Are Dollar Stores Magnets for Violent Crime
A Case Study of Chicago
Self-introduction: my research field

Primary field of research and teaching:
Urban and transportation policy

- Subject: How urban policy and systems shape the opportunities and behavior of disadvantaged populations

- Methodology: My research primarily employs quantitative methods, utilizing open data sources
A showcase from my research portfolio

Do Dollar Stores Attract Violent Crime?: Evidence from Chicago
1. Background
2. Literature review
3. Study area context, data, and methods
4. Results
5. Summary and conclusion
What is a dollar store?

“A retail establishment that sells a wide variety of items, typically with the majority of the merchandise priced around one to ten dollars”
Why did I become interested in dollar stores?
Background

Dollar stores have been booming in the U.S. over the past decades

Mass media has increasingly depicted dollar stores as magnets for local crime

- **ClickOnDetroit**
  Man robs 2 Detroit dollar stores 41 minutes apart, police say
  Derick is a Senior Web Producer for ClickOnDetroit and has been with Local 4 News since April 2013. Derick specializes in breaking news, crime...
  12 hours ago

- **Winston-Salem Journal**
  Man robs a Family Dollar store in Winston-Salem
  An armed man robbed the Family Dollar store at 4194 Ebert Road in ... can call Winston-Salem police at 336-773-7700. Crime Stoppers at...
  2 weeks ago

- **TOD TheTandD.com**
  Orangeburg Family Dollar robbed at gunpoint | Crime ...
  A gunman robbed the Family Dollar at 2429 Russell Street in Orangeburg at 9:40 p.m. ... He fled the store on foot, going toward Goff Avenue.
  12 hours ago
My research questions are three-fold:

• First, how does the opening or closing of dollar stores influence violent crime rates in the surrounding areas?
• Second, how do these effects differ across various types of crime and locations?
• Third, does the impact of dollar store opening vary by neighborhood characteristics?
Literature review
Routine activity theory: 범죄 발생의 원인을 설명하는 이론

- Motivated offender (동기가 있는 범죄자)
- Suitable target (적절한 표적)
- Absence of a capable guardian (감시/보호자 부재)
Routine activity theory

- Dollar store customers
- Dollar store employee
- "Cash"
- Motivated offender
- Suitable target
- Absence of a capable guardian
- Potential offenders near dollar stores
- No security guard
- No high-quality CCTV
Broken windows theory
Small signs of disorder in a neighborhood can lead to more serious crimes.

Cities don't have to settle for ugly dollar stores
Apr 24, 2013 — The latest suburban scourge is worse than noisy neighbors, poorly-timed streetlights or rush-hour road construction. Dollar stores are...
Eyes on the street

Dollar store customers -> Increase pedestrian traffic -> deter criminal activities

Theoretical predications of the relationship between dollar stores and violent crime is mixed
There was no empirical study on the relationship between dollar stores and crime.

Some evidence on the relationship between crime and convenience stores: most of them report positive relationships.

<table>
<thead>
<tr>
<th></th>
<th>Convenience store</th>
<th>Dollar stores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business hour</td>
<td>24/7</td>
<td>8 AM ~ 9 PM</td>
</tr>
<tr>
<td>Main customer</td>
<td>Young men</td>
<td>Older people, women</td>
</tr>
<tr>
<td>Alcohol sale</td>
<td>Yes</td>
<td>Allowed since 2019</td>
</tr>
</tbody>
</table>
Study area context and research design
Chicago

- has one of the highest murder rates among large US cities
- is well known for its highly segregated residential patterns by race/ethnicity

https://demographics.coopercenter.org/racial-dot-map
Y variable->


- Detailed crime type -> homicide, robbery, rape, & aggravated assaults => violent crime
- Location for crime incidents: longitude and latitude
- Location type (street, store, residence, etc)

• Major limitation: Incidents with more than one offense are classified as the most severe offense committed

To overcome this limitation, this study focuses only on violent crimes
To identify dollar stores, I used the

**Historical SNAP (Supplemental Nutrition Assistance Program) retailer locator data**

- The list of stores accepting SNAP benefits
- Extracted stores with names that include “dollar” or “cent” (e.g., 99 Cents Only Stores)
- SNAP authorization starting date and ending date
Data quality check:

What if the SNAP database is biased?
Maybe, stores in lower income neighborhoods are overrepresented

-> Comparison between SNAP database and Yelp data-> confirm no bias

-> Online business review platform
Research methods

Methods for research questions #1 & #2

• First, how does the opening or closing of dollar stores influence violent crime rates in the surrounding areas?
• Second, how do these effects differ across various types of crime and locations?

