

# The Geography of Consumption and Local Economic Shocks: The Case of the Great Recession

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# Motivation

- ▶ Consumption accounts for about 70% of GDP
- ▶ Growing research studying local markets to understand consumption, labor, and the economy
  - ▶ Wealth shocks from housing
    - ▶ Mian, Rao, and Sufi (2013), Mian and Rao (2014), and Guren, McKay, Nakamura, and Steinsson (2020)
- ▶ Advantages of local market analysis
  - ▶ Greater variation in economic shocks and policy changes
  - ▶ Application of standard applied microeconomic tools for improved identification (Athey and Imbens (2017))

# Limitation of Data Sources

- ▶ Key data sources on local markets are restricted to geographic boundaries
  - ▶ Economic Census (EC) - spending at the firm's location
  - ▶ Quarterly Census of Employment and Wages (QCEW) - employment and wages at the firm's location
- ▶ In reality firms and consumers are not restricted by geographic boundaries
  - ▶ Consumers cross markets to consume
  - ▶ Firm's revenue and level of employment are affected by cross-market consumption

## Key Data on Employment and Spending are Confined to Geographic Boundaries



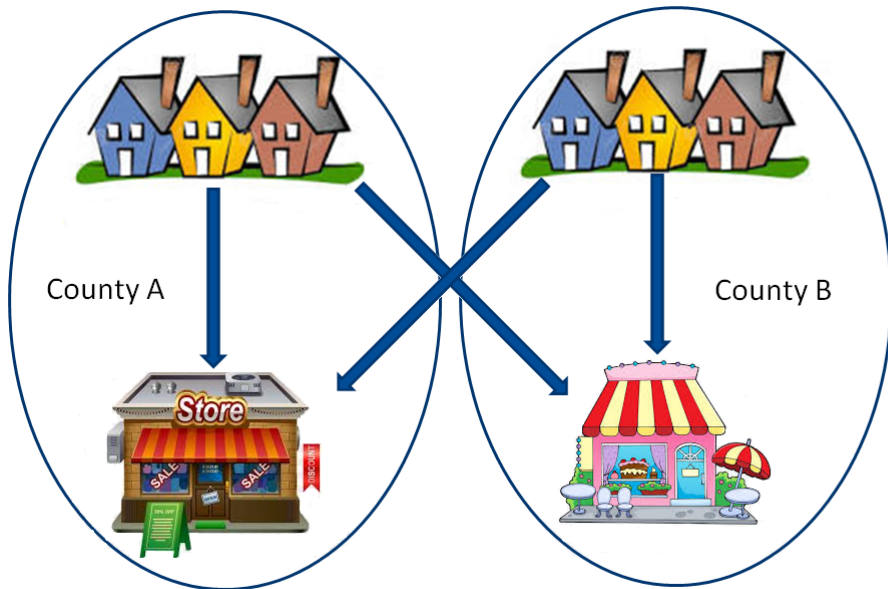
County A



County B



## In Reality, Consumers and Firms are Not Confined by Boundaries



# What We Do

- ▶ Use unique card transaction data from a large card transaction intermediary, Fiserv, with information on firm and consumer locations
- ▶ Estimate cross-county consumption flows between consumers and firms for all counties in the U.S.
- ▶ Show how this consumption link improves local economic measurement by:
  - ▶ Testing the importance of the consumption link using basic economic accounting
  - ▶ Apply consumption flows to re-examine the effects of the Great Recession and housing wealth decline from 2007-2009

## Findings: Accounting Test

- ▶ Use consumption flow measures to estimate and test basic accounting relationship:
  - ▶ Household Consumption = (Final Product Sold) - (Export of Consumption) + (Import of Consumption)
- ▶ Strongly reject the hypothesis that the effects of consumption stop at county borders



## Findings: Effect of the Great Recession

- ▶ Confirm that housing wealth decline had a significant effect on spending and employment (Mian , Rao, and Sufi (2013), Mian and Sufi (2014))
- ▶ Demonstrate cross-border effects have a significant impact on local spending and employment
- ▶ Ignoring consumption flows:
  - ▶ Reduces the precision of the estimates
  - ▶ Understates local economic effects on spending and employment by: 17-26%
  - ▶ Misallocates the location of the economic effects by: 11%

