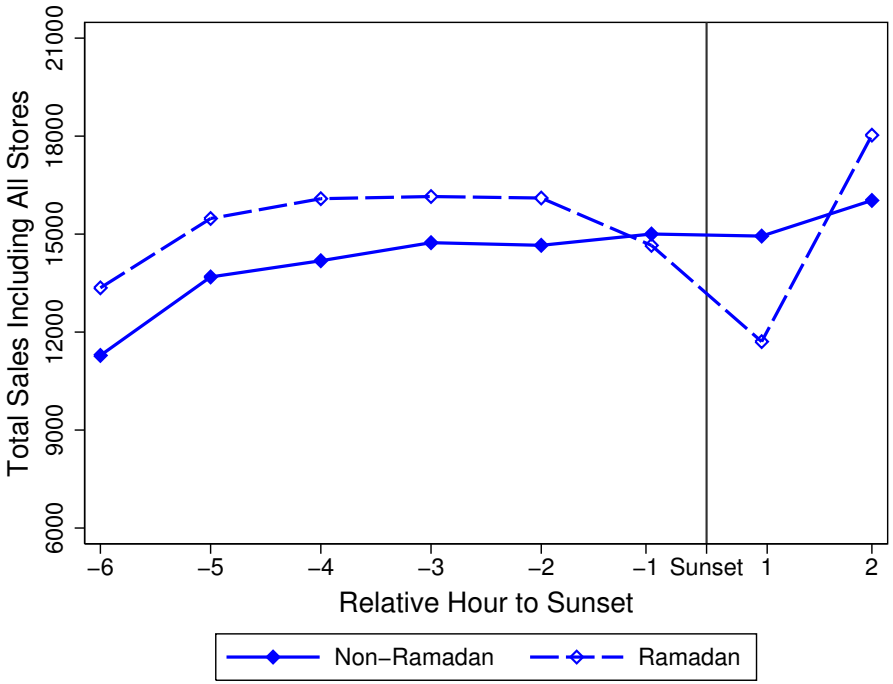


- A pattern unique to the Ramadan period

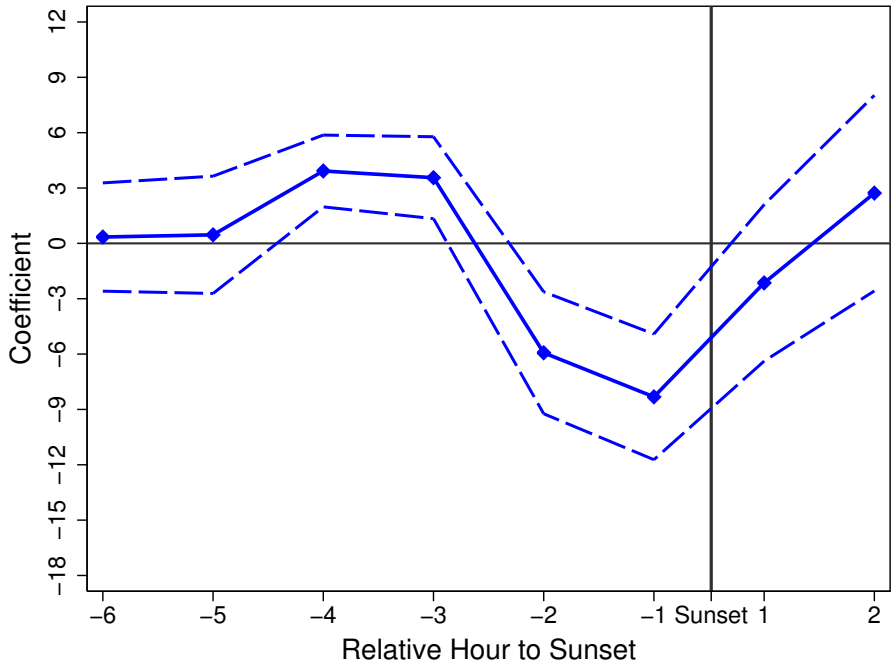
Productivity

