The Effect of Increasing Access to Gambling on Local Amenities: Evidence from Legalizing Video Gambling in Illinois.

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Motivation

- Historically, gambling has been highly regulated in most countries and remains a significant source of tax revenue.
  - Sin taxes are usually easier to justify to the electorate
- In the United States, there was a large expansion in casino-based gambling during the early 1990s.
  - Typically concentrated in select areas (e.g., tribal lands)
  - Accounts for up to 5% of total tax revenue in some states
  - Casino construction has been well studied, mixed findings:
    + labor markets, + crime, **?** property values.

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  - Typically concentrated in select areas (e.g., tribal lands)
  - Accounts for up to 5% of total tax revenue in some states
  - Casino construction has been well studied, mixed findings:
    + labor markets, + crime, **?** property values.
- Technology reduced the cost of monitoring, leading to a large decentralization of the activity through video gaming terminals.
  - Less evidence about its effects
  - Difficult to extrapolate casino-based evidence, dramatically different in nature

This paper

- We study the effects of a large expansion in access to gambling
  - Crime
  - Property Values
- We leverage
  - The legalization of *retail* gambling in Illinois
  - Historic ban on gambling in Chicago
  - The spatial and temporal variation of the adoption of video gambling by establishments

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- We leverage
  - The legalization of *retail* gambling in Illinois
  - Historic ban on gambling in Chicago
  - The spatial and temporal variation of the adoption of video gambling by establishments
- We find that in the immediate surroundings of a gambling establishment
  - 7% and 4% average increase in violent and property crime.
  - New rather than displaced incidents
  - 2-4% average decrease on property values
  - Effects are persistent over time

Contributions

- **Literature on the effects of gambling**
  - *Gambling and Crime*
    Gazel et al. (2001), Wilson (2001), Reece (2010), Hyclak (2011), Nichols and Tosun (2017), Falls and Thompson (2014), Humphreys and Soebbing (2014), Evans and Topoleski (2002), Humphreys and Marchand (2013), Grinols and Mustard (2006)
  - *Gambling and Property Values*
    Landers (2004), Wenz et al. (2007), Wiley and Walker (2011), Humphreys and Marchand (2013)

Contribution

Areas before and after gambling

(a) Before casino opening

(b) After casino opening

(c) Before adoption of gambling

(d) After adoption of gambling

Contribution

- **Literature on the effects of gambling**
  - *Gambling and Crime*
    Gazel et al. (2001), Wilson (2001), Reece (2010), Hyclak (2011), Nichols and Tosun (2017), Falls and Thompson (2014), Humphreys and Soebbing (2014), Evans and Topoleski (2002), Humphreys and Marchand (2013), Grinols and Mustard (2006)
  - *Gambling and Property Values*
    Landers (2004), Wenz et al. (2007), Wiley and Walker (2011), Humphreys and Marchand (2013)
- **Expansion of "sin tax" activities**
  Ciacci and Sviatschi (2016), Chang and Jacobson (2017), Rossow and Norstrom (2012), Anderson et al. (2017)

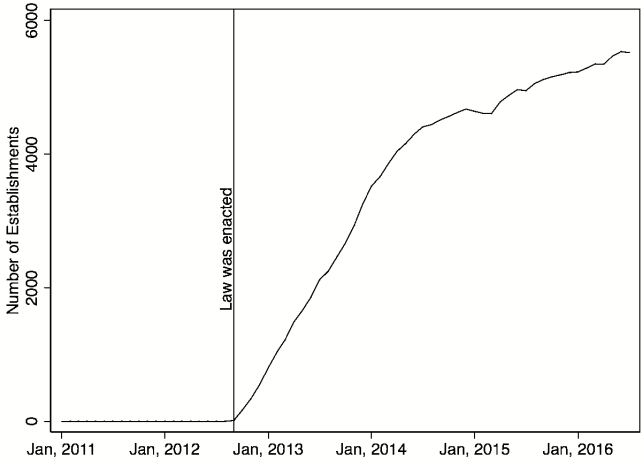
Background

Background on Gambling

- **Gambling in the US**
  - Most of the 20th century was criminalized (except Nevada)
  - Reversed in the 90s in 40 states, allowing gambling in casinos
  - States now are moving towards more decentralized forms of gambling

- **Gambling in Illinois**
  - Gambling in Illinois was illegal until 1990, when Riverboat casinos were allowed.
  - In 2009, the Video Gaming Act (230 ILCS 40/1) was passed in order to finance the *Illinois Jobs Now!* program.
    - Legalized video gambling beginning in September 2012.
    - Municipalities held a referendum to opt in/out. ▸ Outcomes
  - Since the VG's implementation, more than 24,000 electronic terminals are operational in Illinois.
  - In 2024, it raised $1.03 bn