# Data on Receipts and Employment

- ▶ Economic Census data (EC): Census of establishments for the years 2002, 2007, 2012, and 2017 data
  - ▶ Standard interpolation methodology for intercensal years using wages
  - ▶ Method applied by BEA and others
- ▶ Quarterly Census of Employment and Wages (QCEW)
  - ▶ Administrative records from state unemployment insurance
  - ▶ Covers 95 percent of employment in the country

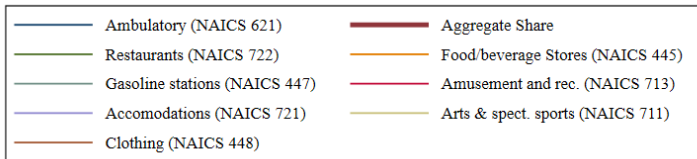
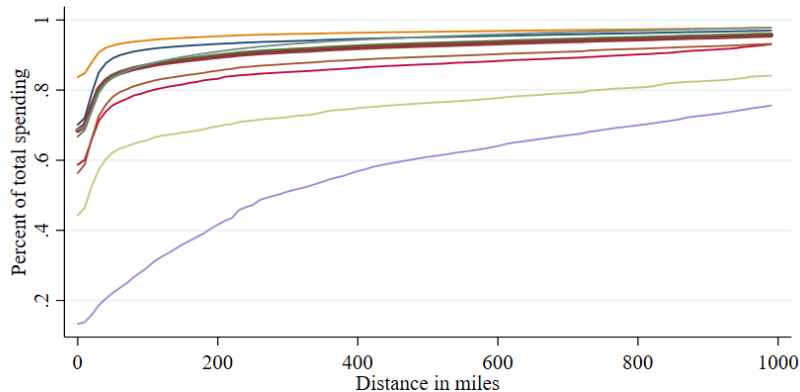
## Data: Fiserv

- ▶ Fiserv is one of the largest card transaction intermediaries in the country with more than \$2 trillion dollars in transactions annually
- ▶ Observation is a swipe of a card (debit, credit, gift cards etc) paid by a consumer
- ▶ Data are aggregated and anonymized to county 3-digit NAICS level
- ▶ Records the location of the firm and guessed home location of consumer (Alternative data with known home location also analyzed)
- ▶ Focus on 15 NAICS 3-digit industries where coverage is the strongest from the year 2015
- ▶ Information is suppressed if estimates are too concentrated in a single merchant in an area