Total Demand Trend V.S. Productivity Change

Total Demand

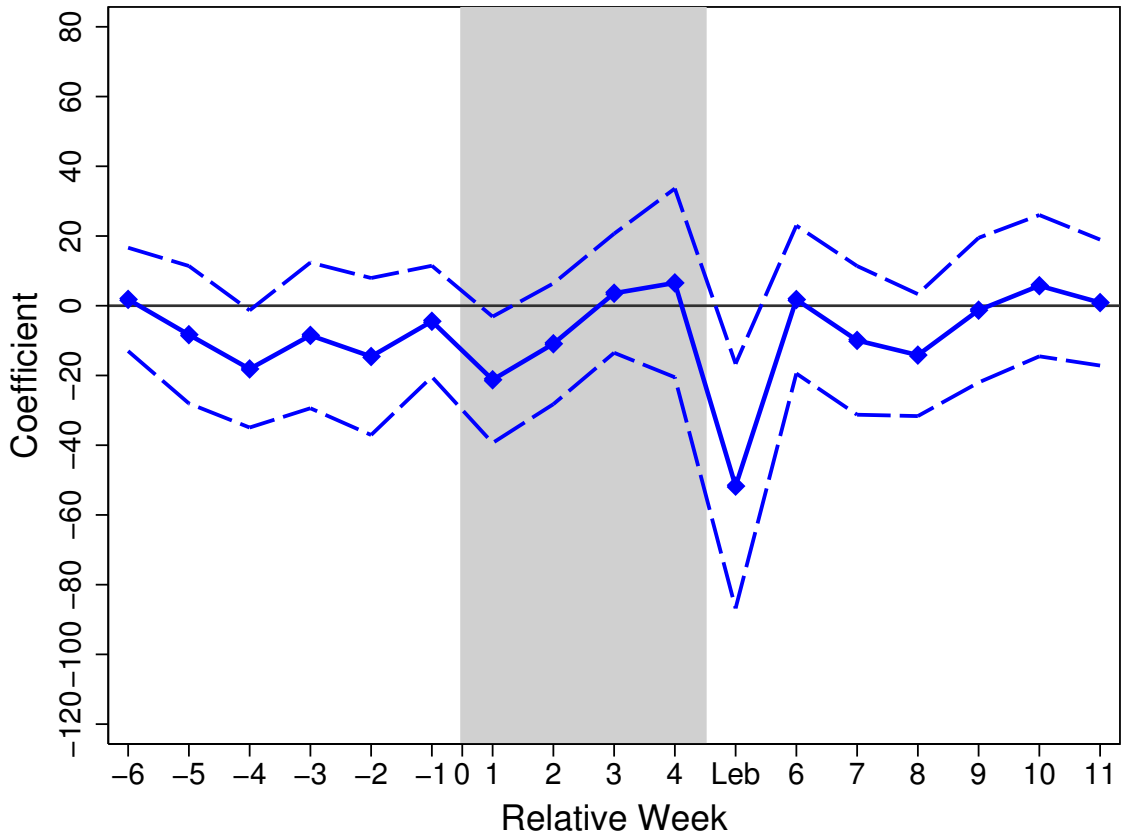


Productivity During Ramadan



Productivity: Daily Sales (Day Shift)