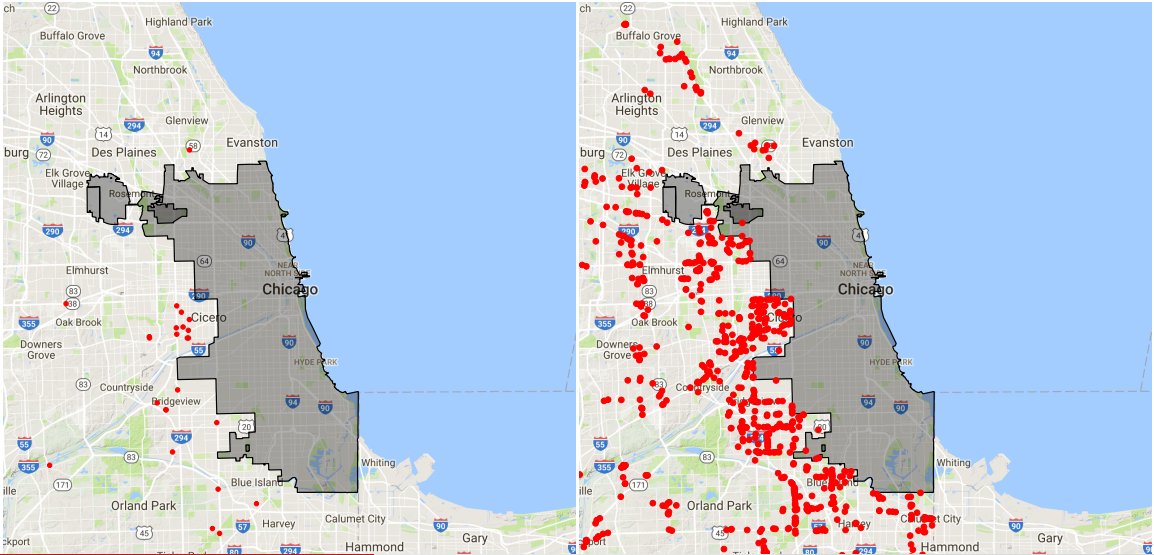
Number of Video Gaming Establishments



Back

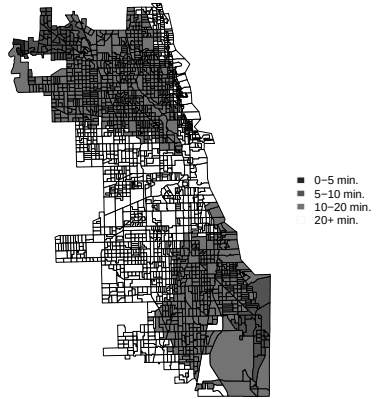
Background: Increased access to gambling.

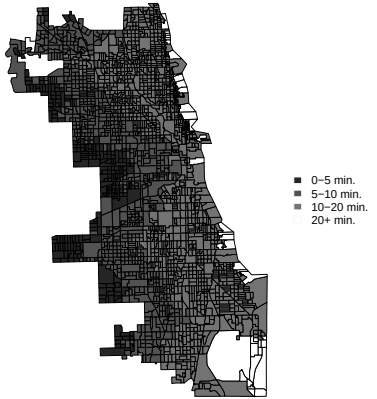
Rapid expansion across the state and around Chicago



Access to Casinos versus Video Gambling Establishments in Chicago

Travel time by car to nearest gambling establishment





Background

Requirements for a Video Gambling Establishments

- Pay an annual liquor license of $750
- Fill an online application and pay $100 in a gambling license, and $100 for each machine
- Can have at most 5 video gaming terminals.
- Revenue split: 35% establishments, 35% machine companies, 25% state, and 5% to municipalities.

- $2 maximum wager per play and terminals cannot dispense more than $500 per play
- Terminals do not dispense coins, cash or tokens. Players receive vouchers that can be redeem at the register
- Cannot be within 100 feet of a church or school and 1000 feet of a casino or racetrack

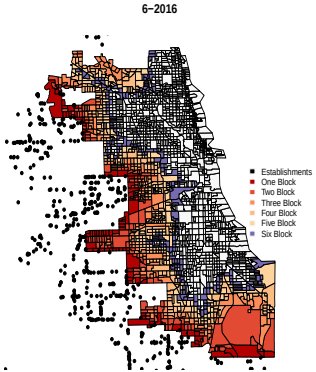
Inside Jupiter's Pizzeria

Eligible

Empirical Strategy

Identification

- Assumption that closer places have greater access and are more likely to be affected (Linden and Rockoff, 2008, Pope, 2008, Diamond and McQuade, 2016).
- Exploit geographical and temporal variation in the expansion of video gambling



Note: Maps of Chicago's census block groups. Data represent video gambling establishments operating in June 2016. Each block group is classified by proximity to

Empirical Strategy

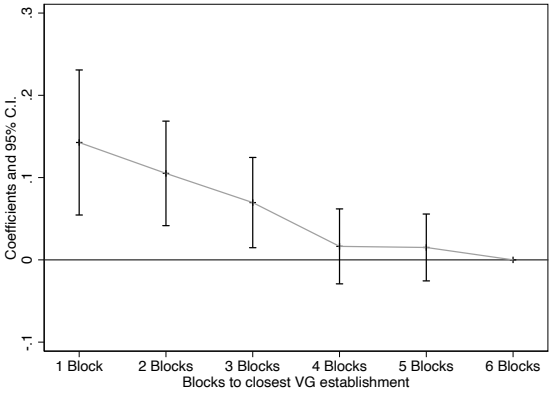
Data

We construct monthly panel data at the census block group (BG) level using:

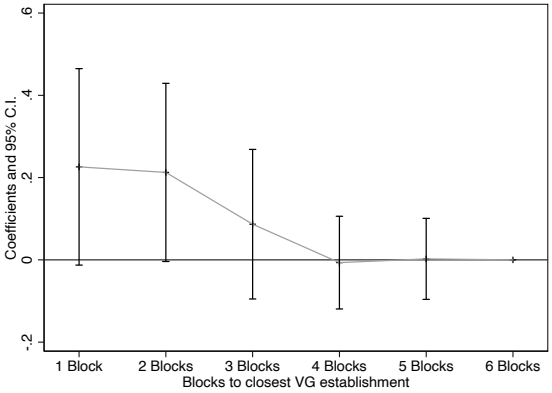
1. Gambling data from the Illinois Gaming Board:
   - Address of the establishments,
   - Number of terminals installed
   - Volume played
2. Geolocated incident level data on crime (January 2006- December 2019)
   - Violent Crimes: Robbery, Agg. Battery, Agg. Assault, Sexual Assault and Homicide.
   - Property Crimes: Larceny, Burglary, and Auto Theft
3. BG characteristics from the 2000 Population Census.