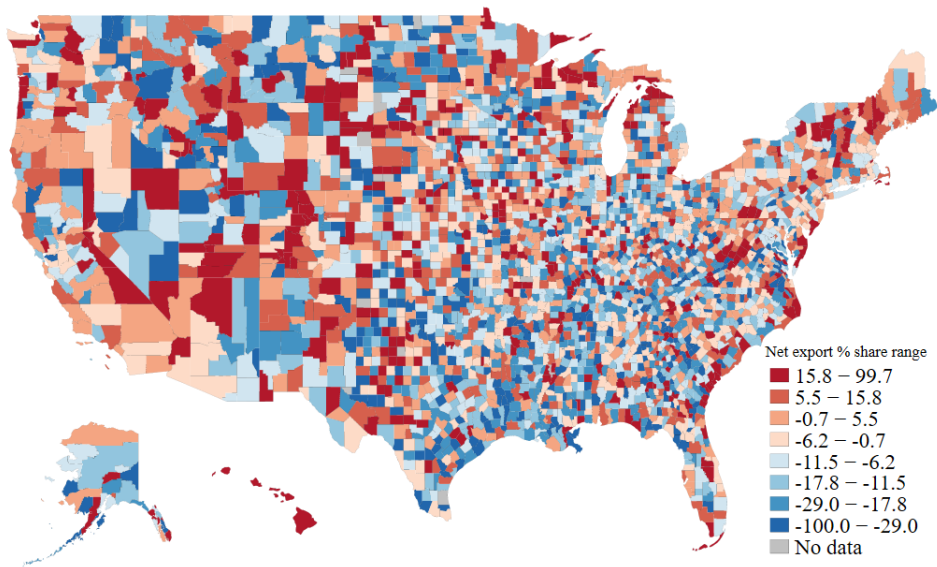
# Spending by Industry 2015

	Total \$Millions	% Observed	% Imputed	% Unknown
Accommodations (NAICS 721)	225,765.3	85.59	14.34	0.07
Ambulatory Health Care Services (NAICS 621)	960,110.3	95.74	4.21	0.04
Amusement, Gambling, and Recreation Industries (NAICS 713)	119,829.8	86.72	13.21	0.07
Building Material and Garden Equipment and Supplies Dealers (NAICS 444)	341,689.4	70.10	29.76	0.14
Clothing and Clothing Accessories Stores (NAICS 448)	232,950.2	95.87	4.11	0.02
Food Services and Drinking Places (NAICS 722)	660,300.4	98.31	1.68	0.01
Food and Beverage Stores (NAICS 445)	720,160.9	87.92	12.04	0.04
Furniture and Home Furnishings Stores (NAICS 442)	126,712.8	82.53	17.34	0.13
Gasoline Stations (NAICS 447)	523,039.2	84.00	15.94	0.06
General Merchandise Stores (NAICS 452)	749,349.3	66.71	33.16	0.13
Miscellaneous Store Retailers (NAICS 453)	138,279.0	95.36	4.61	0.03
Performing Arts, Spectator Sports, and Related Industries (NAICS 711)	104,468.5	63.40	36.53	0.07
Personal and Laundry Services (NAICS 812)	110,372.0	94.68	5.20	0.12
Repair and Maintenance (NAICS 811)	181,223.3	89.66	10.23	0.11
Sporting Goods, Hobby, Book, and Music Stores (NAICS 451)	103,789.1	82.05	17.86	0.09
Total	5,298,039.5	85.99	13.95	0.07

## Share of Spending by Distance from Firm by NAICS



Net Export Share: **Blue (More Net Import)** to **Red (More Net Export)**



# Consumption Flow Accounting

$$\text{Household Consumption} = \text{Final Product Sold} - \text{Export of Consumption} + \text{Imports of Consumption}$$

- ▶ Test the importance of the accounting relationship
- ▶ Estimate four corresponding data elements:
  - ▶ Household Consumption
  - ▶ Final Products Sold
  - ▶ Exports of Consumption
  - ▶ Imports of Consumption

# Consumption Flow Accounting: Empirical Test

- Obtain estimates of each element of the accounting relationship and test

$$\widehat{\text{Household Consumption}}_{j,t} = \beta_1(\widehat{\text{Final Product Sold}}_{j,t}) - \beta_2(\widehat{\text{Exports of Consumption}}_{j,t}) \\ + \beta_3(\widehat{\text{Imports of Consumption}}_{j,t}) + \epsilon_{j,t}$$

Null Hypothesis 1:

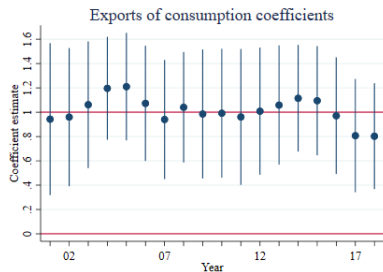
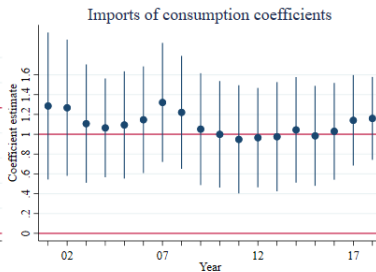
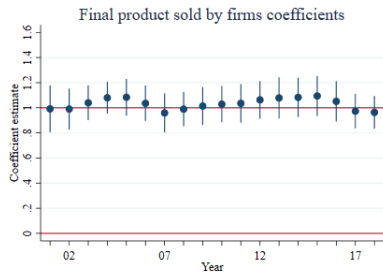
- $\beta_2 = \beta_3 = 0$  net exports do not matter (standard assumption)

Null Hypothesis 2:

- $\beta_1 = \beta_2 = \beta_3 = 1$  accounting relationship holds in the data



## Regression Test Run Separately for Each Year



# Test for the importance of cross-border accounting

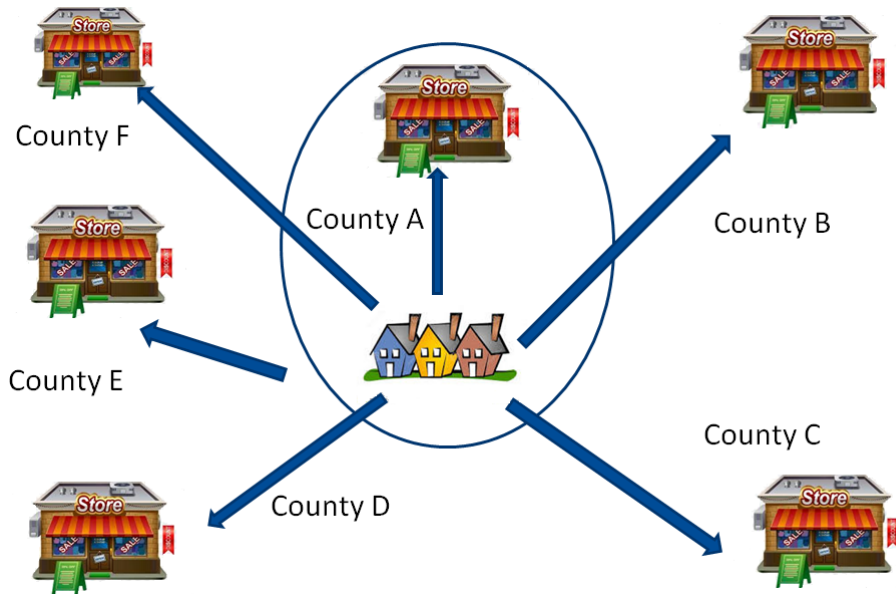
Null hypothesis 1: (standard assumption)

- ▶  $\beta_2 = \beta_3 = 0$  – Net exports do not matter
- ▶ Rejected in every year

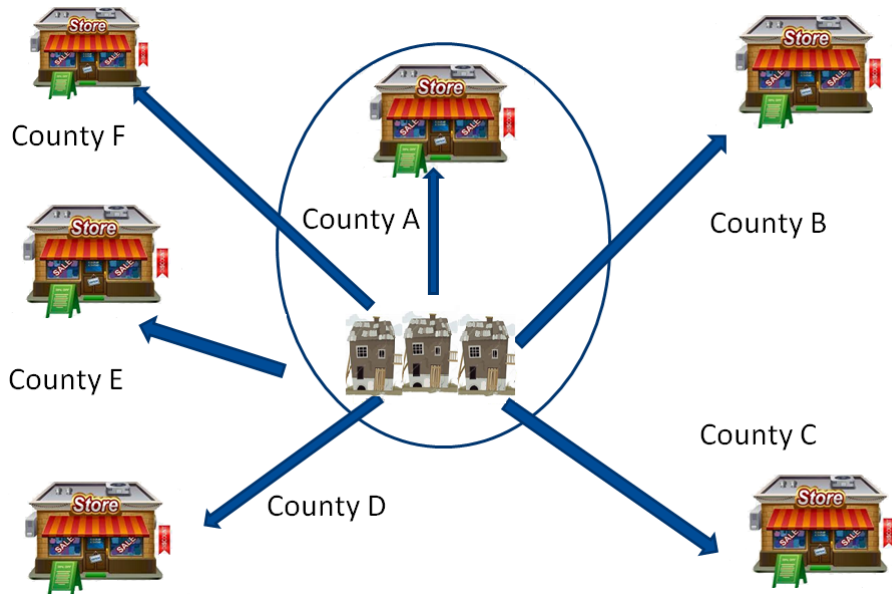
Null hypothesis 2:

- ▶  $\beta_1 = \beta_2 = \beta_3 = 1$  – Accounting relationship holds in the data
- ▶ Never rejected in any year

# The Case of the Great Recession



# The Case of the Great Recession



# The Case of the Great Recession - 2007 to 2009

- ▶ Measure the effects of changes in net wealth on spending and employment (Following Mian, Rao, and Sufi (2013) and Mian and Sufi (2014))
- ▶ Change in housing net wealth in county  $i$ :

$$\Delta HNW_i = \frac{P_{h,i}^{2009} - P_{h,i}^{2006}}{P_{h,i}^{2006}}$$

- ▶  $P_{h,i}^t$  - housing price for consumers in county  $i$  in year  $t$

# Alternative Measures of Housing Wealth Shock

- ▶ Aggregate share of revenue between counties  $i$  and  $j$  is a proxy for potential demand

$$S_{i,j}^{AGG} = \frac{\sum_{\forall n} R_{j,n} \cdot S_{i,j,n}}{\sum_{\forall n} R_{j,n}}$$

