# Importing the Opioid Crisis? International Trade and Drug Overdoses

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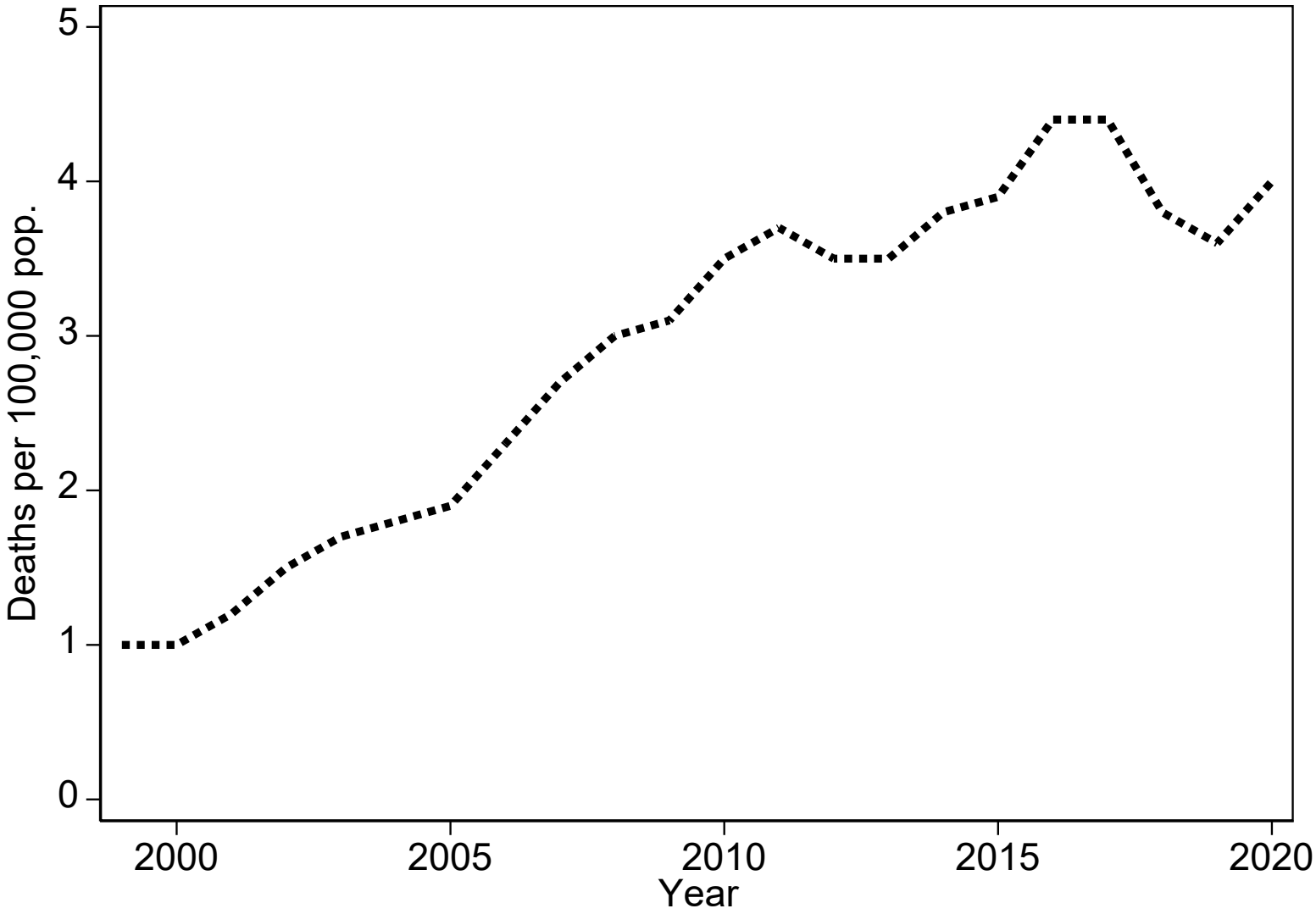
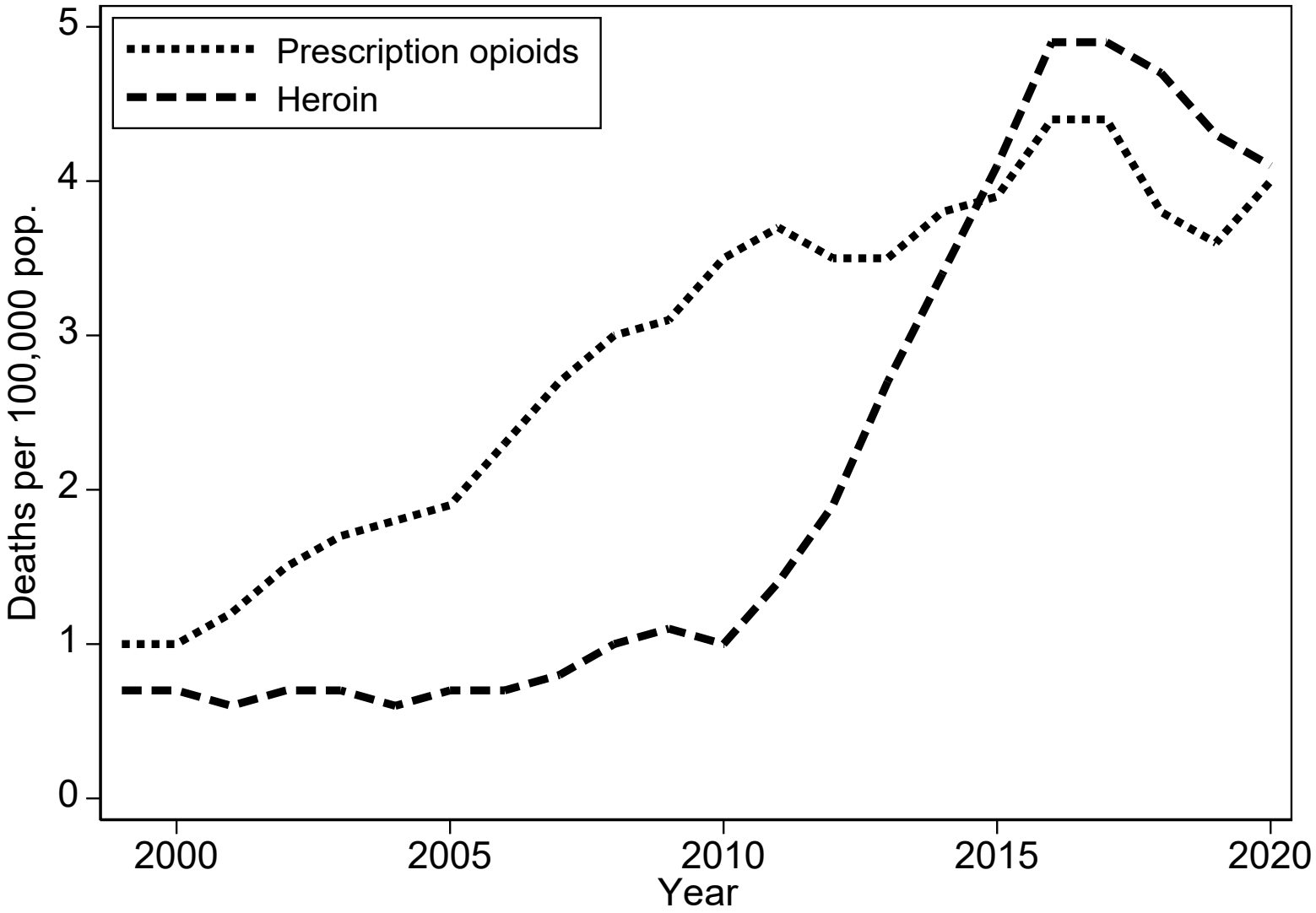
with Ben Hansen (Oregon & NBER)

and Will Olney (Williams)

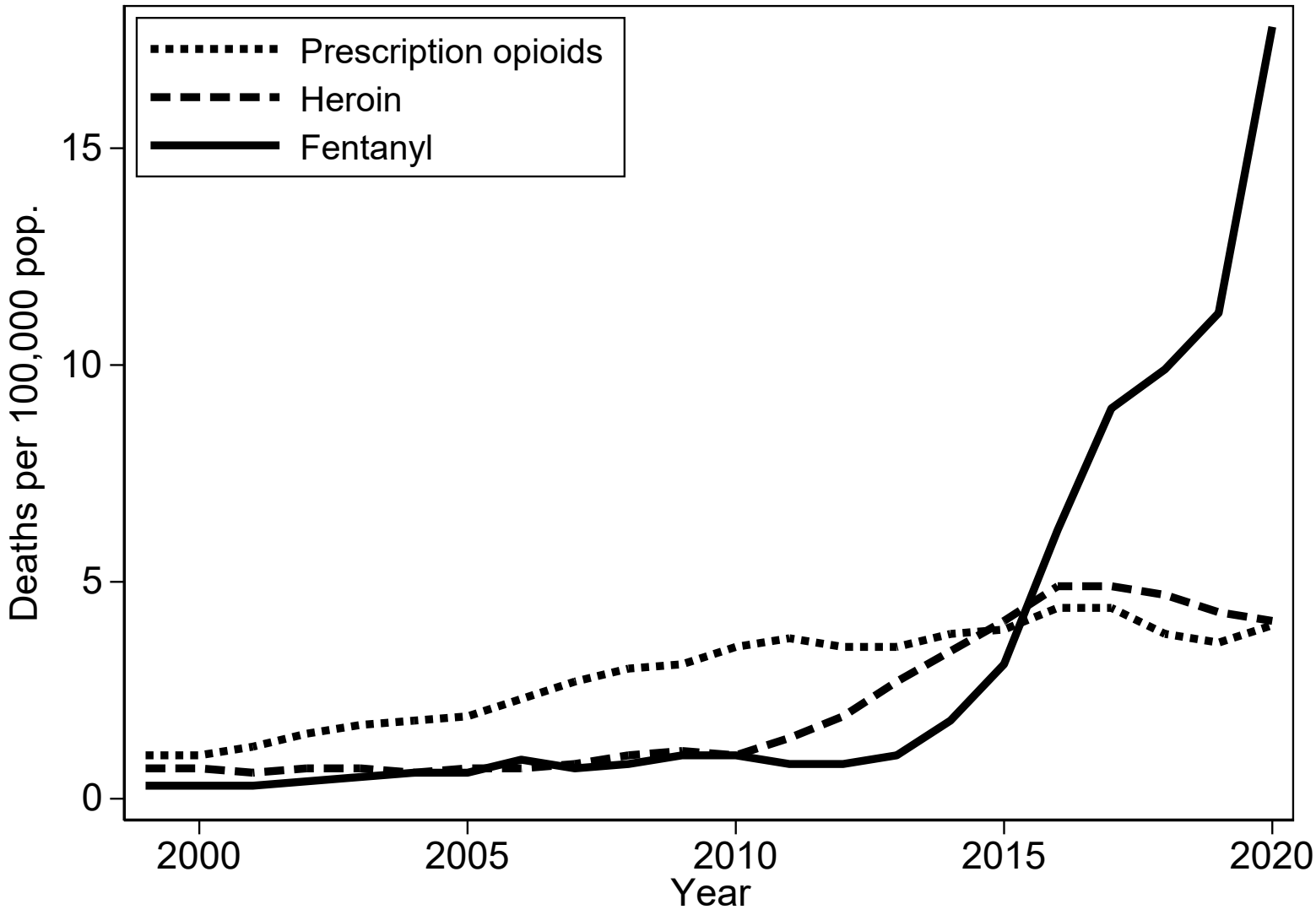
# Opioid crisis began with prescription opioids…



# Before being surpassed by heroin overdoses…



# And then swamped by fentanyl overdoses



# The opioid crisis is now an illicit drug crisis

- Fentanyl now present in 90% of opioid overdose deaths
  - Opioid overdose deaths w. only prescription opioids now < 5%