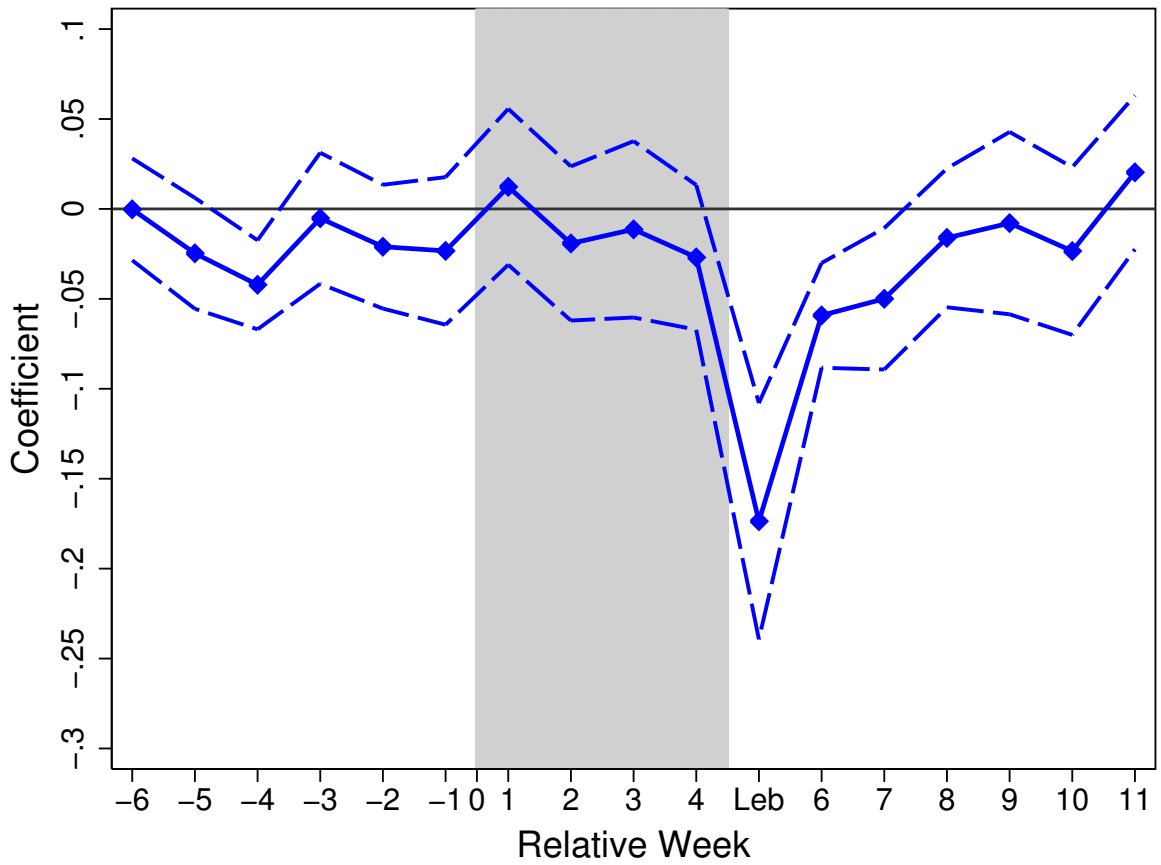
Dependent: daily total sales (Day Shift)