- ▶ Flow measure of wealth shock:

$$\Delta HNW_j^{FLOW} = \sum_{\forall i} (\Delta HNW_i) \cdot S_{i,j}^{AGG}$$

$$\Delta HNW_j^{FLOW} = \Delta HNW_j^{Home} + \Delta HNW_j^{Export}$$

- ▶ Home - housing wealth shock from consumers' that reside in same county as merchant

$$\Delta HNW_j^{Home} = (\Delta HNW_{i=j}) \cdot S_{i=j,j}^{AGG}$$

- ▶ Export - housing wealth shock from consumers' that reside outside of merchant's county

$$\Delta HNW_j^{Export} = \sum_{\forall i \neq j} (\Delta HNW_i) \cdot S_{i,j}^{AGG}$$

# Estimating Equation

$$\frac{Y_{j,t} - Y_{j,t-2}}{Y_{j,t-2}} = \alpha_1 \Delta HNW_j + \beta X_{j,t} + \epsilon_{j,t}$$

- ▶  $\frac{Y_{j,t} - Y_{j,t-2}}{Y_{j,t-2}}$  – dependent variable is percent change in merchant revenue or employment where  $t = 2009$
- ▶  $\Delta HNW_j$  – housing net wealth change from 2007 to 2009
- ▶  $X_{j,t}$  – controls include 2 digit NAICS industry share in 2007
- ▶  $\epsilon_{j,t}$  – error

# Housing Wealth Change on Spending Growth

	(1)	(2)	(3)	(4)	(5)
	% Chg. Spend	% Chg. Spend	% Chg. Spend	% Chg. Spend	% Chg. Spend
Δ HNW (No Flow)	0.158*** (0.0196)		-0.0841 (0.0861)	-0.0700 (0.0834)	
Δ HNW (Total Flow)		0.191*** (0.0232)	0.290*** (0.100)		
Δ HNW (Home)				0.265*** (0.0969)	0.179*** (0.0254)
Δ HNW (Export)				0.316** (0.119)	0.254*** (0.0788)
Observations	3063	3062	3062	3062	3062

Standard errors in parentheses and are clustered by state. Estimates are weighted by 2007 population levels.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$



# Housing Wealth Change on Employment Growth

	(1)	(2)	(3)	(4)	(5)
	% Chg. Emp.	% Chg. Emp.	% Chg. Emp.	% Chg. Emp.	% Chg. Emp.
Δ HNW (No Flow)	0.120*** (0.0203)		-0.108 (0.0656)	-0.0743 (0.0545)	
Δ HNW (Total Flow)		0.147*** (0.0242)	0.273*** (0.0865)		
Δ HNW (Home)				0.214*** (0.0686)	0.123*** (0.0214)
Δ HNW (Export)				0.337*** (0.113)	0.271*** (0.0863)
Observations	3103	3102	3102	3102	3102

Standard errors in parentheses and are clustered by state. Estimates are weighted by 2007 population levels.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

# Housing Wealth Change on Spending by Export Quartile

High Export Share - Quartile 4

Low Export Share - Quartile 1

	(1) Quartile 4	(2) Quartile 3	(3) Quartile 2	(4) Quartile 1
$\Delta$ HNW (No Flow)	0.0262 (0.0446)	0.0194 (0.0499)	0.0834** (0.0371)	0.192*** (0.0438)
Average $\Delta$ HNW (Export)	0.248*** (0.0892)	0.208*** (0.0745)	0.126* (0.0715)	-0.0157 (0.0982)
Observations	756	763	772	770

Standard errors in parentheses and are clustered by state. Estimates are weighted by 2007 population levels.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

# Housing Wealth Change on Employment by Export Quartile

High Export Share - Quartile 4

Low Export Share - Quartile 1

	(1) Quartile 4	(2) Quartile 3	(3) Quartile 2	(4) Quartile 1
$\Delta$ HNW (No Flow)	0.00842 (0.0324)	0.0393 (0.0351)	0.0825** (0.0353)	0.0802*** (0.0216)
Average $\Delta$ HNW (Export)	0.210*** (0.0700)	0.184*** (0.0542)	0.0733 (0.0481)	0.105 (0.0653)
Observations	770	780	776	776