Crime

Proximity to closest video gambling establishment



Violent Crime



Property Crime

Note: Dependent variables is the number of property or violent crimes. Point estimates and 95% confidence intervals using dummy variables for proximity of closest video gambling establishment (i.e., one block, two, etc.). The omitted category is 6 blocks (that is, has at least one video gambling establishment within six blocks).

Crime

Empirical Strategy: Diff-in-Diff

$$Crime_{it} = \alpha_i + \beta\, Within\ 3_{it} + \rho f(RB_{it}) + \phi X_i \times t + \gamma_s \times t + \delta_t + \varepsilon_{it}$$

- where i=BG and t=month-year.
- $f(RB)$, a quadratic function of the linear distance to the nearest casino
- $X_i \times t$, a vector of controls from 2000 census interacted with linear trends
- $\gamma_s \times t$, Chicago region linear trends.
- α_i: BG fixed effect and δ_t: month-year fixed effects.
- Estimate Poisson regressions with clustered SEs at BG-level.
- Main regressions include up to 6 CBGs .

Crime

Main Results: Violent Crime

	(1)	(2)	(3)	(4)	(5)
	(a) Nr Violent Crime				
Within 3	0.1574***	0.1085***	0.1223***	0.0805***	0.0792***
	(0.0222)	(0.0241)	(0.0223)	(0.0203)	(0.0154)
Effect Size	0.12	0.10	0.11	0.07	0.06
Obs	179,088	179,088	179,088	179,088	179,088
Nr BG	1,066	1,066	1,066	1,066	1,066
Estimator	OLS	Poisson	Poisson	Poisson	Poisson
Model	TWFE	TWFE	TWFE	TWFE	Wool
Controls	No	No	Yes	Yes	No
Trends	No	No	No	Yes	No

Mean DV (pre-2012): 1.3. S.E. in parenthesis clustered at BG level. * Significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Crime

Main Results: Property Crime

	(1)	(2)	(3)	(4)	(5)
	(b) Nr Property Crime				
Within 3	0.3743***	0.1620***	0.2002***	0.1515**	0.1217***
	(0.0738)	(0.0605)	(0.0661)	(0.0723)	(0.0444)
Effect Size	0.09	0.05	0.06	0.04	0.03
Obs	179,088	179,088	179,088	179,088	179,088
Nr BG	1,066	1,066	1,066	1,066	1,066
Estimator	OLS	Poisson	Poisson	Poisson	Poisson
Model	TWFE	TWFE	TWFE	TWFE	Wool
Controls	No	No	Yes	Yes	No
Trends	No	No	No	Yes	No

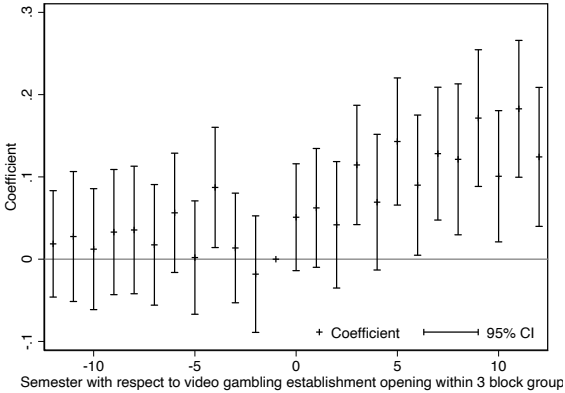
Mean DV (pre-2012): 4.2. S.E. in parenthesis clustered at BG level. * Significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Robustness

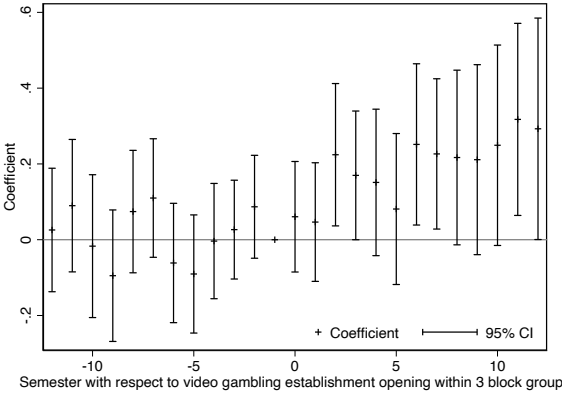
- **Parallel Trends**
- Supply of Bars/Access to Bars
- Estimator (staggered DID)
  - Wooldridge (2023) for Poisson
  - Other estimators (OLS)
- OLS with Alternative Transformations
- Continuous measures of access to gambling

Crime

Robustness: Parallel trends and Effects over time



Violent Crime



Property Crime

Notes: Dependent variables are the number of property or violent crimes. Point estimates and 95% confidence intervals using dummy variables by year with respect to the first video gambling establishment operating within three blocks. The omitted category is the semester prior.