- Rapidly become one of the most pressing concerns in U.S. society
  - 76,000 fentanyl deaths in most recent 12 months of data (to 2/2023)

    More than for breast cancer (43K), prostate cancer (33K), liver disease/cirrhosis (57K), all gun deaths (46K), homicides (26K), motor vehicle accidents (47K)
  - Fentanyl overdose is the leading cause of death for ages 18-45 years
  - Focus on overdoses, but other negative effects of opioid addiction

    E.g., Buckles et al. 2022, Harris et al. 2020, Powell et al. 2019, Arteaga & Barone 2022

- Lack literature on fentanyl, new empirical and policy challenges
  - Maclean, Mallatt, Ruhm & Simon (2022) reviewed 177 economic studies on the opioid crisis; 5 covered any aspect of fentanyl market

# Our paper

- Examine relationship between state-level legal imports and drug overdoses between 2008 and 2020
  - **Idea:** More imports decrease detection risk of drug smuggling

- Find that fatal overdoses are positively related to imports per capita since the rise of fentanyl in 2013
  - Similar relationship in forensic drug cases by local police agencies – around 120K fentanyl cases per year by end of sample period

- Do not find alternative explanation for this import-overdose link
  - *Note:* Import competition "China shock" affects local labor markets (e.g., Autor, Dorn & Hanson 2013), not where imports are coming in

- This channel can account for 15-20K deaths per year over 2017-2020

# Contributions

1. Identify a new and recent supply-side determinant of opioid problems
   - Growing literature on the supply of prescription opioids

     E.g., triplicate programs (Alpert et al. 2019); prescription drug monitoring programs (Meara et al. 2016, Moyo et al. 2017, Buchmueller & Carey 2018); abuse-deterrent formulations (Alpert, Pacula & Powell 2018; Evans, Lieber & Power 2018); physician behavior (Schell 2022); ER practices (Eichmeyer & Zhang 2022); marketing to physicians (Nguyen, Bradford & Simon 2019)
   - Few studies examine determinants of illicit opioid supply and demand

     E.g., Alpert et al. 2018; Evans et al. 2018; Pardo et al. 2019; Moore & Schnepel 2023

2. Identify a cost of trade associated with a potent new opioid
   - Adds to literature on costs of trade and smuggling/evasion

     E.g., Autor, Dorn Hansen 2013; Fisman & Wei 2004, 2009; Mishra et al., 2008

3. Important application of forensic economics (Zitzewitz 2012; Dell 2015)
   - Increases insights into drug trafficking (McCully 2021)
   - Fentanyl smuggling patterns different to customs/border seizures

# Background on fentanyl

- Synthetic opioid created in the 1960s, approved by FDA in 1972
  - Used for major surgery and to treat severe pain and advanced cancer
  - US legal market is tightly regulated, <1 kg in US pharmacies in 2020

- "Fentanyl" typically covers fentanyl analogs and novel synthetic opioids
  - Potency is typically 50+ times morphine and heroin
  - Fentanyl price 90% lower than equivalent heroin dose (Miller 2020)
  - Like other opioids, death occurs when drug slows and stops breathing


*White grains are amount of fentanyl for fatal overdose*

# Illicit fentanyl supply

- Rapid increase in illicit fentanyl globally since 2013
  - Worst problems in US, but fentanyl problems elsewhere, e.g., Canada
- Mix of factors thought to contribute to its rise
  - Production simplified 10-15 years ago, from “chemists” to “cooks”
  - Large stock of opioid users, policies restricting access to other opioids
  - Regulatory gaps for fentanyl in many countries
- China is main producer of illicit fentanyl (Pardo et al. 2019)
  - Large pharmaceutical industry with limited oversight
  - Thought to be smuggled directly and via other countries

# The changing geography of the opioid epidemic

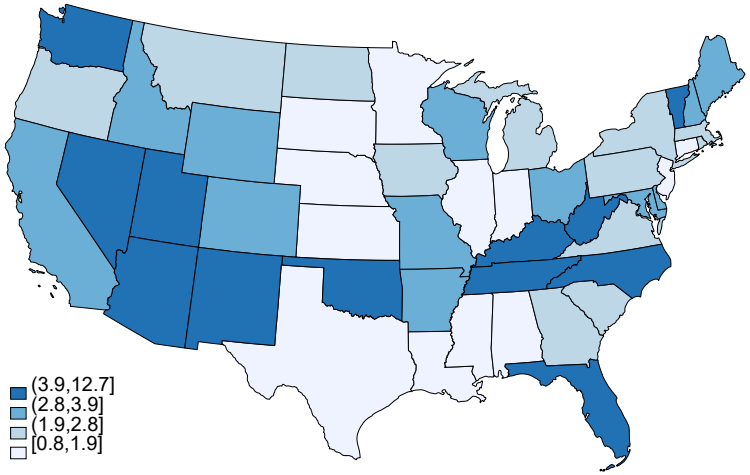
- Economic research has highlighted that past prescription opioid abuse affects current levels of opioid problems. E.g.,
  - States targeted by Purdue Pharma in 1990s due to poor drug monitoring have higher opioid problems now (Alpert, Evans, Lieber & Powell 2022)
  - Areas targeted by Purdue Pharma due to high cancer rates have high opioid problems, SNAP, disability insurance (Arteaga & Barone 2022)

- Policies addressing prescription drug abuse increased use of illicit opioids, again emphasizing demand factors
  - E.g., Introducing abuse-deterrent OxyContin in 2010 increased heroin use (Alpert, Pacula and Powell 2018; Evans, Lieber & Power 2018)

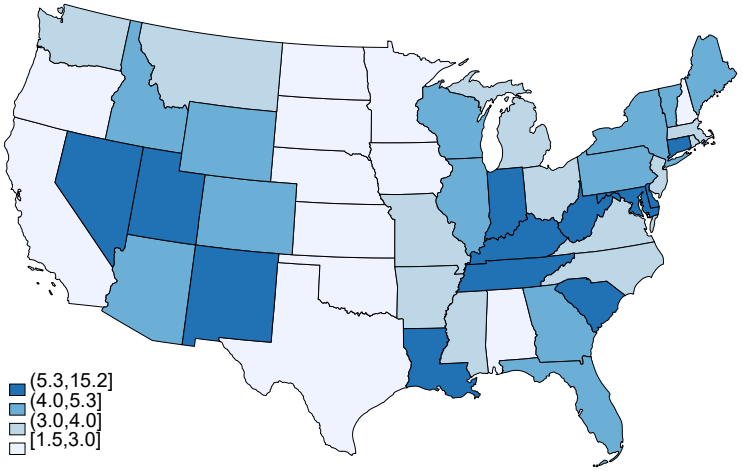
- However, recent changes in geographic patterns point to relevance of new supply factors

# Oxycodone (prescription) and fentanyl overdoses

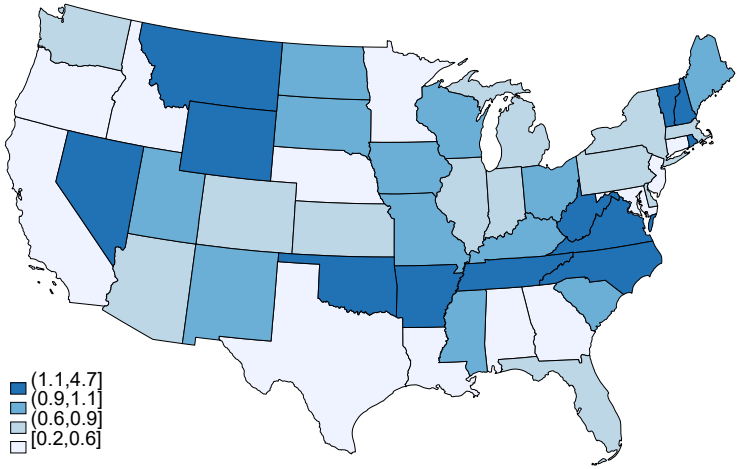
Oxycodone, 2008
[Ave. 3.45 deaths per 100,000]



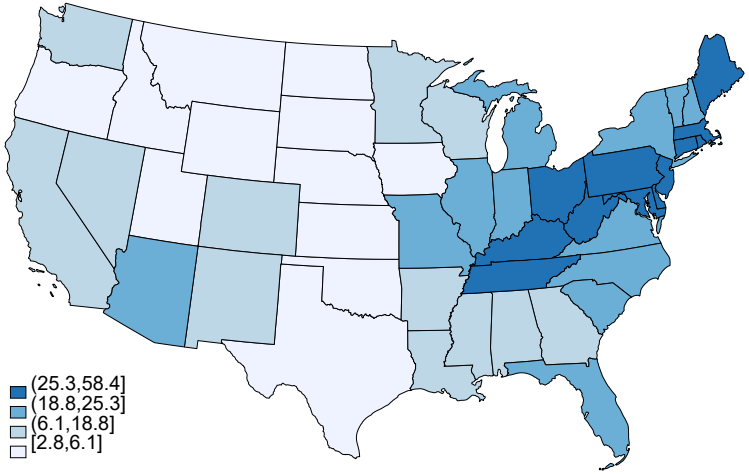

Oxycodone, 2020
[Ave. 4.52 deaths per 100,000]




Fentanyl, 2008
[Ave. 0.99 deaths per 100,000]




Fentanyl, 2020
[Ave. 17.4 deaths per 100,000]




*Notes:* Relative differences in a given year (each color represents a quartile of continental US).

# Imports and drug smuggling

- Understood illicit drugs and other goods are smuggled in legal imports
  - Smuggling via shipping containers key in Australia's heroin epidemic
  - Legal trade used to smuggle restricted goods, like antiques (Fisman & Wei 2009) and natural resources (Vezina 2015)
  - Extensive misreporting to evade tariffs (Slemrod 2019)
  - Reports Chinese mislabel fentanyl-related goods (Westhoff 2019)

- Federal government is concerned about role of legal supply chains
  - White House issued supply-chain warnings to businesses in 2019
  - Customs & Border Protection & Drug Enforcement Agency find fentanyl
    - Not just pharmaceuticals and not just goods from China

- Exact role of imports in smuggling not well understood

# Why might it matter where fentanyl sent?

- We focus on state where imports are unloaded
  - Security seals on containers and GPS tracking until this point

- Smuggling location may matter, as domestic fentanyl distribution has risks
  - ~1,000 federal convictions for fentanyl trafficking last year, thousands of fentanyl seizures by state and local authorities
  - Cross-state smuggling exposes smugglers to more laws & agencies
  - Less risky to distribute fentanyl near smuggling location and through personal connections

- Proximity to key smuggling locations has been shown to be important for crack cocaine problems (Evans, Garthwaite & Moore 2016) and Australian heroin prices (Moore et al. 2005)

# Distribution of imports across the US

- Imports depend on natural resources, industries, broad population characteristics (Wolf 2000, Knaap 2006, Bailey et al. 2018)
  - Substantial differences in states' value of imports per capita
  - Substantial variation in mix of products and source countries
  - Patterns are persistent: rank correlation between 2008 & 2020 is 0.9

States ranked by value of imports per capita, 2008-2020 ($000s)

| Top quintile | | Second quintile | | Middle quintile | | Fourth quintile | | Bottom quintile | |
|---|---|---|---|---|---|---|---|---|---|
| State | Ave. | State | Ave. | State | Ave. | State | Ave. | State | Ave. |
| New Jersey | 12.2 | New Hampshire | 7.6 | Massachusetts | 4.8 | Mississippi | 3.7 | Alaska | 2.4 |
| Michigan | 11.2 | South Carolina | 7.1 | Maryland | 4.5 | Florida | 3.5 | Nebraska | 1.9 |
| Tennessee | 10.2 | Indiana | 7.0 | Louisiana | 4.4 | Nevada | 3.1 | Colorado | 1.9 |
| California | 9.3 | New York | 6.4 | Minnesota | 4.4 | Idaho | 3.0 | West Virginia | 1.9 |
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| Georgia | 7.7 | North Carolina | 5.0 | Kansas | 3.7 | Arkansas | 2.6 | South Dakota | 1.1 |

# Empirical approach

- There is a large shock to fentanyl supply starting around 2013
  - ➢ We use a national shock and see if imports mediate sensitivity to it
    - ➢ We do not explain the reasons for the overall rise of fentanyl

- Imports can be used to smuggle drugs, and authorities know this
  - But difficult to know how much, from where, establish empirically
  - ➢ Expect that more imports makes it easier to smuggle more fentanyl
  - ➢ But initially agnostic about types of imports, source countries, etc.

