

Does Restricting the Availability of Cigarettes Reduce Smoking?

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Motivation

- Smoking and self-control problems
- Common strategies to deal with self-control problems (WHO Best Buys)
 - Financial incentives (tax)
 - Regulation (minimum age, public space)
 - Packaging (plain package, message)
 - Media campaigns
- Side-effects of the strategies: compensating, temporary

- Are there any strategies to address these side effects?
- Availability interventions (BMJ, 2022)

Analysis

Changing the assortment of available food and drink for leaner, greener diets

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- Changing the types of products available to consumers can reduce consumption on a large scale.
- Despite the growing body of evidence for the intervention, there have been few systematic analyses.

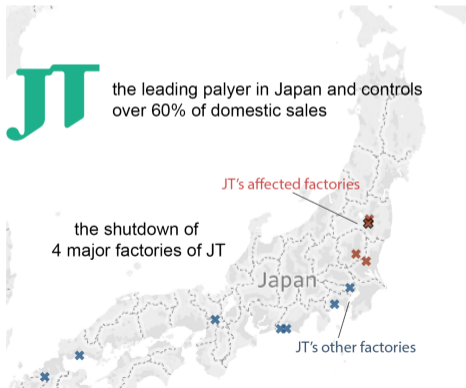


● Challenges

- Theoretically, there is no consensus on the impact of restricting product availability on consumption.
- Empirically, endogenous consumer choices and firm strategies present major challenges to causal inferences.

In this paper

We draw causal inference from a natural experiment – the cigarette supply shock caused by the 2011 earthquake in Japan.

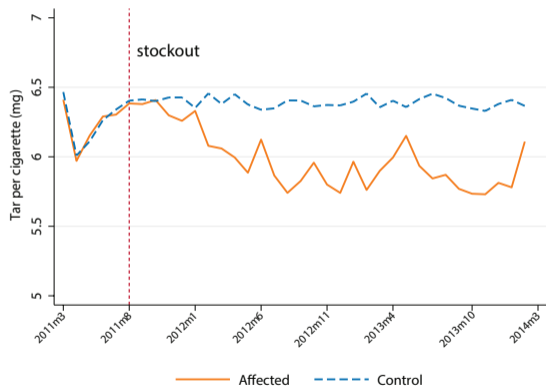


Research Questions

Does restricting the availability of cigarettes reduce smoking?

- Impacts on product choices
- Impacts on consumption
- Adjustment of choices over time

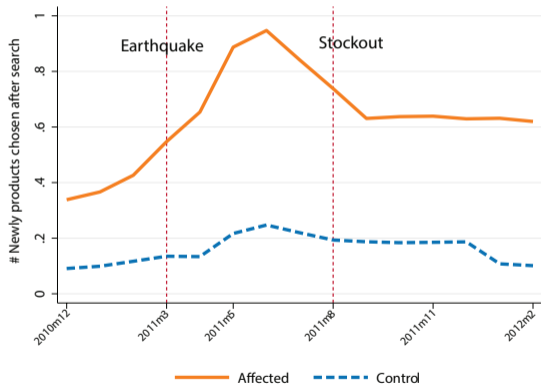
Main Findings: Product Choice



Affected consumers switched to lower-tar (nicotine) products following the stockout of discontinued products.

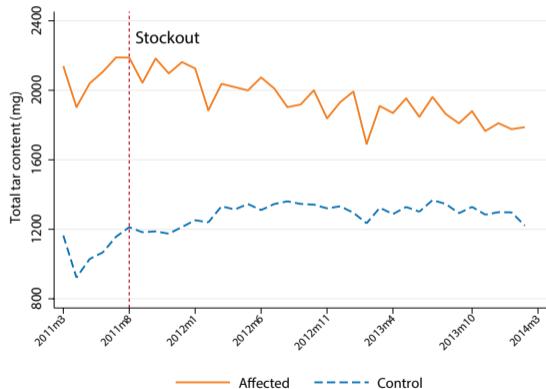
- Tar (nicotine) content in a cigarette
↓ 12% (3%)

Main Findings: Product Search



Despite the attempts to find new replacements for discontinued products, affected consumers ultimately chose other previously purchased products.