Crime

Potential Mechanisms: Theory

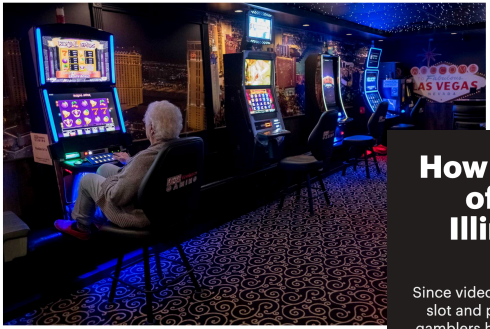
- Standard Becker (1968) model :
  - $\uparrow$ access to gambling, $\uparrow$ need to carry cash $\rightarrow$ more profitable victims

Crime

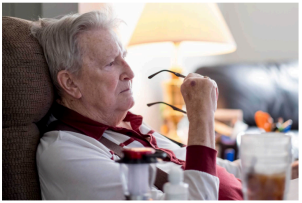
Potential Mechanisms: Addictions

Illinois has done little to address addiction 6½ years into legal video gambling

By Jason Grotto, Sandhya Kambhampati | ProPublica Illinois, and Dan Mihalopoulos | WBEZ Chicago | Feb 20, 2019, 4:00am CST



The Sunset Inn & Suites in Clinton, Illinois, features a video gambling room open to guests and local res... special to ProPublica Illinois)



Orville Dash, a former statistical engineer at Caterpillar, says he lost more than $25,000 on video slot machines. (Whitney Curtis, special to ProPublica Illinois)

THE BAD BET

How Has the "Crack Cocaine of Gambling" Affected Illinois? The State Hasn't Bothered to Check.

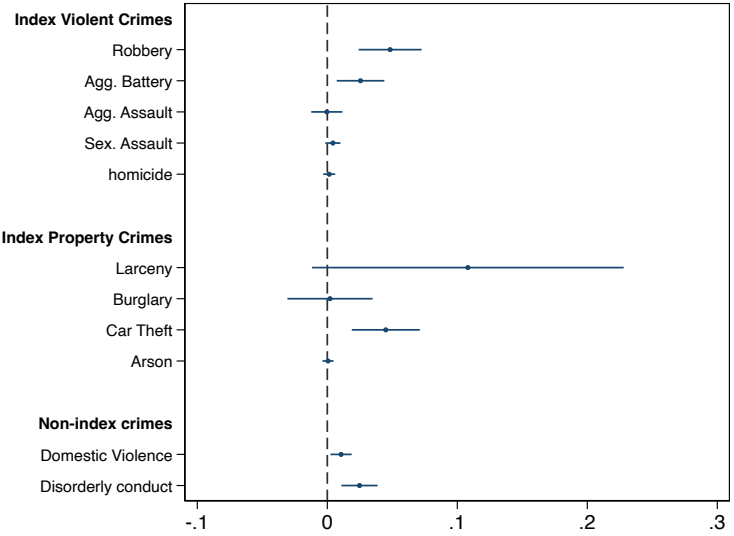
Since video gambling went live in 2012, more than 30,000 video slot and poker machines have been installed in the state and gamblers have lost more than $5 billion. Yet Illinois has failed to address the issue of gambling addiction in any meaningful way.

Crime

Potential Mechanisms: Theory

- Standard Becker (1968) model :
  - ↑ access to gambling, ↑ need to carry cash → more profitable victims
- Problem or pathological gamblers (Wheeler et al., 2011)
  - More likely to engage in criminal activities as a result of financial distress (Kindt and Palchak, 2002)
  - Linked to emotional distress resulting in Domestic violence (Dowling et al., 2016, Lorenz and Shuttlesworth, 1983, Bland et al., 1993)
- ↑ in complementary activities to gambling: alcohol consumption

By Crime Type



Crime

Interpreting Mechanisms

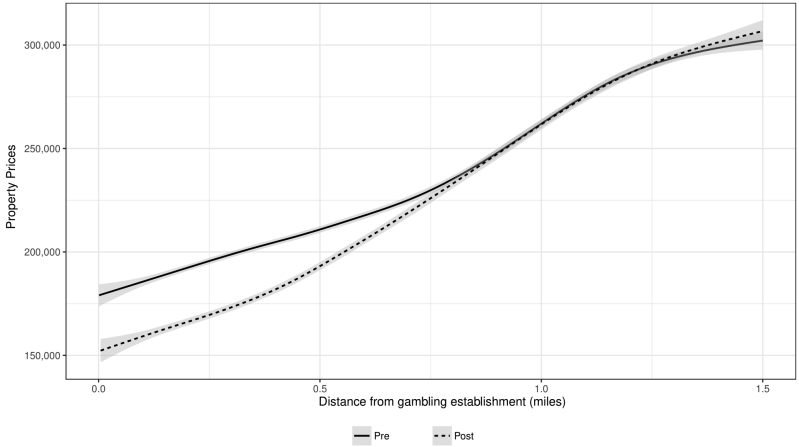
- Standard Becker model:
  - ↑ Robbery and Larceny
- Problem or pathological gambling:
  - Financial distress
    - ↑ Robbery, Larceny, Car Theft
  - Emotional distress:
    - ↑ Agg. Battery, Domestic Violence, Disorderly Conduct
- Alcohol Consumption
  - ↑ Agg. Battery, Domestic Violence, Disorderly Conduct

Property Values

- Expanding access to gambling can be socially costly beyond crime.
- Externalities generated by gambling (e.g. crime, bankruptcy) can be capitalized into property values.
- Important for local governments: lower property values translate into a lower property tax base or redistributes tax burden spatially
- Channels
  1. There is social stigma associated with gambling; therefore, individuals may consider living near an establishment with video gambling terminals as a dis-amenity
  2. Indirectly, through increase in crime

Property Values

Descriptive Evidence: Before and After Gambling



Note: Dependent variables is the log of Sales Price. Point estimates and 90% confidence intervals.