- Substantial spatial variation in imports across the US for reasons unlikely to be strongly related to other determinants of opioid problems
  - ➢ Key assumption: import differences not related to other factors affecting the demand and supply of opioids – will test for this
  - ➢ Will check for reverse causality using imports from 2008

# Main data

- Mortality: National Vital Statistics System data
  - Compilation from death certificates: census of deaths in US
  - Overdoses coded by opioid type, including fentanyl, heroin, oxycodone

- Trade: U.S. Census data on imports by state (available from 2008)
  - Value of imports based on port of unlading; includes packages
  - By method of transport, product codes, country of origin, and weight
  - Remove oil and gas imports (NAICS 211)

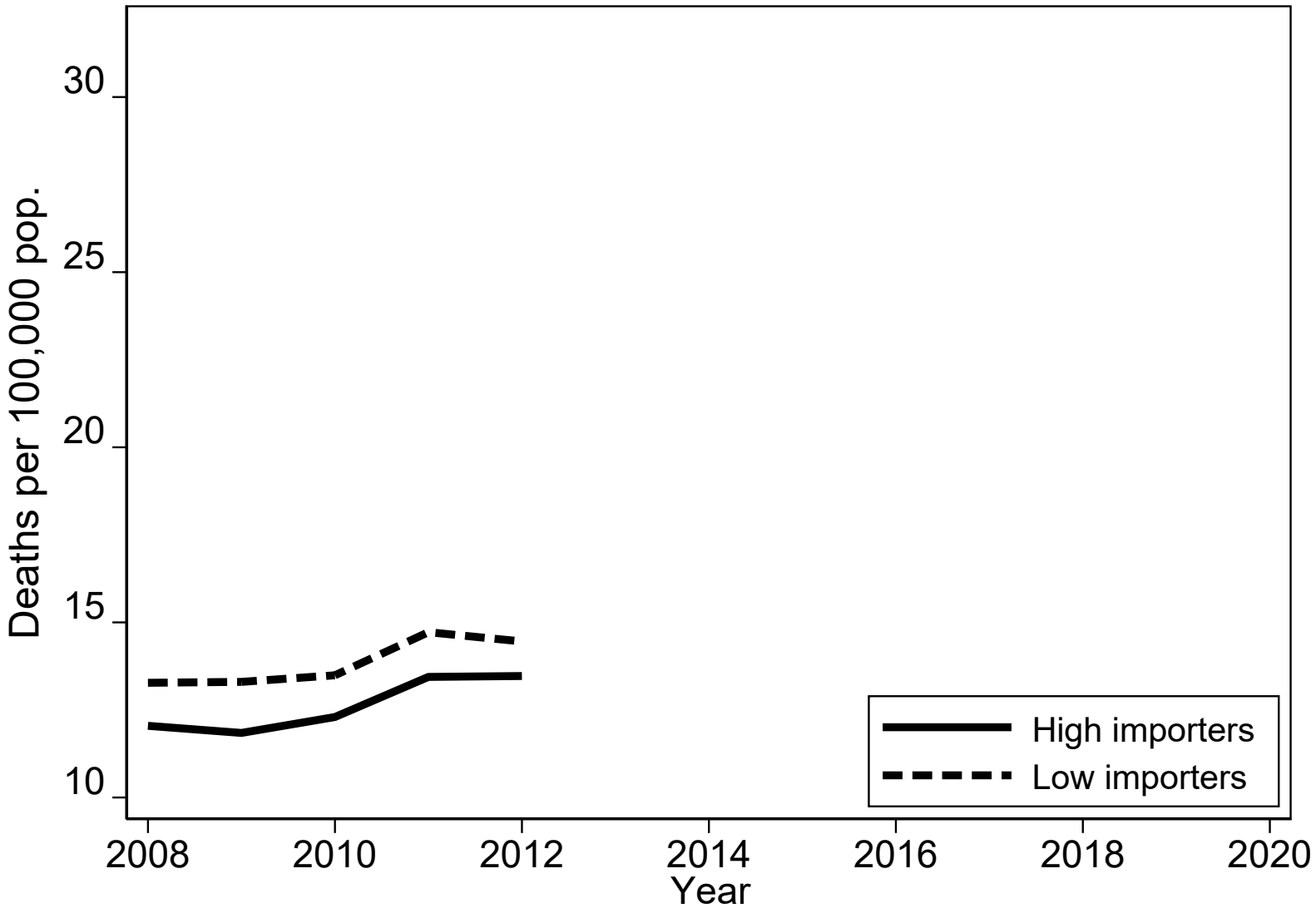
- Police forensic cases: DEA National Forensic Laboratory Information System

- Other data: demographic and economic variables, DEA data on supply of legal opioids, Prescription Drug Monitoring Program laws dates, triplicate status, import competition, land border crossings (Bureau Trans. Services)

# Graphical evidence using raw overdose rates

- Can examine effects by splitting states based on median imports per capita throughout the sample period and plotting drug overdoses
  - Groups are same throughout: “high import” and “low import” states
- Low import states are less treated (not untreated)
- Further split overdoses by opioid/non-opioid and fentanyl/non-fentanyl

# Drug overdose rates by median imports / person



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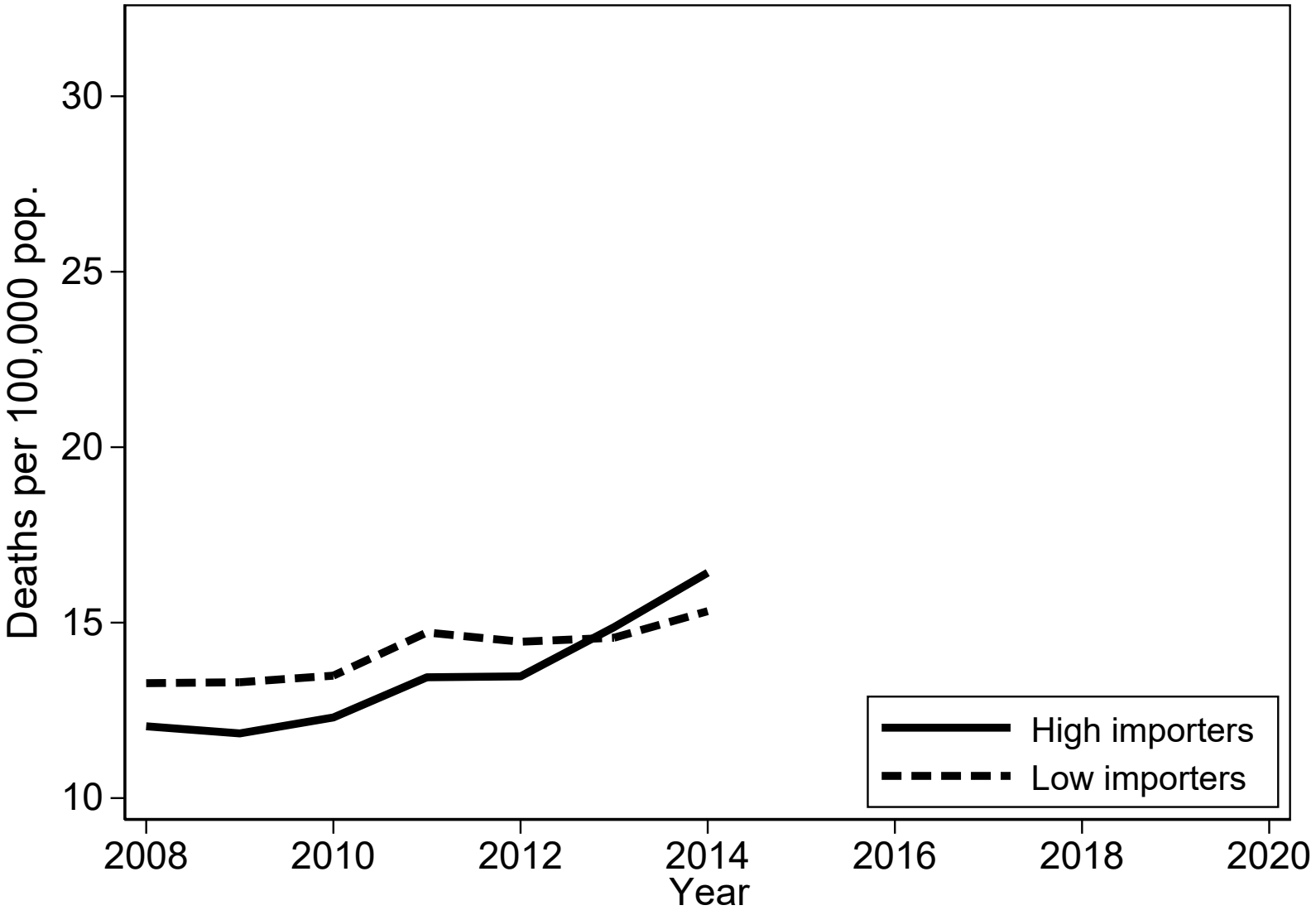

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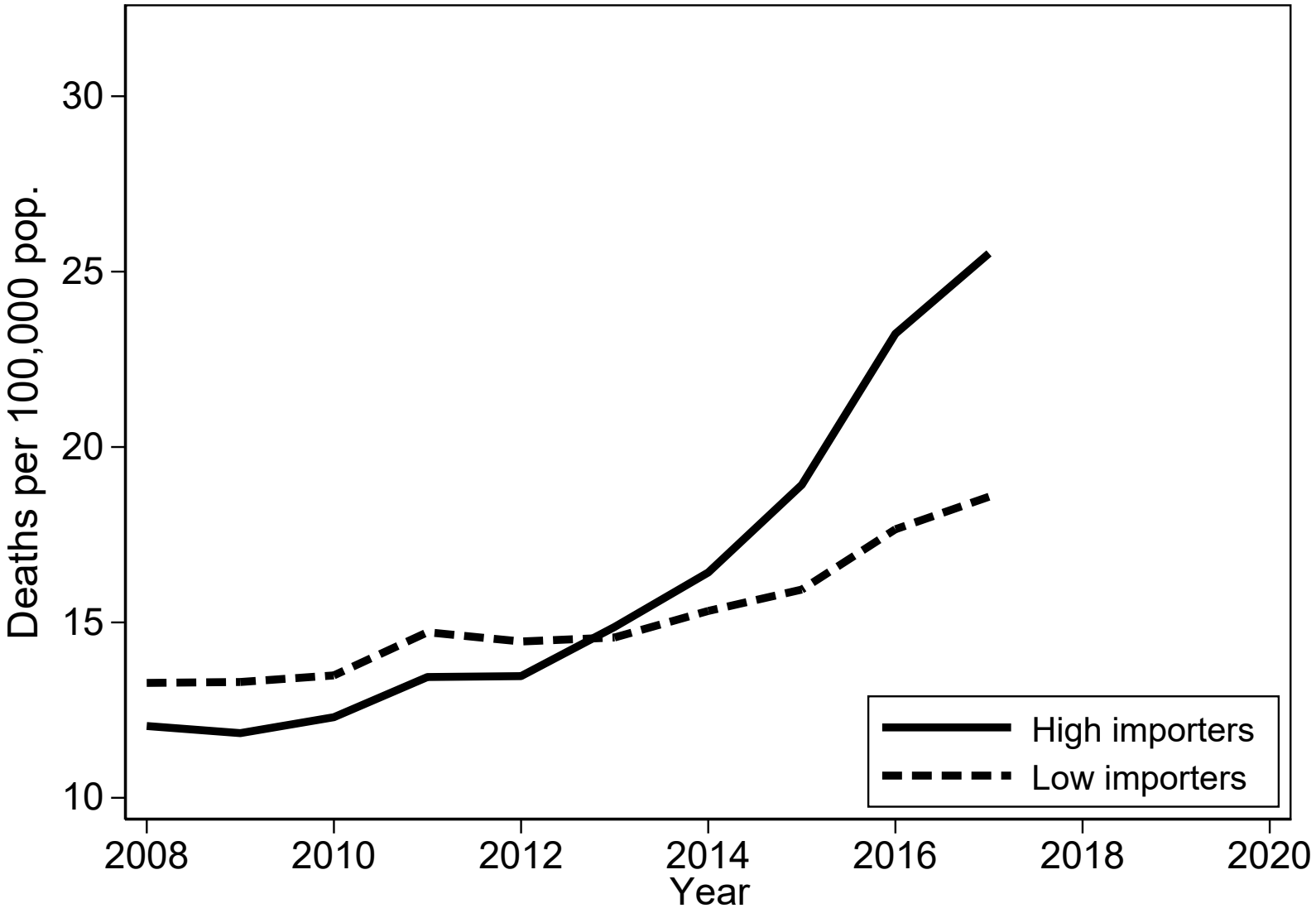