Standard difference in differences method
Difference-in-differences (DID) methods

Methodology

Difference-In-Differences Estimation

- Intervention Effects
- Constant difference in outcome

Treatment group

Control group

Pre-treatment

Post-treatment
Difference-in-differences (DID) methods

- Dollar store that opened during the study period
- Treatment area = 250ft-buffer around each dollar store
- Control area = a donut that circumscribes each treatment ring (250ft-354ft)
Difference-in-differences methods

Why 250 foot? Why 354 foot?
Difference-in-differences methods

*Baseline equation

\[
\text{ViolentCrime}_{itr} = \alpha + \beta_1 \text{Open}_{it} + \beta_2 \text{Close}_{it} + \beta_3 T_r + \beta_4 T_r * \text{Open}_{it} + \beta_5 T_r * \text{Close}_{it} + \beta_6 Q_t + \beta_7 \text{Dollarstore}_{i} + \beta_8 \text{Control}_{itr} + \varepsilon_{itr} \quad (1)
\]

Dependent variable for Q1: Number of total violent crime
Dependent variable for Q2: Number of robberies/aggravated assaults

Number of violent crimes occurring on streets/sidewalks, residence, small stores, parking lots, etc
Baseline results (RQ#1 & RQ#2)

- Pre-store opening period (=reference)
- Store opening period
- Dollar store opening
- Store closing period
- Dollar store closing

Beta4
Beta5
Method for research question #3

Third, does the impact of dollar store opening on violent crime vary by neighborhood characteristics?

Causal random forest (CRF)

Background Concepts

Causal Inference

Random Forests: A machine learning method that uses many decision trees to make predictions. Each tree is trained on a random subset of the data and makes its own predictions. The forest then combines these predictions to produce a more accurate and robust outcome.
Random Forest
Causal random forest (CRF)

Difference between RF & CRF

Random Forest: splitting criterion-> Data is repeatedly split in order to minimize prediction error of an outcome variable.

예시: 은행에서 고객이 대출을 상환할 수 있을지 없을지를 예측하고 싶다고 가정
Causal random forest (CRF)

Difference between RF & CRF

RF: splitting criterion-> Data is repeatedly split in order to minimize prediction error of an outcome variable.

예시: 은행에서 고객이 대출을 상환할 수 있을지 없을지를 예측하고 싶다고 가정

CRF: splitting criterion-> Data is split in order to maximize the difference in treatment effect.

특정 ‘treatment'(예: 교육 프로그램, 약물 투여 등)가 결과에 미치는 효과의 차이를 극대화하는 방향을 선택
Causal random forest (CRF): simple visualization example

예시: 어떤 교육 프로그램이 사람들의 소득에 미치는 영향

![Diagram](attachment:image.png)
Causal random forest (CRF)

Dollar store -> violent crime

Neighborhood characteristics:

• Median household income,
• % Black residents,
• % Hispanic rates,
• % vacant home,
• Retail density,
• Poverty rate, etc
Causal random forest (CRF)

First step: identifying the factors that have the greatest impact on the heterogeneity of treatment effects

➔ Variable importance measure, which quantifies how frequently the forest splits on specific covariates across all the trees it contains

: 2 most important factors were identified
Causal random forest (CRF)

Second step: investigating how the effect of dollar store openings on violent crimes differs across these two important variables.

➔ Heatmaps were created to present how the CATEs (conditional average treatment effects) change across the two most important variables while holding other covariates at their average values.
Results
Violent crimes & recently opened dollar stores (2010-2019)
## Descriptive statistics

### Average sociodemographic and violent crime characteristics by dollar store presence in 2009

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Census block groups without any dollar stores (a)</th>
<th>Census block groups with recently opened dollar stores (b)</th>
<th>(b)-(a)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Socioeconomic and demographic characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population density (/acre)</td>
<td>27.98</td>
<td>30.51</td>
<td>2.53</td>
</tr>
<tr>
<td>Median household income ($)</td>
<td>50049.51</td>
<td>41445.64</td>
<td>-8603***</td>
</tr>
<tr>
<td>% Non-Hispanic blacks</td>
<td>40.47</td>
<td>45.31</td>
<td>4.84</td>
</tr>
<tr>
<td>% Hispanic</td>
<td>23.03</td>
<td>32.87</td>
<td>9.84***</td>
</tr>
<tr>
<td>% Households below poverty level</td>
<td>19.9</td>
<td>21.77</td>
<td>-1.87</td>
</tr>
<tr>
<td><strong>Crime</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Violent crime density (annual count/acre)</td>
<td>0.36</td>
<td>0.55</td>
<td>0.19***</td>
</tr>
<tr>
<td>N</td>
<td>2,126</td>
<td>143</td>
<td></td>
</tr>
</tbody>
</table>

Note: + \( p < 0.1 \), * \( p < 0.01 \), ** \( p < 0.05 \)

Compared to BGs without dollar stores, BGs with recently opened dollar stores, on average, have:

1. higher proportion of Hispanic residents,
2. lower median household income and
3. higher violent crime density
Difference-in-differences methods