- **Hourly data is important for non-physical demanding occupation**

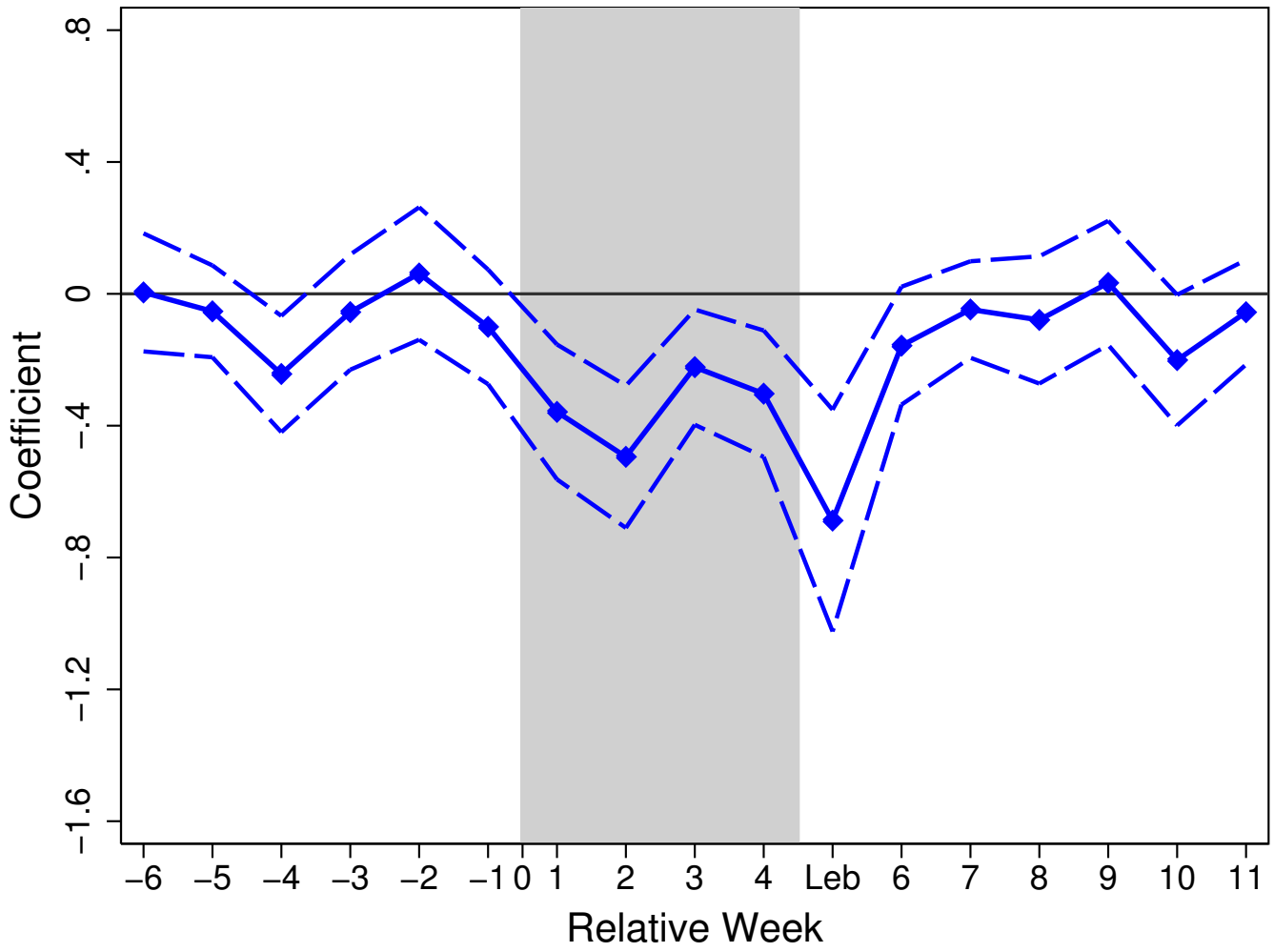
Labor Supply: Working Day

Dependent: Indicator of coming to work on certain day (0 = absence)



Labor Supply: Working Hours

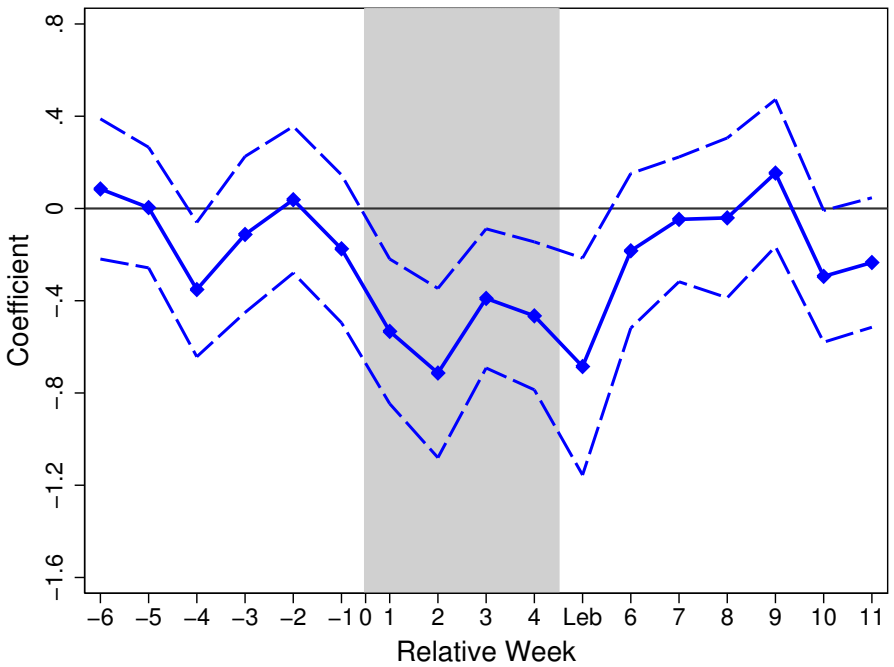
Dependent: Working hours in a day conditional on coming to work