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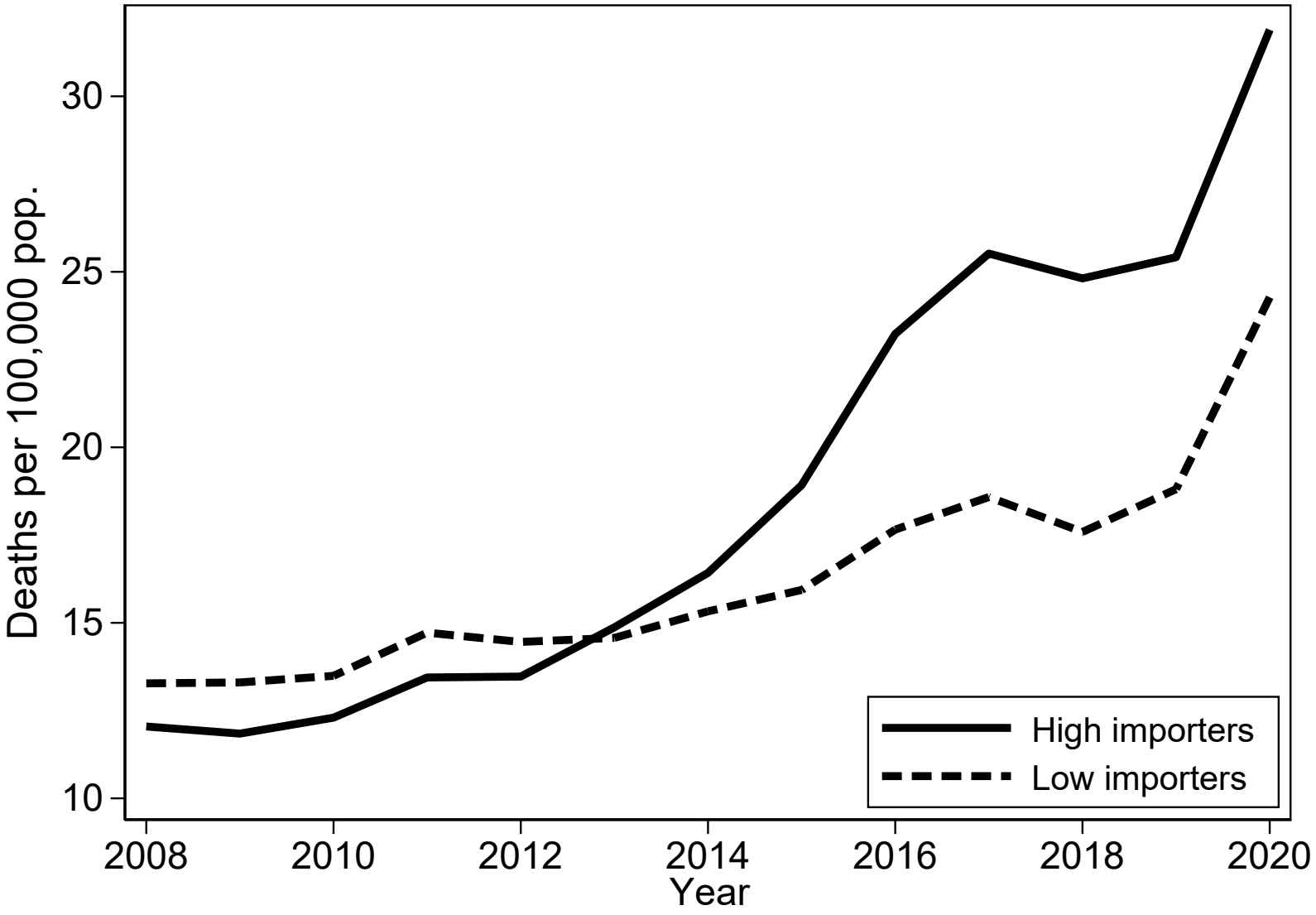
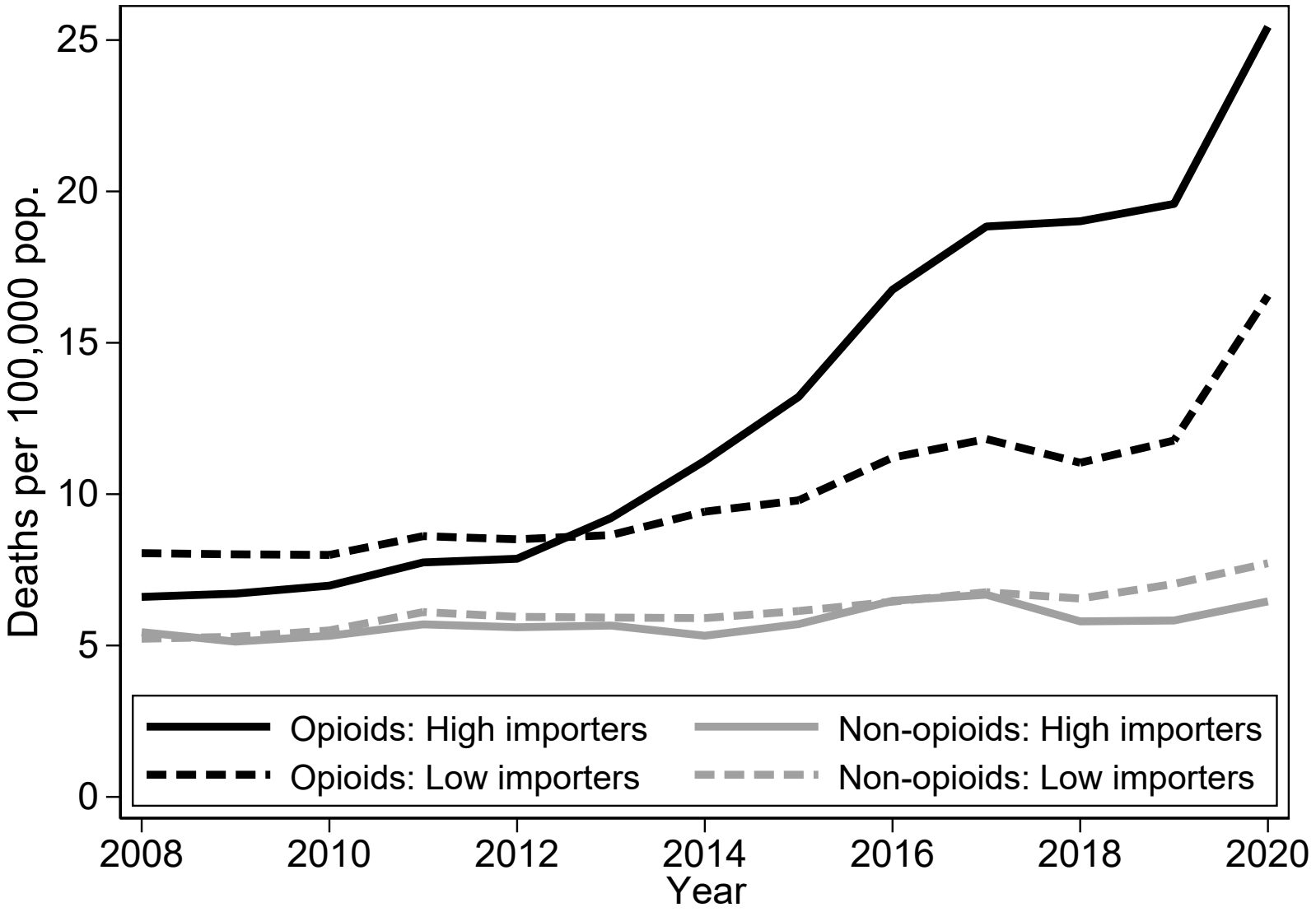
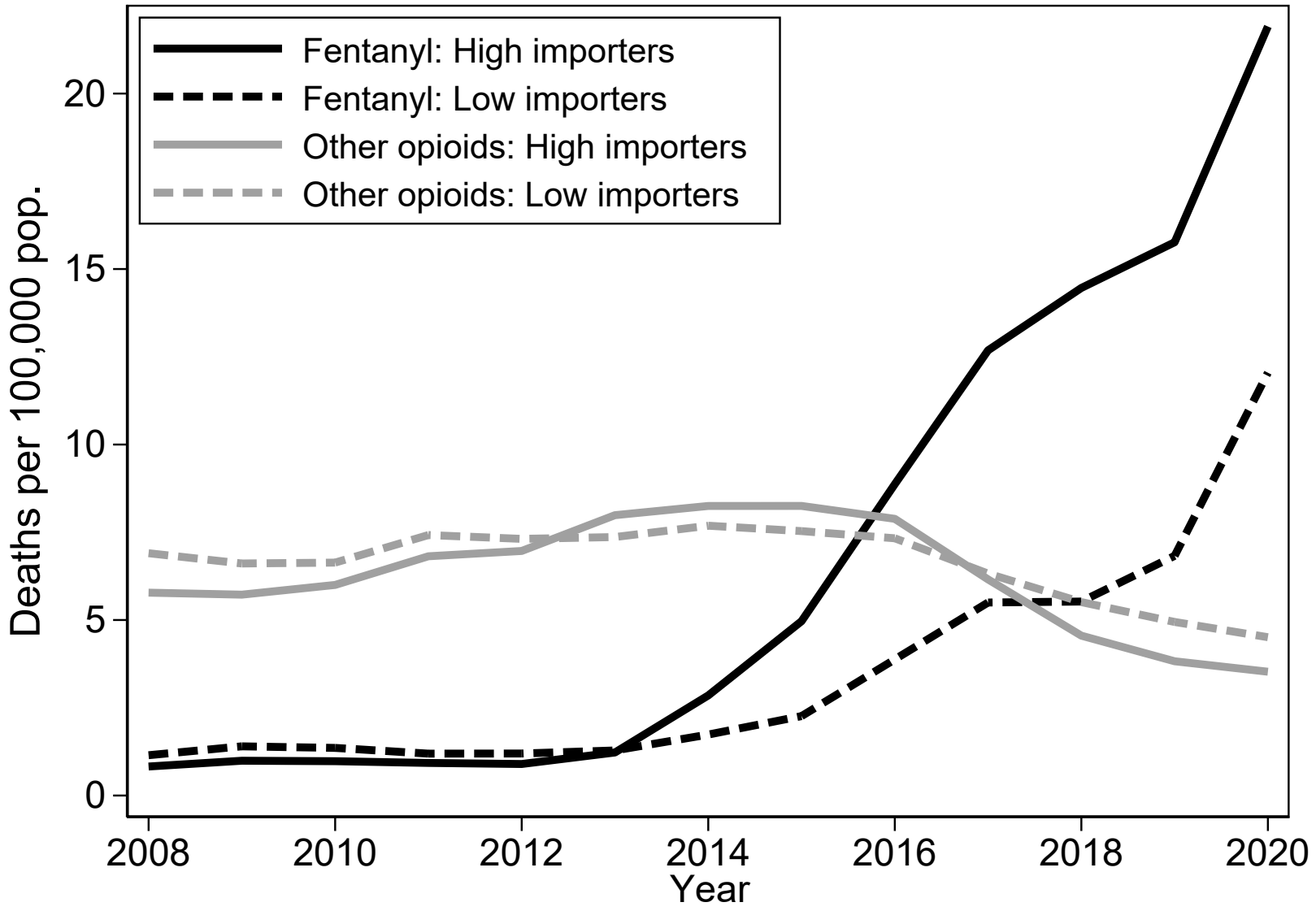