Main Findings: Consumption



Cigarette consumption exhibited a sustained decline following the stockout of discontinued products.

- # cigarettes ↓ 32%
- Total amount of tar (nicotine) ↓ 43% (30%)

What do we add to the literature?

- We investigate a supply restriction of some (not all) products in the tobacco market.
- Our unique study design precludes bias in the effect of supply restrictions on consumption associated with the price elasticity of demand.
- We adopt a research design that minimizes biases from “policy endogeneity”.
- Our findings imply that policies that limit the range of tobacco products on the market can lead to a sustained decline in smoking prevalence among the population, which is barely documented in the literature.

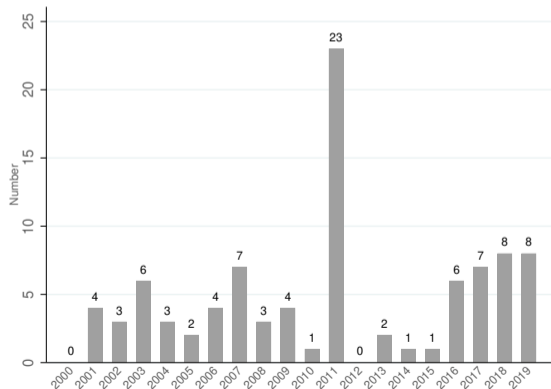
Roadmap

- Background
- Data and Methods
- Results

Background

JT Product Lineup

The Number of Discontinued Products:
2000–2019



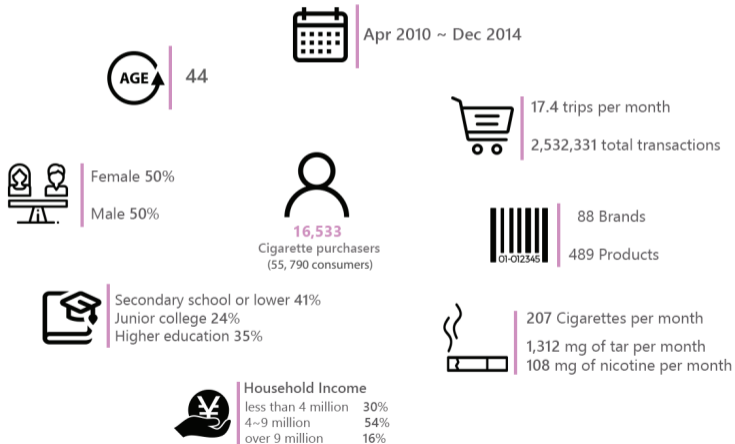
- Product discontinuations are usually planned, with the exception in 2011.
- In 2011, the earthquake and subsequent tsunami caused JT to lose 30 percent of its production capacity.
- JT eventually discontinued 23 products that possessed low market shares before the earthquake.

What are the characteristics of the products discontinued in 2011?

	Attribute	Mean	SD	Median	Min.	Max.
Discontinued products (<i>n</i> = 23)	Tar per cigarette (mg)	7.3	4.4	7	1	17
	Nicotine per cigarette (mg)	0.6	0.3	0.6	0.1	1.2
	Year of release	1997	12	2000	1970	2010
	Price per pack (20 cigarettes)	424.3	19.5	410	390	470
Key products (<i>n</i> = 25)	Tar per cigarette (mg)	7.7	5.7	8	1	19
	Nicotine per cigarette (mg)	0.6	0.4	0.6	0.1	1.4
	Year of release	1991	16	1996	1957	2011
	Price per pack (20 cigarettes)	402.8	49	410	240	440
Other JT products§ (<i>n</i> = 46)	Tar per cigarette (mg)	7.5	6.9	6	1	28
	Nicotine per cigarette (mg)	0.5	7	0.5	0.1	2.3
	Year of release	1994	22	2003	1906	2011
	Price per pack (20 cigarettes)	412.9	62.9	410	200	600