Standard errors in parentheses and are clustered by state. Estimates are weighted by 2007 population levels.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

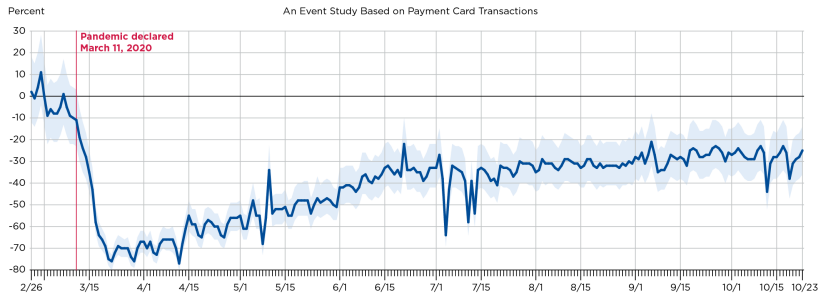
# Conclusion

- ▶ Replicate Mian, Rao, and Sufi (2013) and Mian and Sufi (2014)
  - ▶ Find evidence consistent with their papers, but with larger sample and alternative methodology
- ▶ Cross-county flows help to fully utilize some of our best available source data on firms (e.g., QCEW, Regional BEA Data) and consumers (e.g., Economic Census, Regional BEA Data)
- ▶ Ignoring cross-market flows:
  - ▶ Limits the ability to identify policies and economic shocks at the local level
  - ▶ Understates effects on spending and employment (approximately 17-26% on spending and employment effects)
  - ▶ Misallocates where those effects occur by around 11%

# Effects of Covid-19 on Consumer Spending (Dunn, Hood and Driessan (2020))

## Spending on Food Services and Drinking Places

An Event Study Based on Payment Card Transactions



Note: Chart shows the difference from the typical level of spending without COVID-19-related changes in the economy. The typical level corresponds to a value of 0.  
The shaded area represents 95 percent confidence interval bands.

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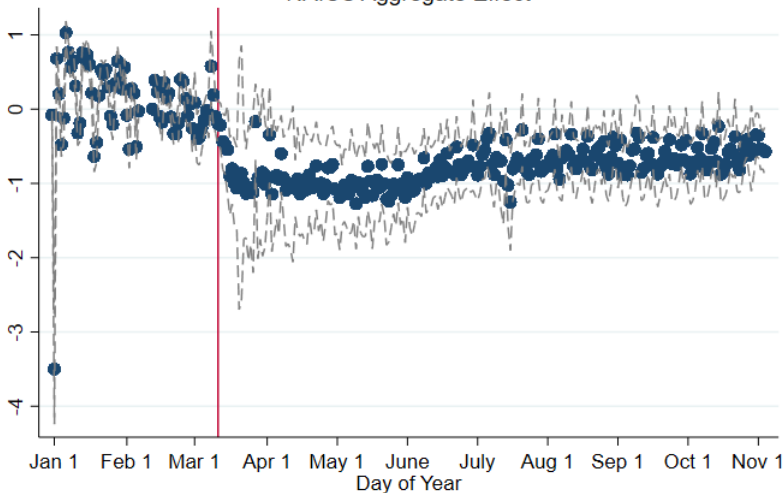
- ▶ <https://www.bea.gov/recovery/estimates-from-payment-card-transactions>
- ▶ Builds off FRB work from Aladangady et al. (2019)

## Export Share and Covid-19 Spending - preliminary Dunn, Gholizadeh, and Mallat

- ▶ Pandemic has affected how much people spend
- ▶ Pandemic also affects *where* they spend
- ▶ Hypothesis is that potential demand from net exports are disproportionately affected, so we expect larger declines in high export areas pre-pandemic
  - ▶ In other words, the pandemic has caused the consumption-link to shift
- ▶ Difference-in-difference specification with export share interacted with post-pandemic variable
  - ▶  $\log(spend_{s,d}) = \alpha ExportShare_{s,d} \cdot PostPandemic_d + \beta \cdot X_{s,d} + \gamma_d + state_s + \epsilon_{s,d}$