Property Values

Empirical Strategy: Diff-in-Diff

$$\ln Price_{jit} = \alpha_i + \beta\, Within\ 3_{it} + \theta HH_j + \phi X_{it} + t\gamma_n + \delta_t + \varepsilon_{it}$$

- We expand the sample to all single-family homes in Cook County from January 2006 to June 2016 from Corelogic
- where i=BG and t=month-year.
- HH_j Property j characteristics
- $X_{i,t}$, a vector of controls that include socio-demographic characteristics from the Census and proximity to riverboat casinos
- $t\gamma_n$, neighborhood specific time trends
- α_i: BG fixed effect and δ_t: month-year fixed effects.
- Main regressions include up to 6 BGs.

Property Values

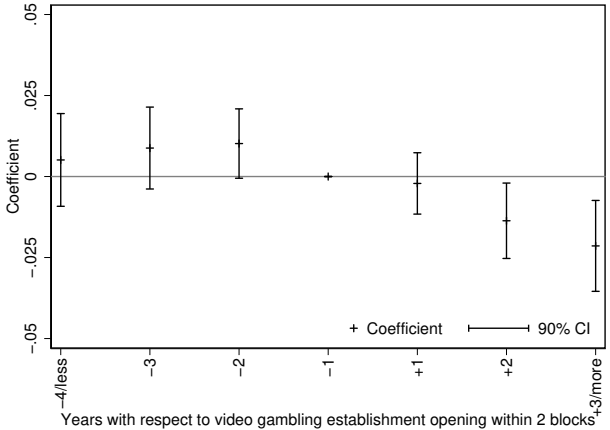
Main Results

	(1)	(2)	(3)	(4)
	log(Property Transaction Price)			
Within 3	-0.0403***	-0.0444***	-0.0211***	-0.0149***
	(0.0064)	(0.0060)	(0.0058)	(0.0056)
Obs	150,624	149,459	149,459	149,457
Nr BG	1,413	1,413	1,413	1,413
Estimator	OLS	OLS	OLS	OLS
Model	TWFE	TWFE	TWFE	TWFE
Controls	No	Property	+ Dist RB	+ Dist RB
Trends	No	No	No	Yes

Notes: * Significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Property Values

Robustness: Parallel trends and over time



Note: Dependent variables is the log of Sales Price. Point estimates and 90% confidence intervals.

Conclusions

- Exposure to video gambling significantly increased violent and property crimes in Chicago.
- The average number of crimes in blocks with exposure to video gambling rises after the policy's implementation. Violent crime increased by 7% and property by 4% in adjacent blocks.
  - Back of the envelope estimates puts the costs of crime to victims in the City of Chicago at around $16 million a year.
- The average house price in Cook County decreased by 1.5-4% near video gambling establishments.

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Previous literature

US

1. Evans and Topoleski (2002). Study spread of Indian casinos and find that crime increases after 4 years since casino opening.
2. Nichols and Tosun (2017). Find mixed results that are sensitive to specification when using county-level panel data for the entire US.
3. Wilson (2001). Riverboat casinos in Indiana lead to small increases in crime without increasing level of offenses.
4. Gazel et al. (2001). Find that casinos in Wisconsin increase crime rates and have negative externalities on neighboring counties.
5. Falls and Thompson (2014). No effect of casinos on property crime rates in Michigan using county-level panel data.

Canada

1. Humphreys and Marchand (2013). Focus on labor market effects, finding that casinos provide a positive employment effect in the short-run.
2. Humphreys and Soebbing (2014). Report little association between gambling (casinos and video lottery terminals) and crime in Alberta. Unable to disentangle positive and negative consequences.