# Opioid and non-opioid overdoses



# Fentanyl and non-fentanyl opioid overdoses



# Pairwise comparisons using nearby states

- Can also compare overdose rates across states that are close to each other and "similar," but that have different imports per capita

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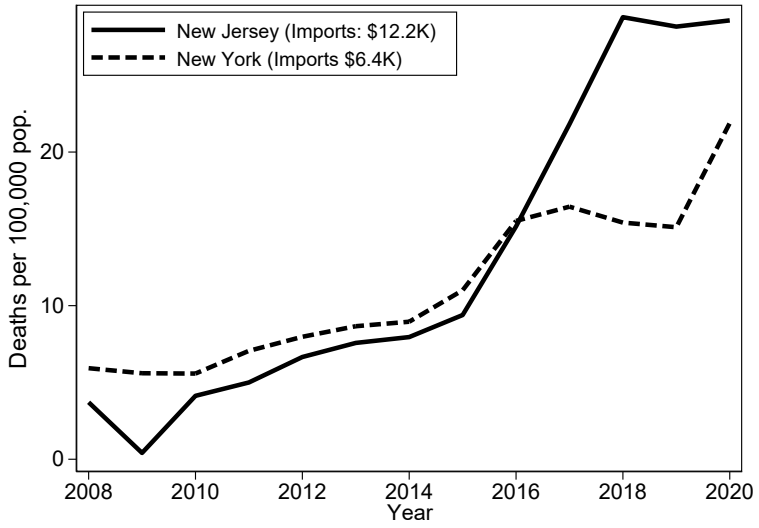
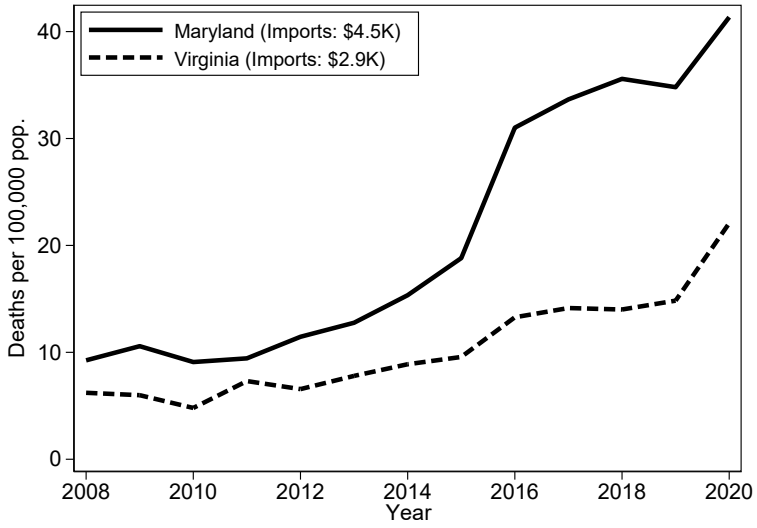
# Opioid deaths in nearby states with different levels of imports