# 2018 Export Share x Time Indicators: All Retail

Export Share x Pandemic Over Time  
NAICS Aggregate Effect



## Differential Effect By Export Share

	Weighted	Unweighted
Pandemic · Export Share	-0.846*** (0.163)	-0.991*** (0.153)
Pandemic · Import Share	0.195* (0.109)	0.0324 (0.0593)
Stay Home Order	-0.0605*** (0.0176)	-0.0375** (0.0179)
N	71400	71400
r <sup>2</sup>	0.980	0.980



**Thank you!**

# Steps for Estimating Final Expenditure Flows

- ▶ Estimate receipt data for 2015 using QCEW data
- ▶ Remove foreign and business spending from Fiserv data
- ▶ Impute missing merchant share information between counties and industries using flexible prediction model
- ▶ Flexible prediction model includes:
  - ▶ County-to-county fixed effects
  - ▶ Industry and distance interactions
  - ▶ Census receipts and distance interactions
  - ▶ Population and distance interactions
  - ▶ Cross-validation to determine best imputation method
- ▶ Multiply flows by receipts to obtain estimates of consumer spending in each geography

# Instrumental Variable Construction

- ▶ Follow Guren, McKay, Nakamura, and Steinsson (2020)
- ▶ Use historical information on local area housing price responsiveness to regional price movements to estimate local responsiveness to aggregate economic shocks

$$HousingPrice_{i,t} = \alpha_i + \beta_i \cdot RegionalHousingPrice_{R,t} + \beta \cdot X_{i,t} + \epsilon_{i,t}$$

- ▶ Instrument for county  $i$  is the coefficient estimate of  $\beta_i$  for county  $i$

## Panel: Effects of Housing Wealth on Spending

	(1)	(2)	(3)
	% Chg. Spend	% Chg. Spend	% Chg. Spend
$\Delta$ HNW (No Flow)	0.217*** (0.0375)		
$\Delta$ HNW (Total Flow)		0.253*** (0.0437)	
$\Delta$ HNW (Home)			0.238*** (0.0636)
$\Delta$ HNW (Export)			0.325* (0.167)
Observations	12201	12198	12198

Standard errors in parentheses and are clustered by state. Estimates are weighted by 2007 population levels.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## Panel: Effects of Housing Wealth on Employment

	(1)	(2)	(3)
	% Chg. Emp.	% Chg. Emp.	% Chg. Emp.
$\Delta$ HNW (No Flow)	0.137*** (0.0312)		
$\Delta$ HNW (Total Flow)		0.161*** (0.0352)	
$\Delta$ HNW (Home)			0.152*** (0.0525)
$\Delta$ HNW (Export)			0.205* (0.113)
Observations	12347	12343	12343

Standard errors in parentheses and are clustered by state. Estimates are weighted by 2007 population levels.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

# Spending Effect Using Instrumental Variables

	(1) IV No Flow	(2) IV Flows	(3) IV Flows	(4) Panel IV Flows	(5) Panel IV Flows
$\Delta$ HNW (No Flow)	0.133*** (0.0245)				
$\Delta$ HNW (Total Flow)		0.167*** (0.0298)		0.211*** (0.0420)	
$\Delta$ HNW (Home)			0.147*** (0.0339)		0.151*** (0.0558)
$\Delta$ HNW (Export)			0.262*** (0.0917)		0.482*** (0.152)
Observations	3063	3062	3062	12194	12194

Standard errors in parentheses and are clustered by state. Estimates are weighted by 2007 population levels.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

# Employment Effect Using Instrumental Variables

	(1) IV No Flow	(2) IV Flows	(3) IV Flows	(4) Panel IV Flows	(5) Panel IV Flows
$\Delta$ HNW (No Flow)	0.110*** (0.0209)				
$\Delta$ HNW (Total Flow)		0.135*** (0.0244)		0.124*** (0.0375)	
$\Delta$ HNW (Home)			0.109*** (0.0284)		0.0796 (0.0524)
$\Delta$ HNW (Export)			0.259*** (0.0983)		0.322*** (0.124)
Observations	3103	3102	3102	12342	12342

Standard errors in parentheses and are clustered by state. Estimates are weighted by 2007 population levels.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$