▸ Research Question

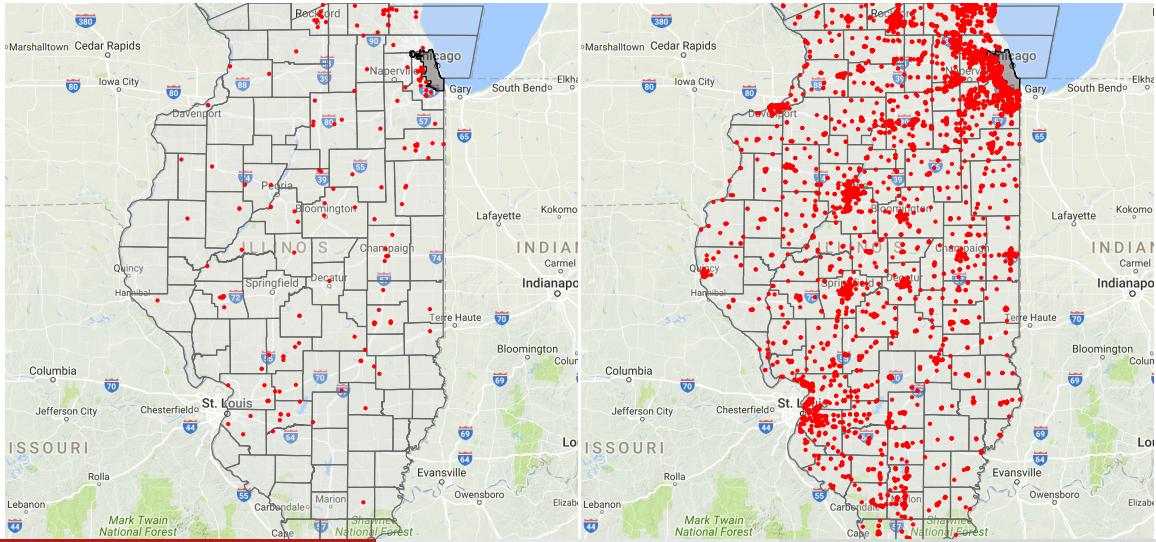
Eligible establishments under the VGA

1. **Licensed establishment**: any retail location with a valid liquor license and not owned by horse racing firms or Riverboat casinos.
2. **Licensed fraternal establishment**: a location where a qualified fraternal organization charter of a national association meets on a regular basis.
3. **Licensed veterans establishment**: a location where a qualified veterans organization charter of a national association meets on a regular basis.
4. **Licensed truck stop establishment**: a facility at least 3-acres in size, with a convenience store, separate diesel islands for commercial motor vehicles, which sells at least 10,000 gallons of fuel per month, and has parking for commercial motor vehicles.

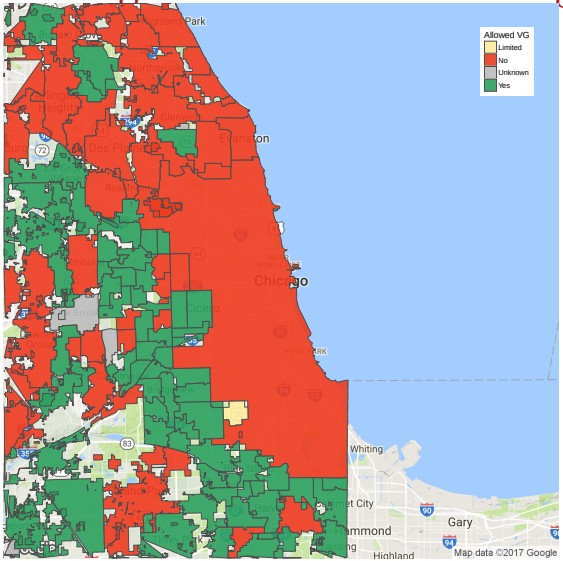
Gambling in Illinois

Increased access to video gambling.

Rapid expansion across the state



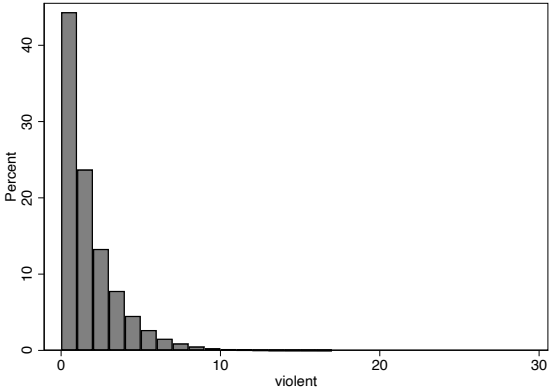
Results of video gambling referendums near Chicago



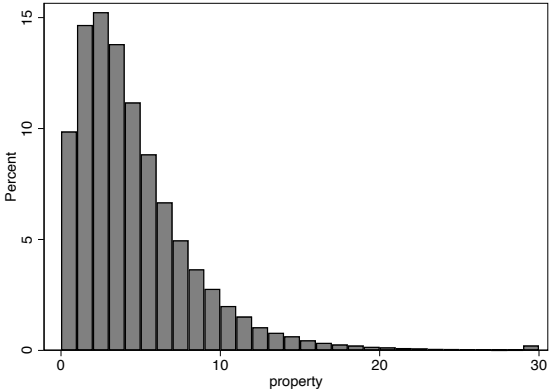
▸ What happened around Chicago? ▸ Gambling in Illinois

Distribution of Crime Incidents

Histograms for Pre-2012 incidents



Violent Crime



Property Crime

- Unit of observation: BG-month.

Robustness

- Parallel Trends
- **Supply of Bars/Access to Bars**
- Estimator (staggered DID)
  - Wooldridge (2023) for Poisson
  - Other estimators (OLS)
- OLS with Alternative Transformations
- Continuous measures of access to gambling

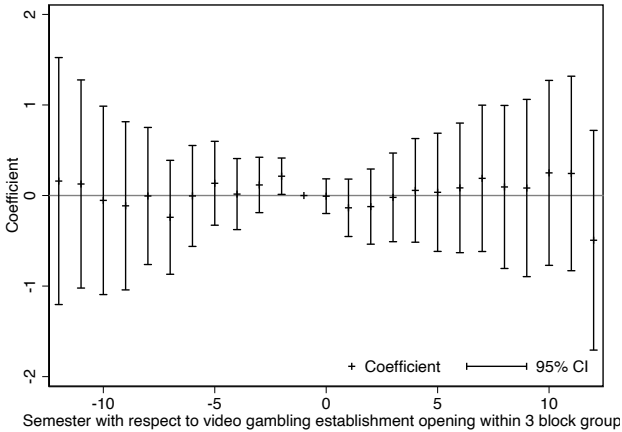
Crime

Robustness: Access to Bars

- In 2016, video gambling terminals brought establishments over $2,500 a month on average in revenues.
- May encourage new bars to open (or extend the life of existing bars)
- Bars located inside Chicago may relocate outside the borders to benefit from video gambling

Supply of Bars

Event Study



Notes: Dependent variables are the number of bars in same BG and within 3 BG. Point estimates and 95% confidence intervals using dummy variables by year with respect to the first video gambling establishment operating within three blocks. The omitted category is the semester prior.