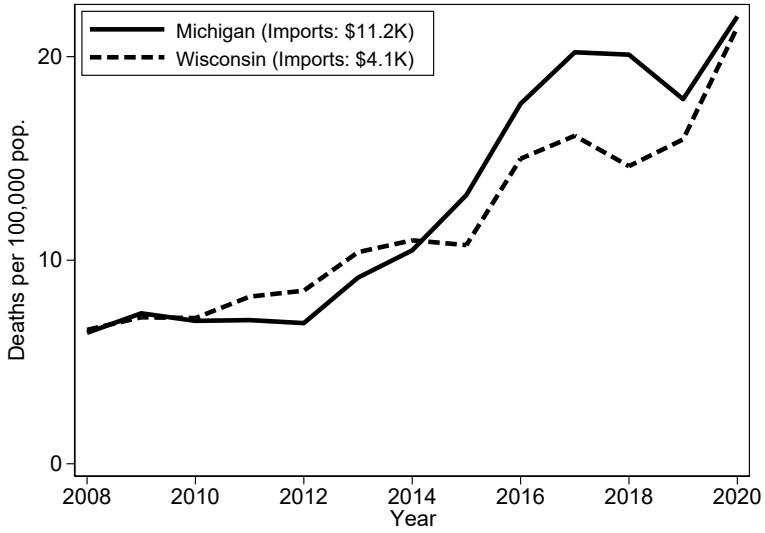
## A: New Jersey and New York



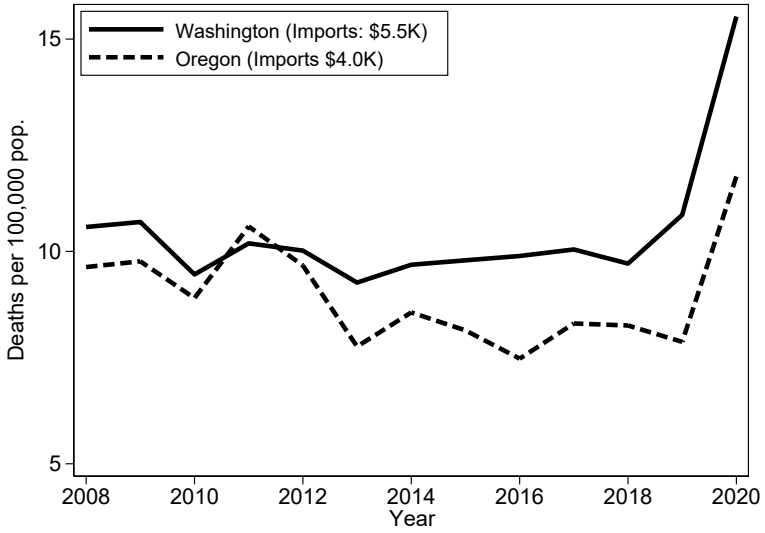

## B: Maryland and Virginia




## C: Michigan and Wisconsin




## D: Washington and Oregon

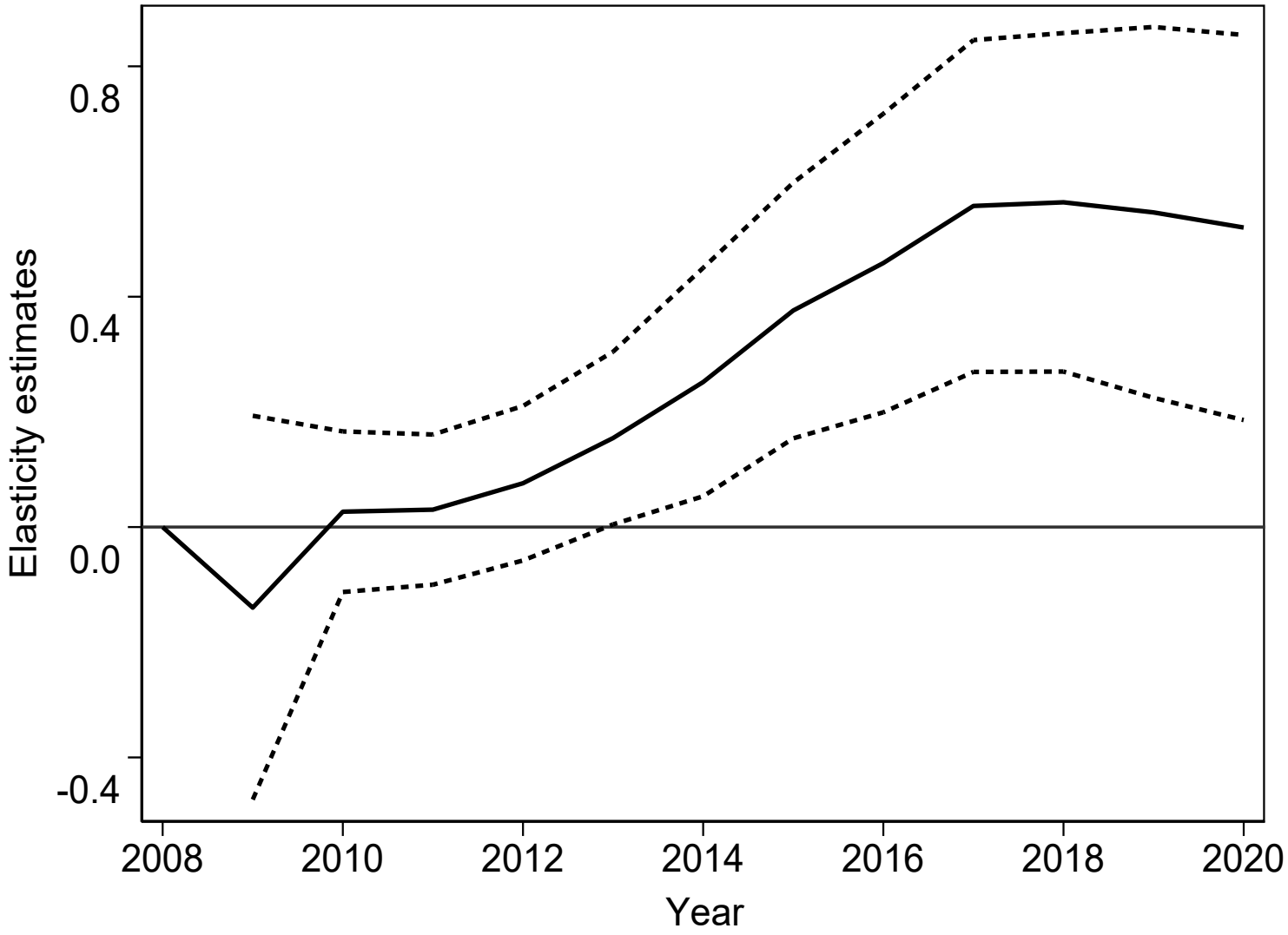


# Regression framework

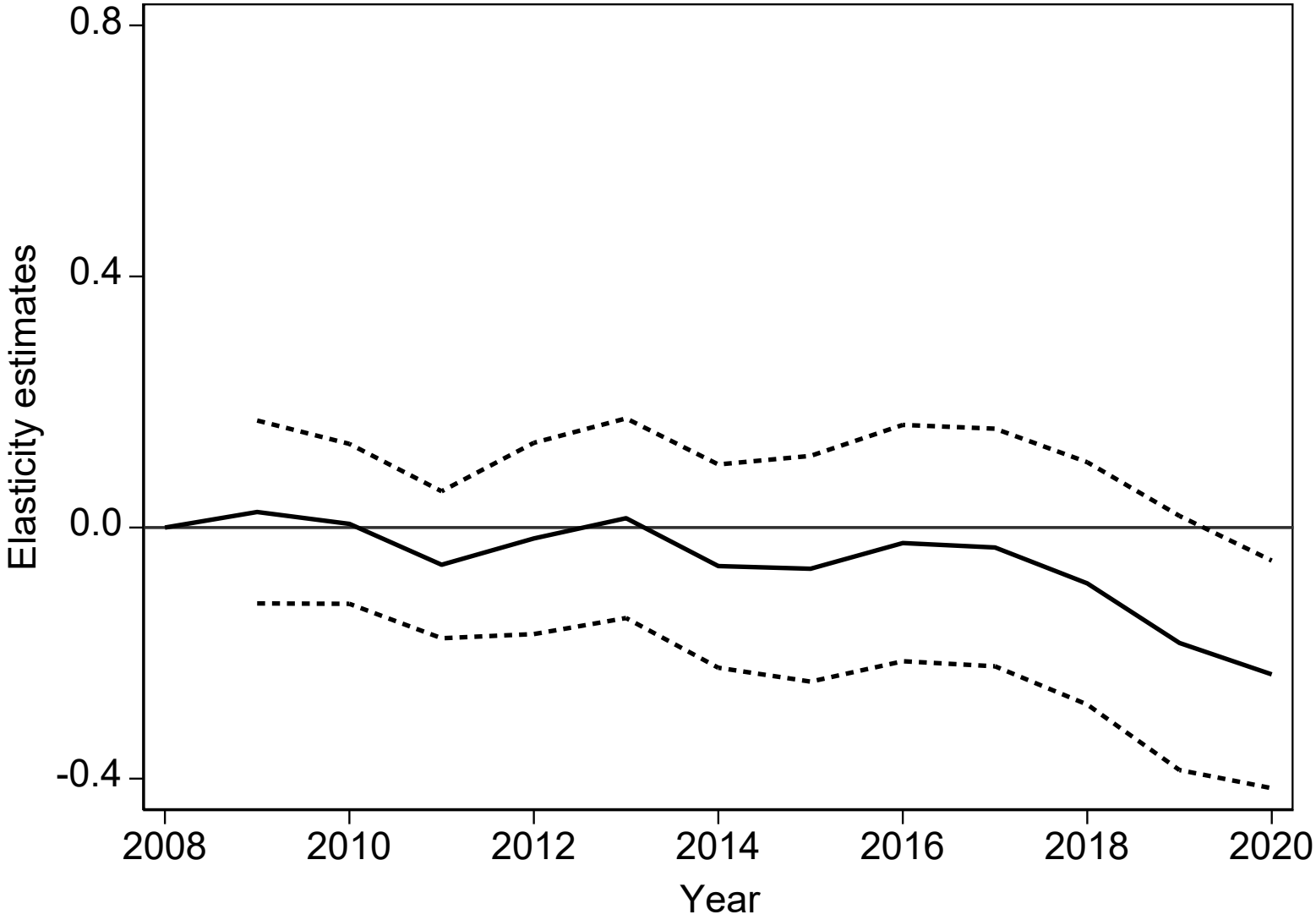
$$\ln Y_{st} = \alpha_s + \gamma_t + \sum_{t=2009}^{2020} \beta_t \ln Imports_{st} * \mathbb{1}(Year = t) + \varepsilon_{st}$$

- $Y_{st}$ is the overdose deaths per capita in state *s* in year *t*
- $Imports_{st}$ is the value of imports per capita into state s in year t
  - Interacted with year indicator variables; reference year is 2008
  - $\beta_t$ measures relationship between imports and deaths over time
- State fixed effects $\alpha_s$ and time fixed effects $\gamma_t$
- Controls includes GDP, unemployment rate, labor force participation, population and population shares by sex, age, race and educ. attainment
  - Consider fewer and more controls in robustness
  - Standard errors clustered at the state level

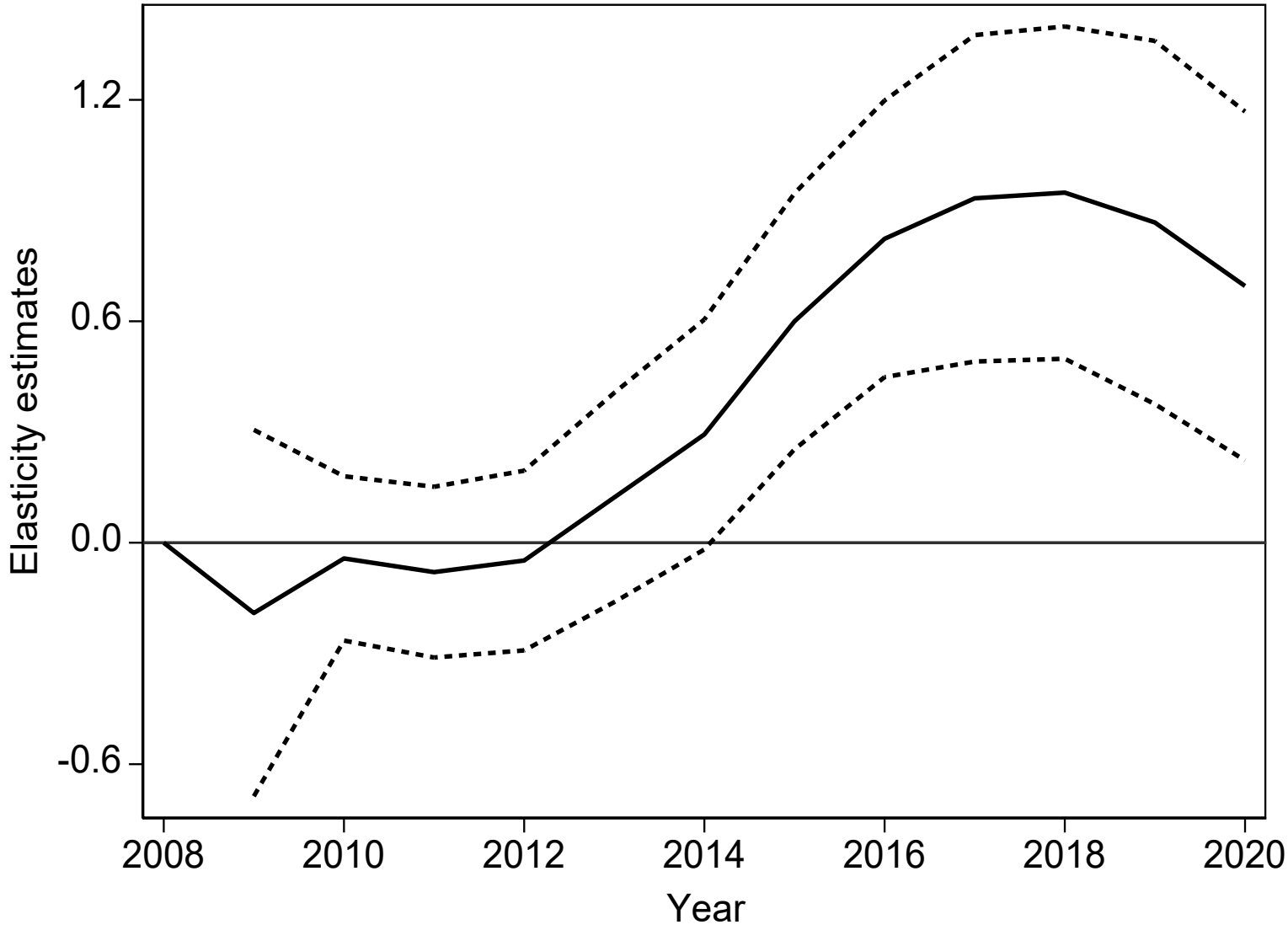
# Imports and fatal opioid overdoses



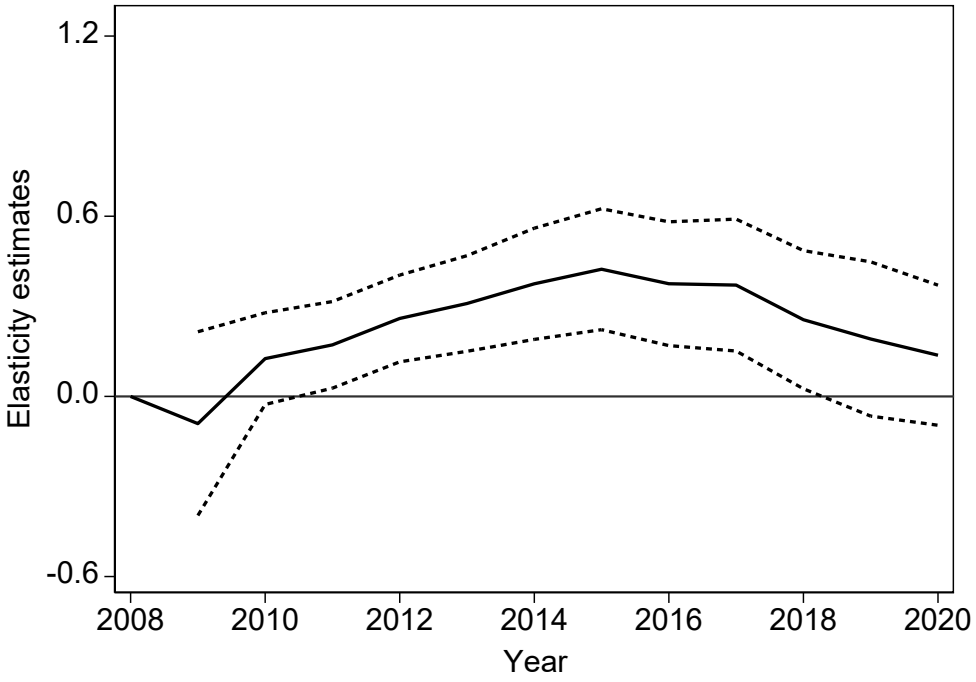
# Imports and fatal non-opioid overdoses



# Imports and fatal fentanyl overdoses



# Imports and non-fentanyl opioid overdoses



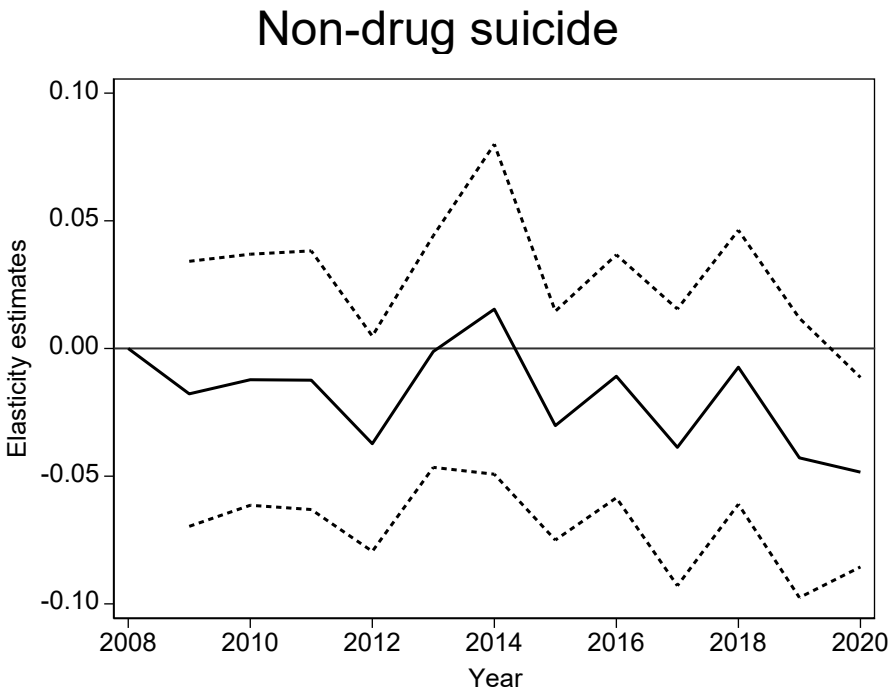

- Fentanyl is main driver of import-overdose relationship
  - Many individuals use multiple opioids, and this often shows up in toxicology reports after death (Ray et al. 2020; Shiue et al. 2021)
  - CDC & Ruhm (2018, 2020) believe some misreporting of opioid types
  - Don’t see same relationship for police forensic cases