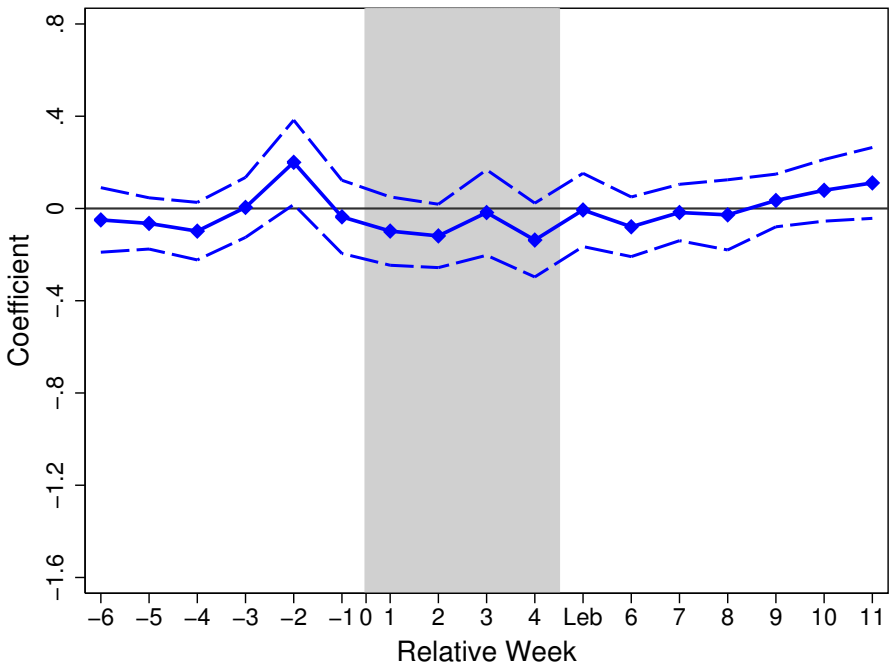
Labor Supply: Working Hours

Dependent: Working hours in a day conditional on coming to work

Day shift (9 a.m. - 5 p.m.)



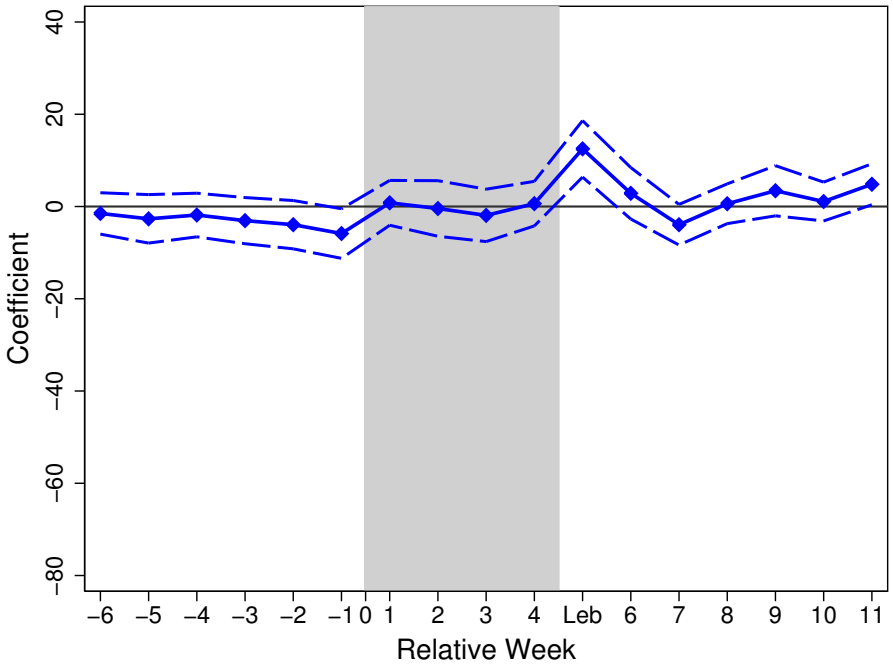
Night shift (2 p.m. - 10 p.m.)