Supply of Bars

Effect of VG adoption on number of bars

	(1)	(2)	(3)	(4)	(5)	(6)
	Nr of bars in same and within 3 BG				Same BG	w/i 3 BG
Within 3	1.0906	-0.0418	0.3463	0.2463	0.0456	0.2223
	(0.8905)	(0.3529)	(0.3672)	(0.3476)	(0.0510)	(0.3457)
Effect Size	0.022	-0.001	0.005	0.003	0.030	0.003
Obs	153,504	150,306	150,306	150,306	62,720	150,306
Nr BG	1,066	1,066	1,066	1,066	448	1,066
Estimator	OLS	Poisson	Poisson	Poisson	Poisson	Poisson
Model	TWFE	TWFE	TWFE	TWFE	TWFE	TWFE
Controls	No	No	Yes	Yes	Yes	Yes
Trends	No	No	No	Yes	Yes	Yes

Notes: Mean DV (pre-2012): 49.3. (same 0.5). S.E. in parenthesis clustered at BG level. * Significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Crime: control for bars

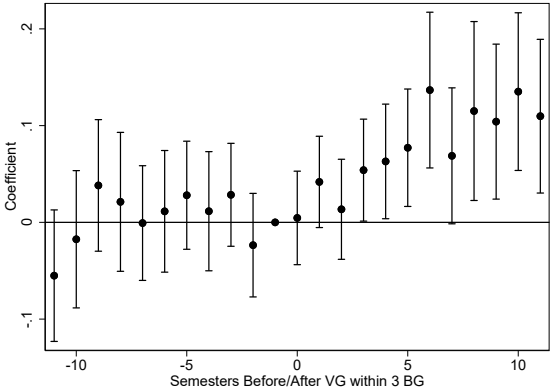
	(1)	(2)	(3)	(4)	(5)
	(a) Violent Crime				
Within 3	0.0805***	0.0669***	0.0664***	0.0667***	0.0662***
	(0.0203)	(0.0191)	(0.0191)	(0.0191)	(0.0191)
Nr Bars: Same BG			0.0101		0.0100
			(0.0081)		(0.0081)
Nr Bars: w/i 3 (/100)				0.0082	0.0069
				(0.0307)	(0.0308)
	(b) Property Crime				
Within 3	0.1515**	0.1335**	0.1320**	0.1341**	0.1326**
	(0.0723)	(0.0644)	(0.0642)	(0.0649)	(0.0646)
Nr Bars: Same BG			0.0263		0.0265
			(0.0213)		(0.0213)
Nr Bars: w/i 3 (/100)				-0.0185	-0.0221
				(0.0704)	(0.0703)
Observations	179,088	153,504	153,504	153,504	153,504
Number of Blocks	1,066	1,066	1,066	1,066	1,066
Estimator	Poisson	Poisson	Poisson	Poisson	Poisson
Model	TWFE	TWFE	TWFE	TWFE	TWFE
Controls	Yes	Yes	Yes	Yes	Yes
Trends	Yes	Yes	Yes	Yes	Yes

Robustness

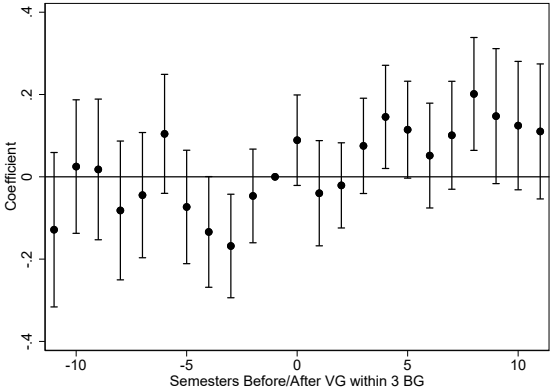
- Parallel Trends
- Supply of Bars/Access to Bars
- **Estimator (staggered DID)**
  - **Wooldridge (2023) for Poisson**
  - Other estimators (OLS)
- OLS with Alternative Transformations
- Continuous measures of access to gambling

Crime

Robustness: Alternative Estimator for Staggered DID



Violent Crime



Property Crime

Notes: Dependent variables are the number of property or violent crimes. Point estimates and 95% confidence intervals using dummy variables by year with respect to the first video gambling establishment operating within three blocks. The omitted category is the semester prior.

Crime

Main Results: Violent Crime

	(1)	(2)	(3)	(4)	(5)
	(a) Nr Violent Crime				
Within 3	0.1574***	0.1085***	0.1223***	0.0805***	0.0792***
	(0.0222)	(0.0241)	(0.0223)	(0.0203)	(0.0154)
Effect Size	0.12	0.10	0.11	0.07	0.06
Obs	179,088	179,088	179,088	179,088	179,088
Nr BG	1,066	1,066	1,066	1,066	1,066
Estimator	OLS	Poisson	Poisson	Poisson	Poisson
Model	TWFE	TWFE	TWFE	TWFE	Wool
Controls	No	No	Yes	Yes	No
Trends	No	No	No	Yes	No

Mean DV (pre-2012): 1.3. S.E. in parenthesis clustered at BG level. * Significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Crime

Main Results: Property Crime

	(1)	(2)	(3)	(4)	(5)
	(b) Nr Property Crime				
Within 3	0.3743***	0.1620***	0.2002***	0.1515**	0.1217***
	(0.0738)	(0.0605)	(0.0661)	(0.0723)	(0.0444)
Effect Size	0.09	0.05	0.06	0.04	0.03
Obs	179,088	179,088	179,088	179,088	179,088
Nr BG	1,066	1,066	1,066	1,066	1,066
Estimator	OLS	Poisson	Poisson	Poisson	Poisson
Model	TWFE	TWFE	TWFE	TWFE	Wool
Controls	No	No	Yes	Yes	No
Trends	No	No	No	Yes	No