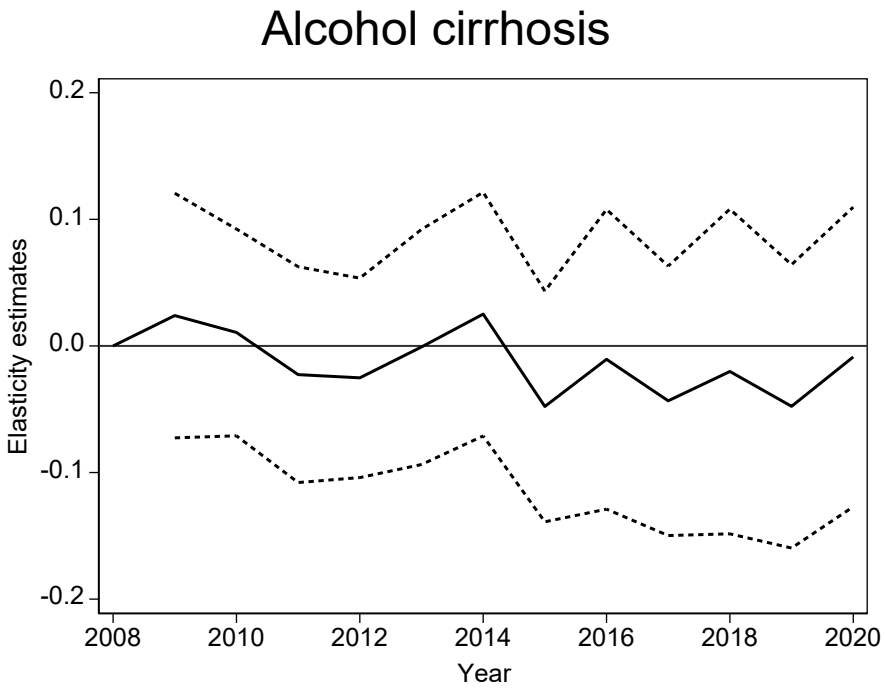
# Consider alternative explanations

Examine by using other deaths as outcome in equation (1)

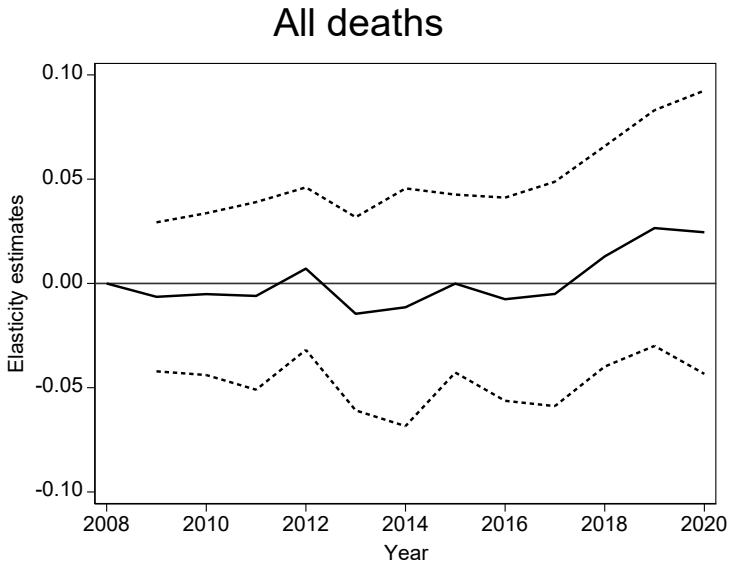
1. “Deaths of despair”: due to poor economic/social outcomes among whites with low education (Case & Deaton 2015, 2020): suicides, alcohol cirrhosis
2. Population health: imports correlated with general changes in health

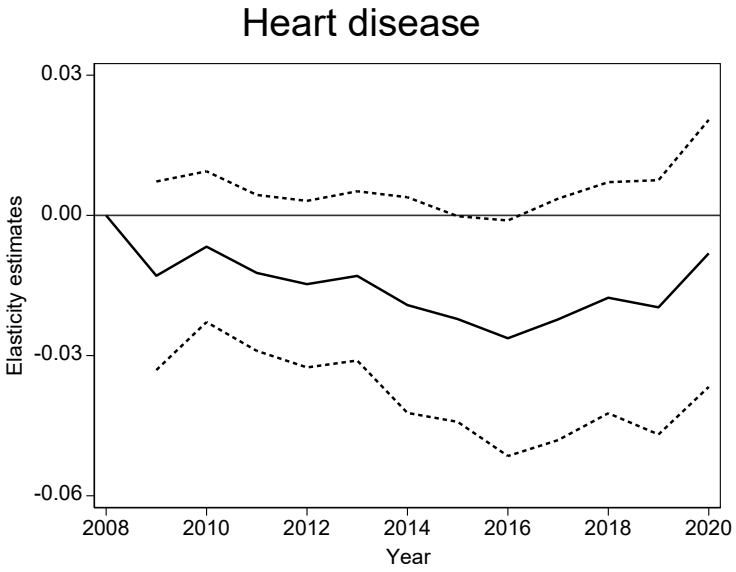
# Imports and “deaths of despair”

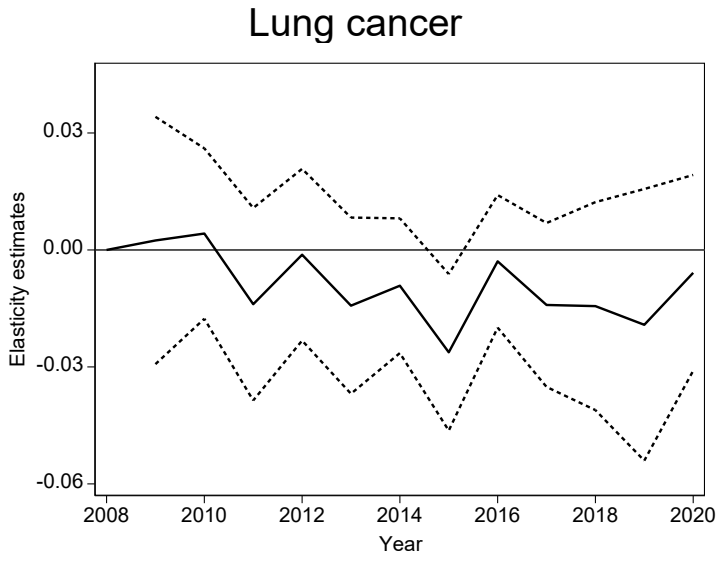


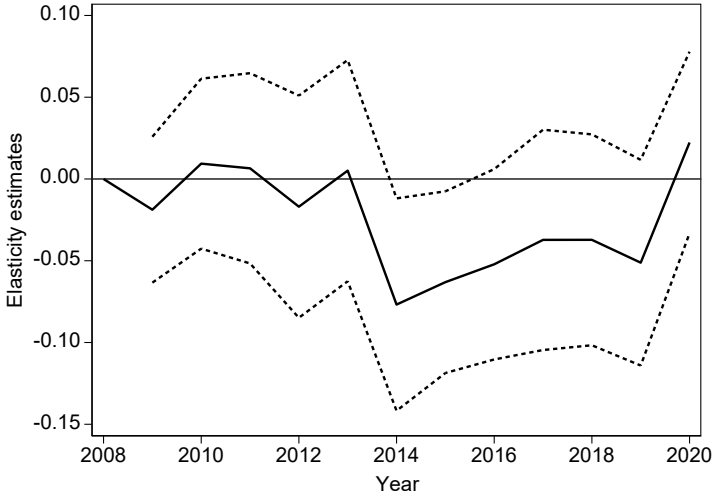



# Imports and other causes of death



# Consider alternative explanations

Examine by using other deaths as outcome in equation (1)

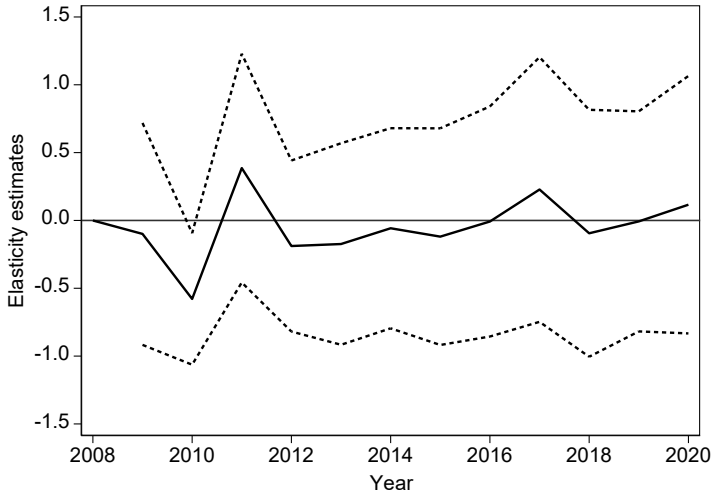
1. "Deaths of despair": due to poor economic/social outcomes among whites with low education (Case & Deaton 2015, 2020): suicides, alcohol cirrhosis
2. Population health: imports correlated with general changes in health

Examine by interacting with year dummies and adding to RHS of equation (1)

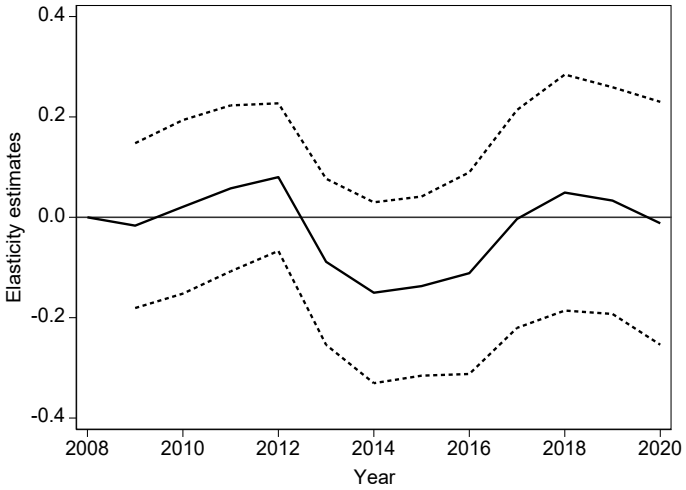
3. Import competition: "China shock" increased unemployment (Autor, Dorn & Hansen 2013, Bloom et al. 2019) & opioid deaths (Pierce & Schott 2020)
    - Import competition measured using states' pre-sample industry employment shares and national industry-level imports in each year
3. States' triplicate status: affected initial Oxycontin shock (Alpert et al. 2000)
4. Use amount of legal fentanyl to measure potential diversion
5. Value of exports per capita to measure role of trade openness
6. Introduction of Prescription Drug Monitoring Programs (PDMPs)
7. Number of individuals crossing Mexican and Canadian borders