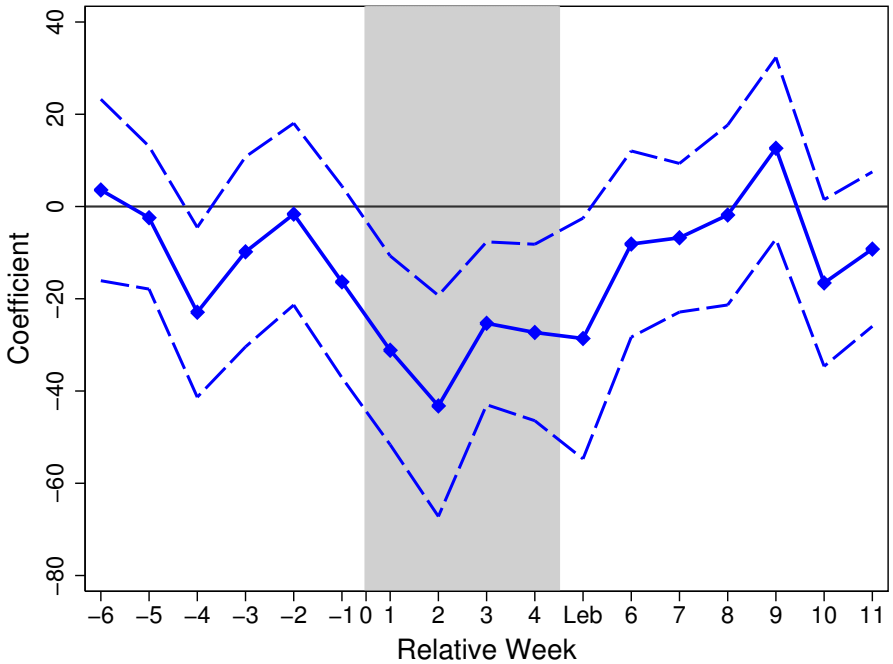
Labor Supply: Day Shift (9 a.m. - 5 p.m.)

Day shift (9 a.m. - 5 p.m.):

Dependent: Check-in Time (min)



Dependent: Check-out Time (min)