Data and Methods

Home scanner data

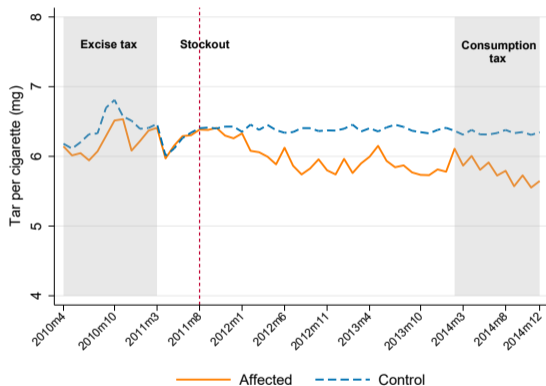


Affected vs. Unaffected Consumers

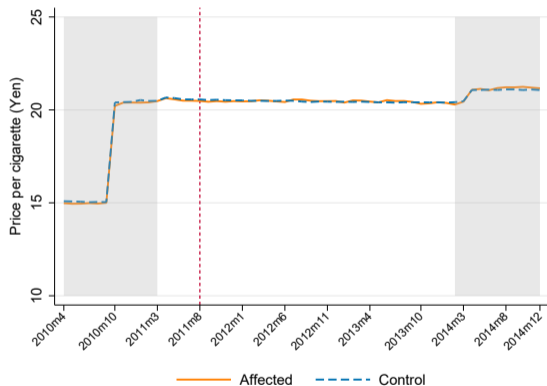
Affected – if bought at least one pack of discontinued products before the earthquake.

Variables	Full Sample	Unaffected ($n = 15,869$)	Affected ($n = 664$)	Difference in Means
Age	43.94	43.7	48.08	-4.39***
Male	0.5	0.49	0.68	-0.19***
Married	0.68	0.68	0.64	0.04***
<i>Education</i>				
Secondary school or lower	0.41	0.41	0.39	0.02***
Junior college or equivalent	0.24	0.25	0.2	0.04***
Higher education	0.35	0.34	0.41	-0.07***
<i>Household income</i>				
<4 million	0.30	0.30	0.29	0.01***
4-5.49 million	0.21	0.21	0.21	0.00
5.5-6.99 million	0.17	0.17	0.18	-0.01***
7-8.99 million	0.15	0.15	0.14	0.02***
≥9 million	0.16	0.16	0.18	-0.01***

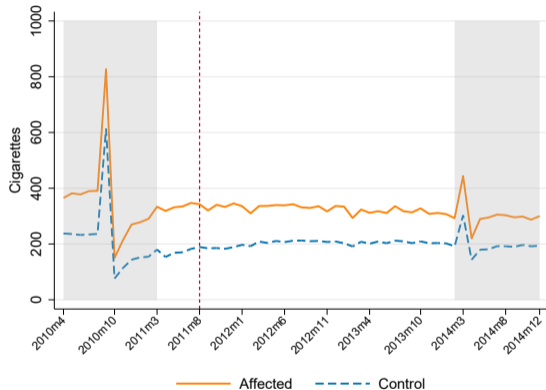
Tar content per cigarette



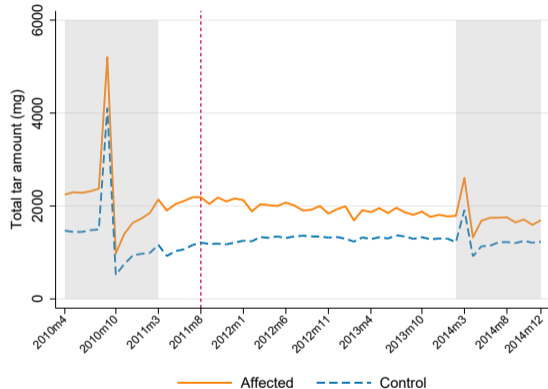
Price per cigarette



Number of cigarettes



Total amount of tar



Difference-in-Differences (DID) Approach

$$\log(Y_{it}) = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 \text{Post}_t + \beta_3 \text{Treat}_i \times \text{Post}_t + \theta \text{Controls}_{it} + \eta_i + \lambda_t + \varepsilon_{it}$$