Mean DV (pre-2012): 4.2. S.E. in parenthesis clustered at BG level. * Significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Robustness

- Parallel Trends
- Supply of Bars/Access to Bars
- **Estimator (staggered DID)**
  - Wooldridge (2023) for Poisson
  - **Other estimators (OLS)**
- **OLS with Alternative Transformations**
- Continuous measures of access to gambling

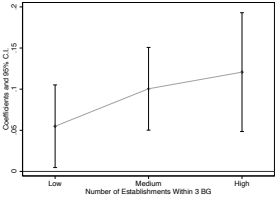
OLS: estimators and transformations

- Results are similar using OLS and other DID approaches:
  - Borusyak, Jaravel, Spiess (2024)
  - Gardner (2022)
  - de Chaisemartin & D'Haultfoeuille (2021)
- Also similar when using $log(Y+1)$ or $ARCHSINH(Y)$ transformations
  - ...though we need to be cautious (Chen and Roth, 2024)
  - Robust to using methods above.

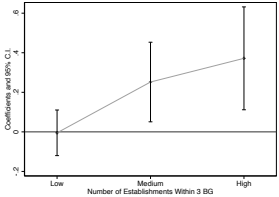
Robustness

- Parallel Trends
- Supply of Bars/Access to Bars
- Estimator (staggered DID)
  - Wooldridge (2023) for Poisson
  - Other estimators (OLS)
- OLS with Alternative Transformations
- **Continuous measures of access to gambling**

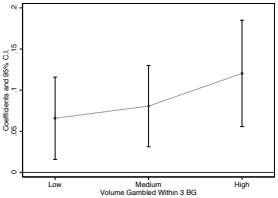
Crime by exposure

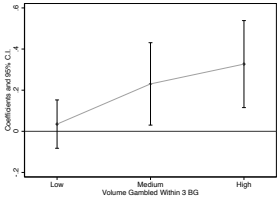


Violent Crime



Property Crime





Alternative measures of access

- Do effects vary with exposure/intensity?
- We use alternative measures of exposure:
  - Number of establishments within 3 BG
  - log(Volume Gambled + 1) within 3 BG
  - Access to VG driving (miles)
  - Access to VG driving (time)

- We measure Access *a la trade*

$$Access_{it} = \sum_{j \in J} exp(-dist_{ijt}) \tag{1}$$

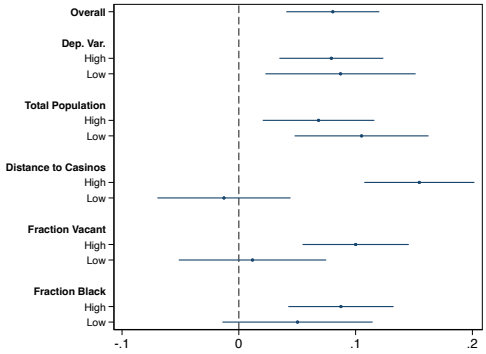
where

- $dist_{ij}$ measures the distance or time driving between centroid of BG i and establishment j in month t
- Measure is standardized with mean 0 and sd 1 for interpretation.

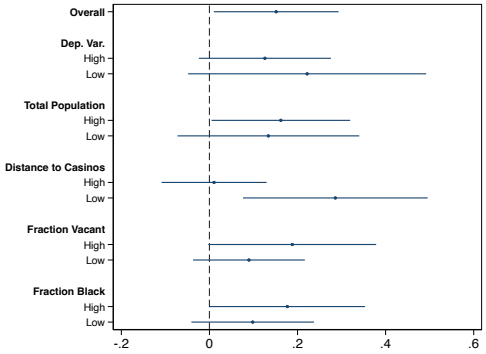
Continuous measures of access

	(1)	(2)	(3)	(4)
	(a) Violent Crimes			
Nr Establishments (/10)	0.0305**			
	(0.0155)			
log(Vol. Gambled +1)		0.0186***		
		(0.0040)		
Access to VG (miles)			0.0326***	
			(0.0099)	
Access to VG (minutes)				0.0442***
				(0.0076)
	(b) Property Crime			
Nr Establishments (/10)	0.0969***			
	(0.0367)			
log(Vol. Gambled +1)		0.0393***		
		(0.0144)		
Access to VG (miles)			0.0509*	
			(0.0287)	
Access to VG (minutes)				0.0381**
				(0.0180)

Heterogeneity



Violent Crime



Property Crime

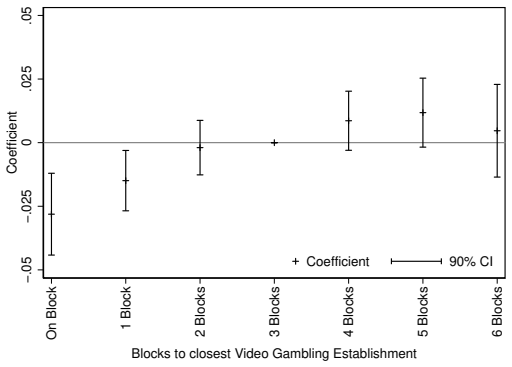
House characteristics

- Log of Living Sqft.
- Age
- Brick Exterior
- Has a basement
- Has a fireplace
- Has 1 garage

properties

Property Values

Identification



Note: Dependent variables is the log of Sales Price. Point estimates and 90% confidence intervals using dummy variables for proximity of closest video gambling establishment (i.e., one block, two, etc.). The omitted category is 6 blocks (that is, has at least one video gambling establishment within six blocks).