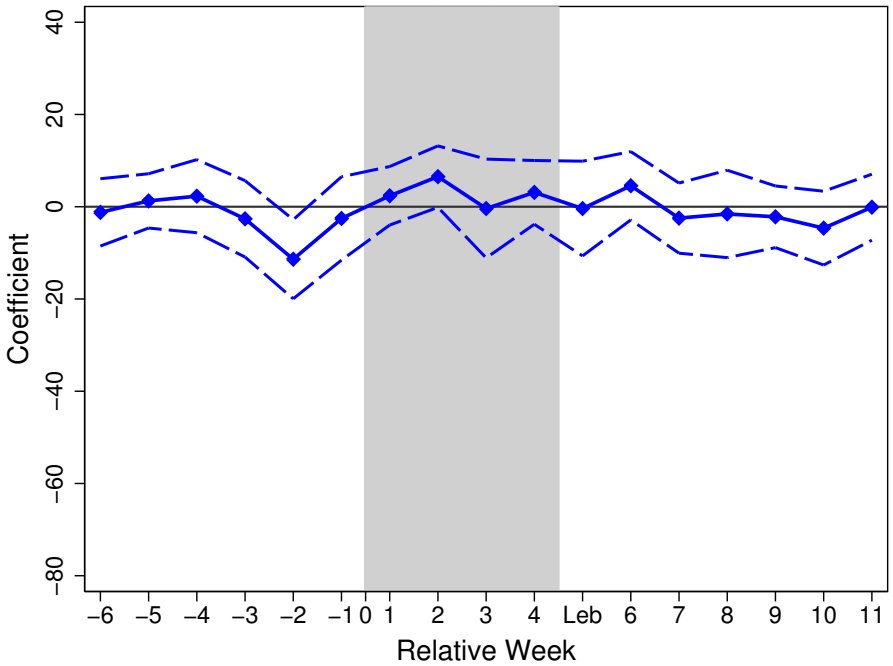


- Only affect leaving work early

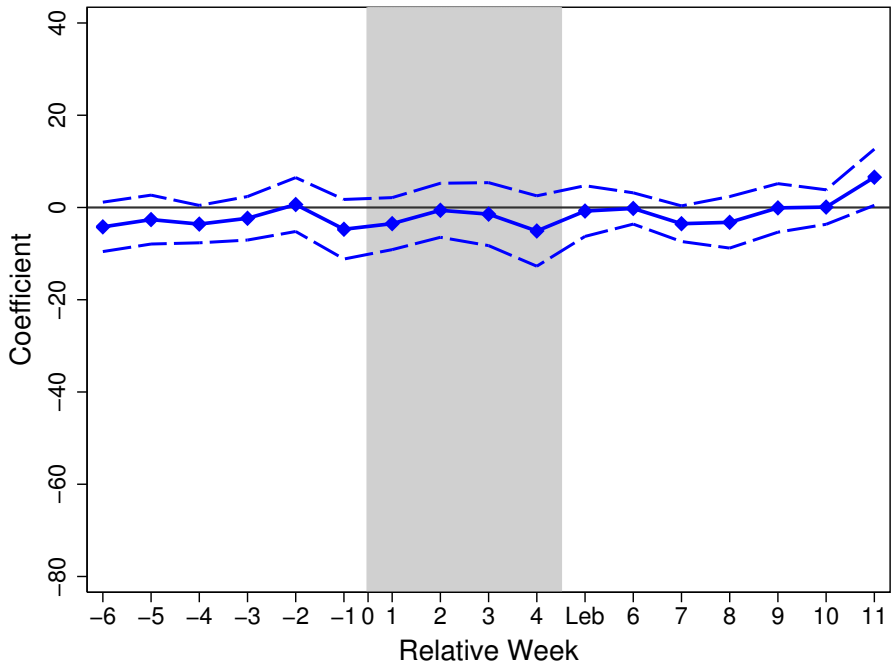
Labor Supply: Night Shift (2 p.m. - 10 p.m.)

Night shift (2 p.m. - 10 p.m.):

Dependent: Check-in Time (min)



Dependent: Check-out Time (min)



- No effects on leaving early (already break fasting)

Concerns

We rule out following alternative explanations:

- Demand side change
  - Customers go to salespersons with same religion ▸ detail
- Additional religious rituals and family reunion events after sunset ▸ detail
- Sleep deprivation
- Dehydration

Conclusion

Even for a non-physically demanding occupation:

- Low calorie intake decreases labor supply
- Negative effects of productivity only before sunset
- Productivity recover to normal right after breaking fast
  - Important to have high frequency data for productivity of cognitive workers

Concern: Customers Go to Same Religion Salespersons

- Muslim do NOT benefit more from increasing demand in a city with more Muslim women

Total Sales	Full	Ramadan Period	Lebaran Period
Muslim X City Sales X Muslim Ratio	-0.000	0.001	0.005
	(0.006)	(0.008)	(0.013)
City Sales X Muslim	0.001	0.000	-0.003
	(0.001)	(0.002)	(0.002)
City Hourly Total Sales (Value)	0.014***	0.014***	0.018***
	(0.001)	(0.002)	(0.002)
Other DDD Controls	Yes	Yes	Yes
Store-Year FE	Yes	Yes	Yes
Date	Yes	Yes	Yes
Individual-Year FE	Yes	Yes	Yes
Hour FE	Yes	Yes	Yes
Observations	2214280	362960	44501
R-Squared	0.227	0.269	0.299

City level Muslim ratios among urban females calculated from Indonesia census 2010

- A lot of Muslim saleswomen do not veil at work (cosmetic)
- Uniform without name tag back

Concern: People Go Home Early for Family Reunion

- People go home early for fast-breaking meal and family reunion
- If so, Muslim workers would go home earlier the earlier the sunset time