By using a smaller micro-geographic unit, I made control areas and treatment areas similar.
After the opening of dollar stores, the number of violent crimes—particularly robberies—increased more in nearby areas compared to control areas.
### Baseline results (RQ#1 & RQ#2)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Violent crime</th>
<th>Robbery</th>
<th>Aggravated assault</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Treatment ring ×</td>
<td>0.193*</td>
<td>0.195**</td>
<td>0.321***</td>
</tr>
<tr>
<td>Store opening</td>
<td>(0.098)</td>
<td>(0.098)</td>
<td>(0.117)</td>
</tr>
<tr>
<td>Treatment ring ×</td>
<td>0.111</td>
<td>0.131</td>
<td>0.014</td>
</tr>
<tr>
<td>Store closure</td>
<td>(0.200)</td>
<td>(0.177)</td>
<td>(0.264)</td>
</tr>
<tr>
<td>Store opening</td>
<td>-0.140*</td>
<td>-0.137*</td>
<td>-0.171*</td>
</tr>
<tr>
<td></td>
<td>(0.077)</td>
<td>(0.076)</td>
<td>(0.095)</td>
</tr>
<tr>
<td>Store closure</td>
<td>-0.167</td>
<td>-0.181</td>
<td>-0.074</td>
</tr>
<tr>
<td></td>
<td>(0.121)</td>
<td>(0.117)</td>
<td>(0.155)</td>
</tr>
<tr>
<td>Treatment ring</td>
<td>0.106</td>
<td>0.103</td>
<td>0.171*</td>
</tr>
<tr>
<td></td>
<td>(0.089)</td>
<td>(0.088)</td>
<td>(0.092)</td>
</tr>
<tr>
<td>Quarter fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Store fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Control variables</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

- After the closing of dollar stores, the number of violent crimes in treatment areas relative to control areas did not differ from that of pre-store-opening period.
- After the permanent closure of dollar stores, the number of violent crimes in treatment areas returned to pre-store-opening levels.
Robustness checks

What if treatment rings are too small (and control rings are affected by dollar stores)?
### Robustness checks

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Total violent crime</th>
<th>Robberies</th>
<th>Aggravated assaults</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Treatment ring × Store opening</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.195*</td>
<td>0.301*</td>
<td>0.160</td>
</tr>
<tr>
<td></td>
<td>(0.114)</td>
<td>(0.124)</td>
<td>(0.136)</td>
</tr>
<tr>
<td><strong>Control ring × Store opening</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.001</td>
<td>-0.024</td>
<td>0.032</td>
</tr>
<tr>
<td></td>
<td>(0.116)</td>
<td>(0.133)</td>
<td>(0.135)</td>
</tr>
<tr>
<td><strong>Treatment ring × Store closure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.067</td>
<td>0.052</td>
<td>0.147</td>
</tr>
<tr>
<td></td>
<td>(0.118)</td>
<td>(0.141)</td>
<td>(0.139)</td>
</tr>
<tr>
<td><strong>Control ring × Store closures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.042</td>
<td>0.039</td>
<td>-0.015</td>
</tr>
<tr>
<td></td>
<td>(0.202)</td>
<td>(0.280)</td>
<td>(0.184)</td>
</tr>
</tbody>
</table>

- This shows that the impact of dollar stores unlikely goes beyond 250 foot buffer, which justifies the research design.
After dollar stores opened, the number of violent crimes increased not only in small retail/convenience stores but also on streets/sidewalks.
Results (RQ#3)

Variable Importance

- retail employment density
- median household income
- % Hispanics
- % vacant housing units
- % males aged 15 to 29
- % non-Hispanic blacks
- % households below poverty level
- % rental housing units

Importance Score
Causal Forest Effect Estimates: Total violent crime

Median household income ($) vs. Retail Density (acre)
Results (RQ#3)

Causal Forest Effect Estimates: Robberies

Estimated Effect
- 0.120
- 0.115
- 0.110
- 0.105
- 0.100
- 0.095

Reass Density (acres)

Median household income ($)
Causal Forest Effect Estimates: Aggravated assault

Estimated Effect

- 0.020
- 0.016
- 0.012

Median household income ($)
Conclusions
• Following the opening of dollar stores, the number of violent crimes tends to increase in areas nearby, compared to control areas.

• However, this effect is mostly driven by an increase in robberies—not by changes in other types of violent crime.

• After the permanent closing of dollar stores, the number of violent crimes decreases to the pre-opening level.

• The opening of dollar stores leads to an increase in violent crime, impacting not only the premises of the stores but also the neighboring streets and sidewalks.
Answers for RQ #3

- Neighborhoods with lower median household incomes, except for the lowest end of income areas, experience a greater increase in total violent crimes after a dollar store opens.
- In areas with denser retail employment, a greater increase in total violent crime and its subtypes post-opening is observed, regardless of income levels.
Local Legislation on Dollar Stores
• Increasing restrictions on dollar store licensing and operations (e.g., dispersal ordinance)
• Potential policy implication: Mandate enhanced security measures for dollar stores

Expanding Geographic Scope in Crime Reduction Policies
• Extend focus beyond dollar stores to nearby streets and sidewalks for effective crime reduction strategies.
• Security initiatives need to be prioritized for dollar stores in lower-middle-income areas with higher density of retail outlet density
Any Questions?
Thank you!

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