- Y_{it} : consumer choices on the products and purchase volume in each month
- Treat_i : if the individual had purchased discontinued products before the earthquake
- Post_t : the month after the discontinued products become unavailable
- Analysis period: March 2011 – Feb 2014
- Control variables: age, sex, education, household income, residential area
- Combine propensity score matching with DID

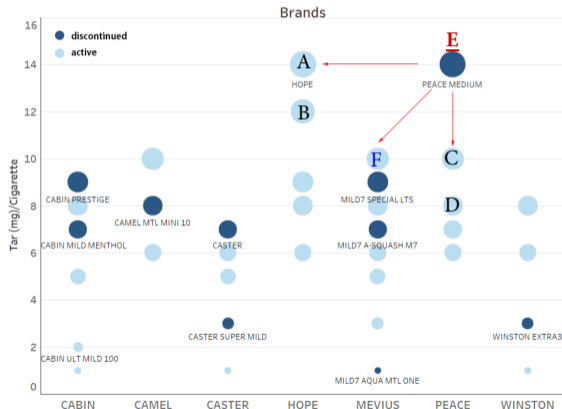
Main Results

Consumer Choices

	Substance per cigarette		Upper bounds		Lower bounds	
	tar	nicotine	tar	nicotine	tar	nicotine
<i>Treat</i> × <i>Post</i>	-0.12*** (0.021)	-0.027*** (0.0052)	-0.16*** (0.023)	-0.044*** (0.0060)	-0.069*** (0.020)	-0.011** (0.0050)
Post	-1.65*** (0.18)	-0.36*** (0.045)	-1.77*** (0.20)	-0.41*** (0.053)	-1.45*** (0.17)	-0.30*** (0.041)
Observations	193,385	193,385	193,385	193,385	193,385	193,385
Mean of Dep. Var.	3.77	0.32	4.28	0.36	3.35	0.28
SD of Dep. Var.	4.68	0.38	5.21	0.42	4.39	0.36

Individual characteristics as well as month fixed effects are controlled. Standard errors in parentheses are clustered at the individual level. **, and *** denote significance at the 5%, and 1% levels, respectively.

Adjustment of Choices



NOTE: This figure only shows 7 brands of JT products. JT has changed the Mild Seven brand name to Mevius since August 8, 2012.

[A,B,C,D,E]

- Product searching strategy
 - new product discovery [A,B,C,D,F]
 - previously purchased products [A,B,C,D]
- Consumers tend to choose familiar purchased products, even if the range of purchase options is narrowed.
- It took 3 months for consumers to stabilize the choices.

Cigarette Consumption

	Number of Cigarettes	Total Tar	Total Nicotine
<i>Treat</i> × <i>Post</i>	-0.32*** (0.062)	-0.43*** (0.076)	-0.30*** (0.052)
Post	-4.08*** (0.30)	-5.06*** (0.37)	-3.27*** (0.25)
Observations	193,395	193,395	193,395
Mean of Dep. Var.	193.8	1200.2	99.8
SD of Dep. Var.	303.5	2565.9	206.8

Notes: Standard errors shown in parentheses are clustered at the individual level. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Short- and long-run changes in consumption

	Number of Cigarettes	Total Tar	Total Nicotine
6 months after stockouts	-0.26*** (0.051)	-0.34*** (0.064)	-0.23*** (0.043)
12 months after stockouts	-0.27*** (0.053)	-0.36*** (0.066)	-0.25*** (0.045)
18 months after stockouts	-0.30*** (0.057)	-0.41*** (0.071)	-0.28*** (0.048)
24 months after stockouts	-0.34*** (0.060)	-0.45*** (0.074)	-0.31*** (0.051)

- Heterogeneity Test

- Purchase intensity
- Education
- Geographical variations

Purchase Intensity

- Heavy or frequent smokers may not exhibit a strong inclination to reduce consumption compared to light or occasional smokers.