# Fentanyl overdoses and other state characteristics

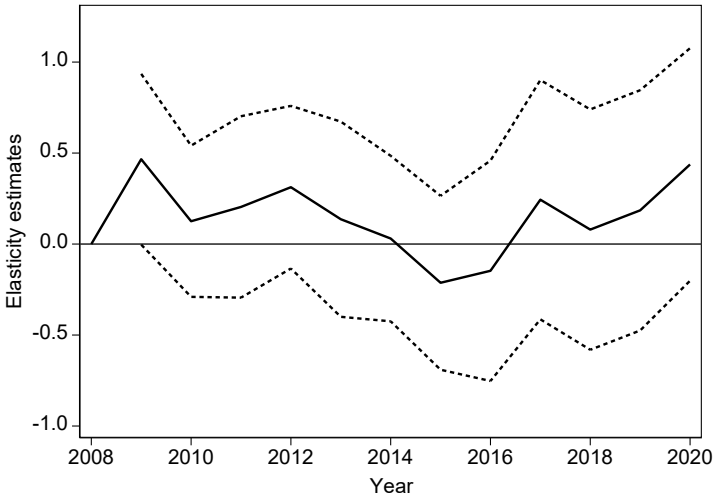
Amount of legal fentanyl



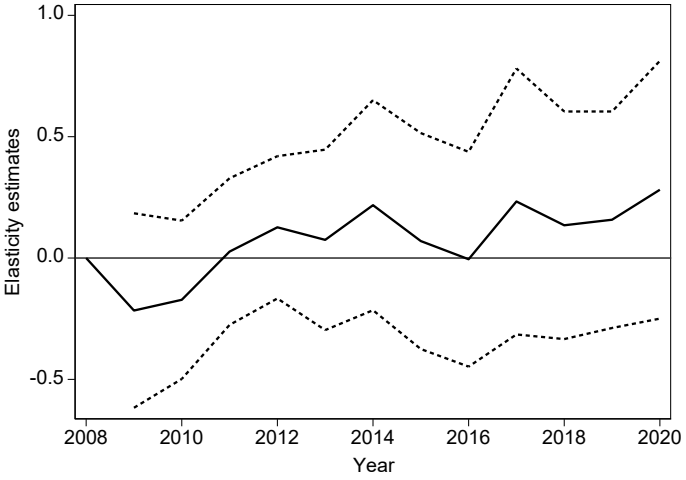

Import competition




International exports




Prescription drug monitoring programs



# Heterogeneity and smuggling routes

- Explore using subsamples and machine-learning approaches
- Product categories with strongest relationship to overdoses:
  - Chemical manufacturing (includes pharmaceuticals), fishing/hunting
- Overdoses and mode of transport:
  - Relationships strongest for sea, less so air and land
- Overdoses and country/region of origin:
  - Split sample into three countries (China/Canada/Mexico) plus five regions (Asia/Europe/Latin America/Rest)
  - Relationships strongest for Europe, South America; not China or Mexico

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➢ Patterns not where Customs seizures made, but consistent with some law enforcement seizures and outcomes of international operations

# Interpreting and scaling estimates

- Strongly positive and robust estimates of imports to all drug overdoses, opioid overdoses and fentanyl overdoses

- If apply 2017-2020 estimates to determine effect sizes:
  - All overdoses: 62,000 deaths (15,500 deaths/year)
  - Opioids: 78,000 deaths (19,500 deaths/year)
  - Fentanyl: 72,000 deaths (18,000 deaths/year)

- Suggest this channel can explain around 15,000-20,000 deaths per year

- Meaningful in terms of deaths and relative to estimated gains from trade of 2-8% of GDP (Costinot & Rodriguez-Clare 2018)
  - At $10 million for the value of a statistical life, equivalent to 8-40% of gains from imports

# Conclusion and potential implications

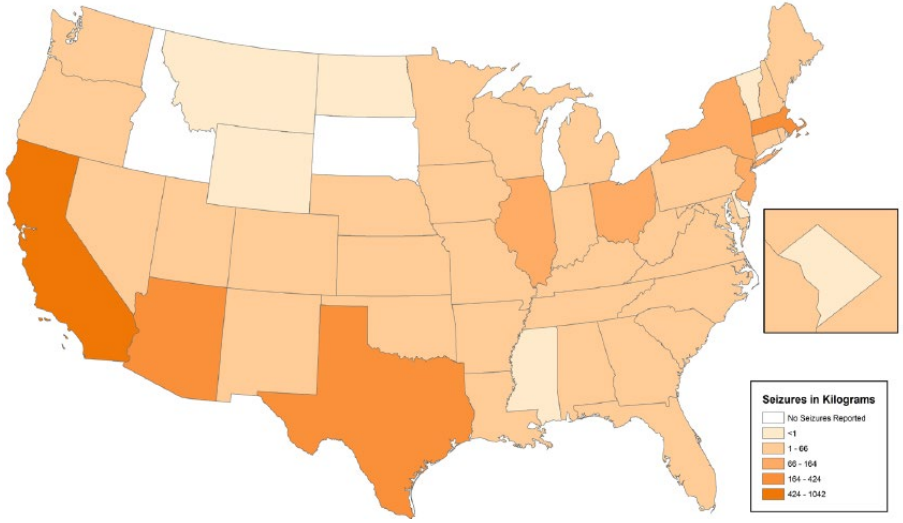
- Find positive relationship between imports and overdoses since 2013
  - Suggests import activity aids recent drug smuggling
  - Reason for new relationship: potency or role of key trading partners?

- Findings could be used to prioritize/expand drug policy resources
  - Expand treatment/harm reduction in more exposed states
  - Use the gains from trade to assist those adversely affected

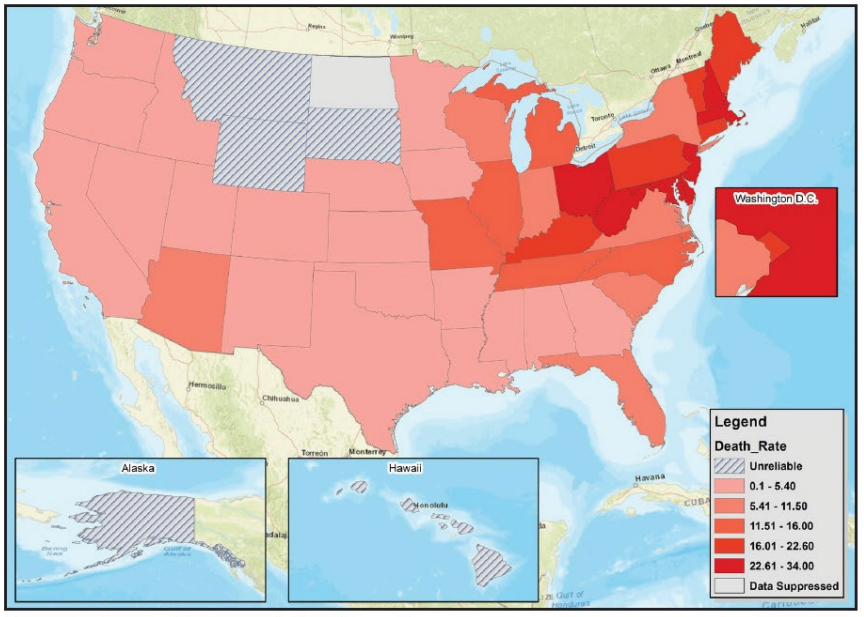
- Potentially informative about the value and focus of screening imports
  - Heterogeneity suggests smugglers limit direct use of Chinese imports
  - Consider: If customs screening could reduce imports-opioids relationship by 20% in 2017-2020, saves 3-4K lives per year
  - At $10 million for the value of a statistical life: $30-40 billion
  - Customs and Border Protection annual budget ~$15 billion

# CBP/DEA seizures are not where deaths occur

*Amounts of fentanyl seized (kg)*

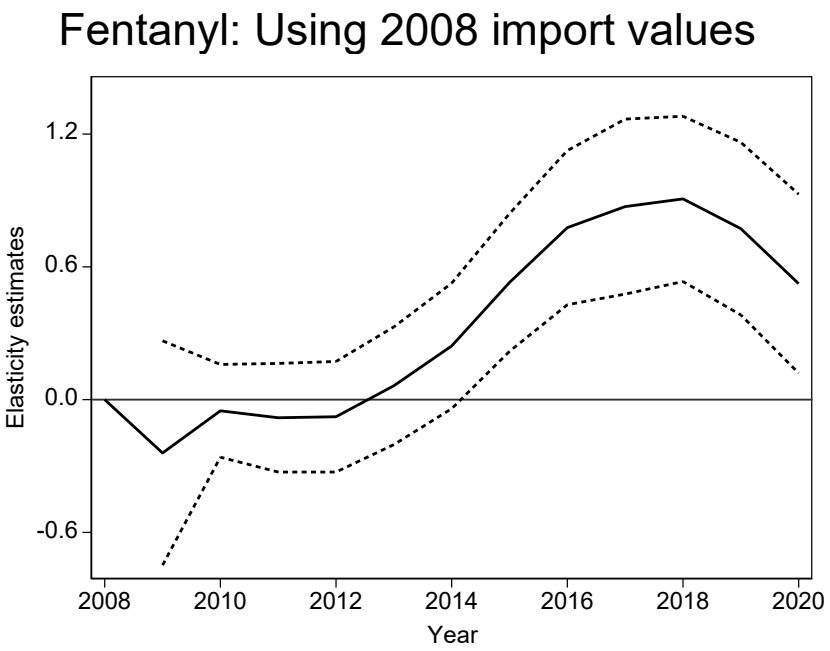


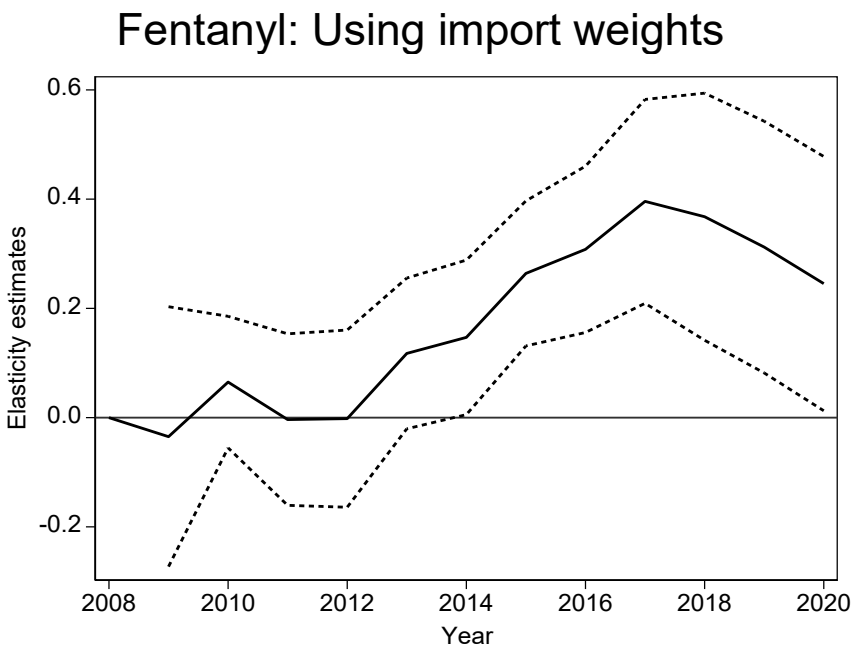

*Fentanyl death rates:*




- These figures are both in DEA's *National Drug Threat Assessment 2020*, so DEA know this

# Robustness of main outcome




- Using 2008 import values rules out reverse causality
- Also results similar with changes to covariates

# Why does it matter where fentanyl sent?

- We focus on state where imports are unloaded
  - Security seals on containers and GSP tracking until this point

- State may matter, as domestic fentanyl distribution has risks
  - ~1,000 federal convictions for fentanyl trafficking last year, thousands of fentanyl seizures by state and local authorities
  - Cross-state smuggling exposes smugglers to more laws & agencies
  - Less risky to distribute fentanyl near smuggling location and through personal connections

- Proximity to key smuggling locations has been shown to be important for crack cocaine (Evans, Garthwaite & Moore 2016) and Australian heroin prices (Moore et al. 2005)