Dependent Variable:	(1) Clock-out Time (Day Shift)	(2) Clock-out Time (Night Shift)
Sunset X Muslim X Ramadan	-0.831***	-0.220
	(0.235)	(0.256)
Other DDD Controls	Yes	Yes
Store-Year FE	Yes	Yes
Date FE	Yes	Yes
Individua-Year FE	Yes	Yes
Observations	120535	112015
R-Squared	0.186	0.309

- Opposite direction
- No effects for night shift back

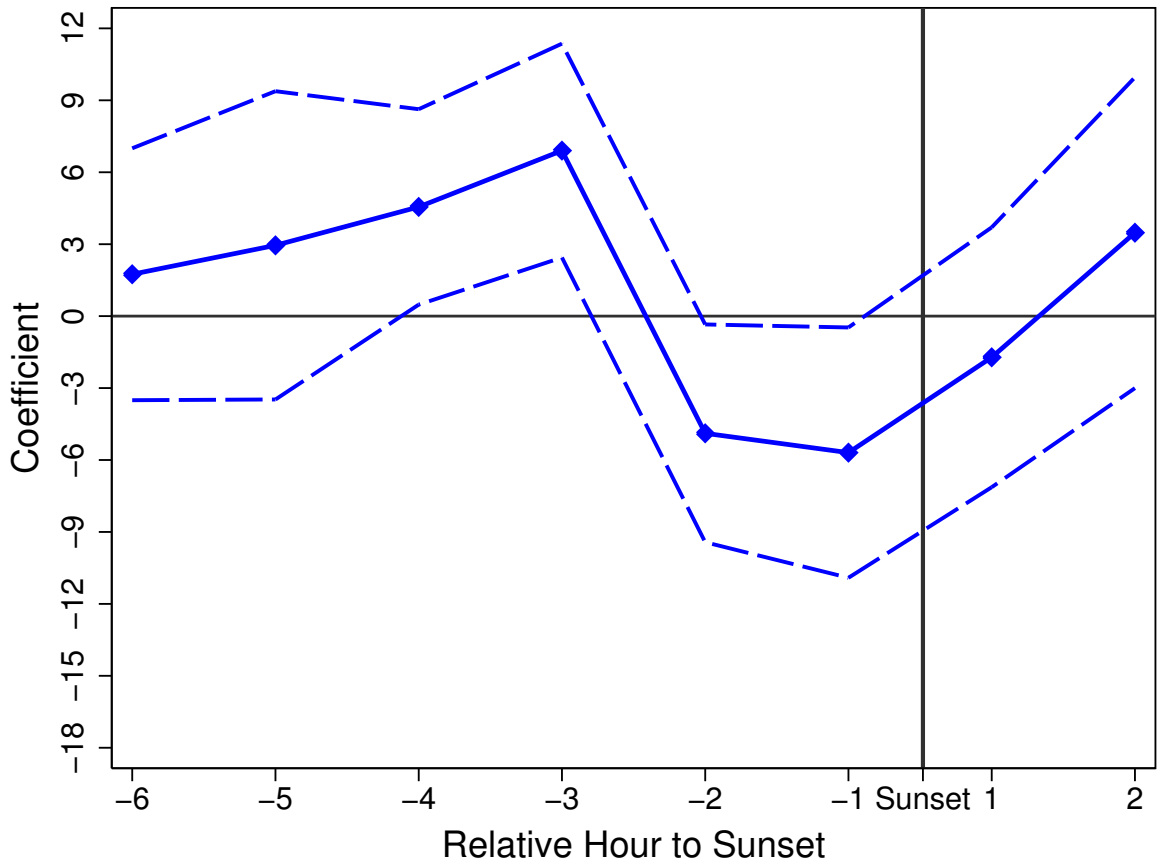
Literature: Nutrition Effects

- Schofield (2015 working paper)
  - Two distinctive research designs
    - Ramadan and annual agriculture output
    - 5-weeks randomized trial among cycle-rickshaw drivers
  - Nutrition promotes labor supply and productivity

- Additional contributions of our paper:
  - Non-physical energy demanding occupation
  - "Immediate" effects using ultra high-frequency data
  - How outcomes recover from low caloric intakes.

Productivity: Balanced Sample

Restrict to day shift salespersons still working one hour after sunset



Productivity: Lebaran Period

Productivity change within a day during Lebaran