	Tar per cig.	Nicotine per cig.	# Cigarettes	Total tar	Total nicotine
Frequent (<i>n</i> = 416)	-0.063** (0.028)	-0.014** (0.0069)	-0.17** (0.084)	-0.24** (0.10)	-0.18** (0.073)
Occasional (<i>n</i> = 248)	-0.058* (0.032)	-0.014* (0.0078)	-0.085 (0.094)	-0.14 (0.11)	-0.082 (0.073)
Diff. in Means	-0.0082 (0.042)	-0.00050 (0.010)	-0.097 (0.13)	-0.11 (0.16)	-0.11 (0.10)

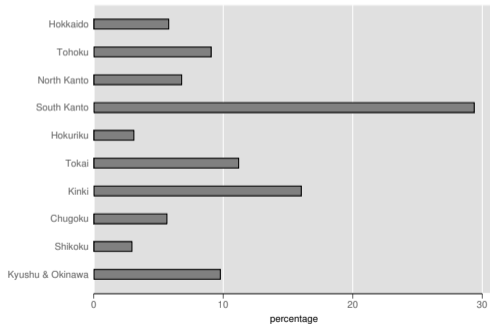
Socioeconomic Disparities: Education

- Past studies suggest that smoking is particularly prevalent among people of low SES.
- The disparities in smoking are largely explained by the education gradient.

	Tar per cig.	Nicotine per cig.	# Cigarettes	Total tar	Total nicotine
Secondary or lower	-0.13*** (0.03)	-0.029*** (0.01)	-0.33*** (0.10)	-0.46*** (0.12)	-0.32*** (0.09)
Junior college or equivalent	-0.12*** (0.04)	-0.023** (0.01)	-0.46*** (0.12)	-0.56*** (0.15)	-0.39*** (0.10)
High education	-0.11*** (0.03)	-0.027*** (0.01)	-0.26** (0.11)	-0.37*** (0.13)	-0.24*** (0.09)

Geographical Variations

Geographical distribution of affected consumers



Differences in Means

	Tohoku vs. Other Regions	South Kanto vs. Other Regions
Tar per cig.	0.018 (0.062)	-0.0062 (0.047)
Nicotine per cig.	0.014 (0.014)	-0.0047 (0.011)
# Cigarettes	-0.23 (0.23)	0.043 (0.15)
Total tar	-0.16 (0.27)	0.037 (0.18)
Total nicotine	-0.063 (0.18)	0.035 (0.12)

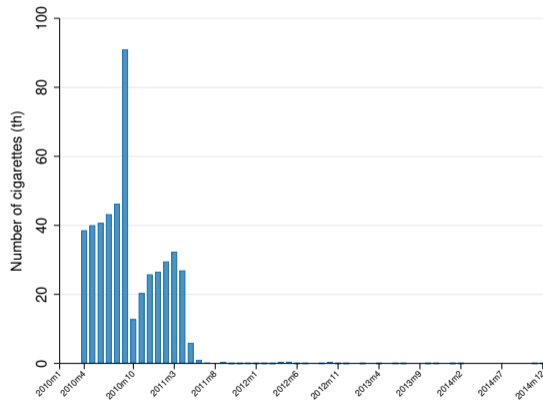
The stockouts of discontinued products uniformly affected consumers across the country.

Wrap-up

- This study predicts that restricting product availability can constrain addictive behavior in the long term.
- The removal of certain products leads smokers to choose “lighter” products from a restricted set of regular choices.
- With the shift to “lighter products”, tobacco consumption exhibits an equivalent decline, not only in the number of cigarettes but also in the total amount of tar (nicotine) purchased.
- Reducing the range of tobacco products on the market can reduce the harm of smoking to population.

Appendix

Purchases of discontinued products over time



This figure shows the total monthly purchases of discontinued products. The first zero purchase occurred in August 2011.