

# The empirics of minimum wage policies

Econ 980z (Harvard) - Empirical research on economic inequality

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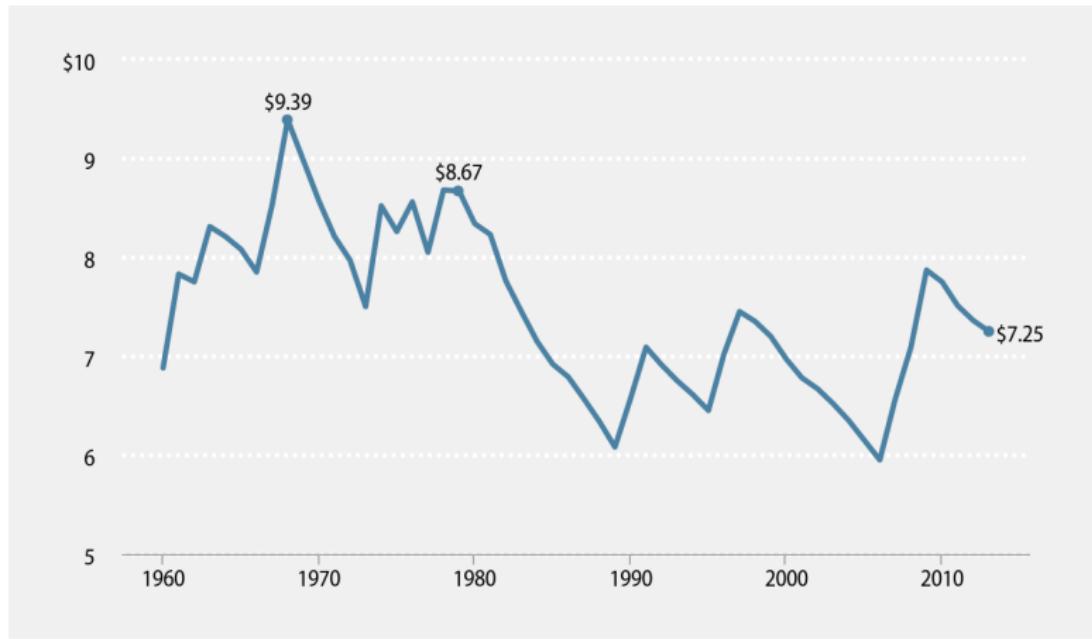
# Outline for lecture

- Nature of US minimum wage policy
- Current evidence base of minimum wages on employment and income
  - identification problem
  - controversies:
    - teen employment
    - restaurant employment
    - overall employment
- Contextualizing the new push to raise minimum wages
  - nature of policies
  - extrapolations from evidence base.

# History of US federal minimum wage

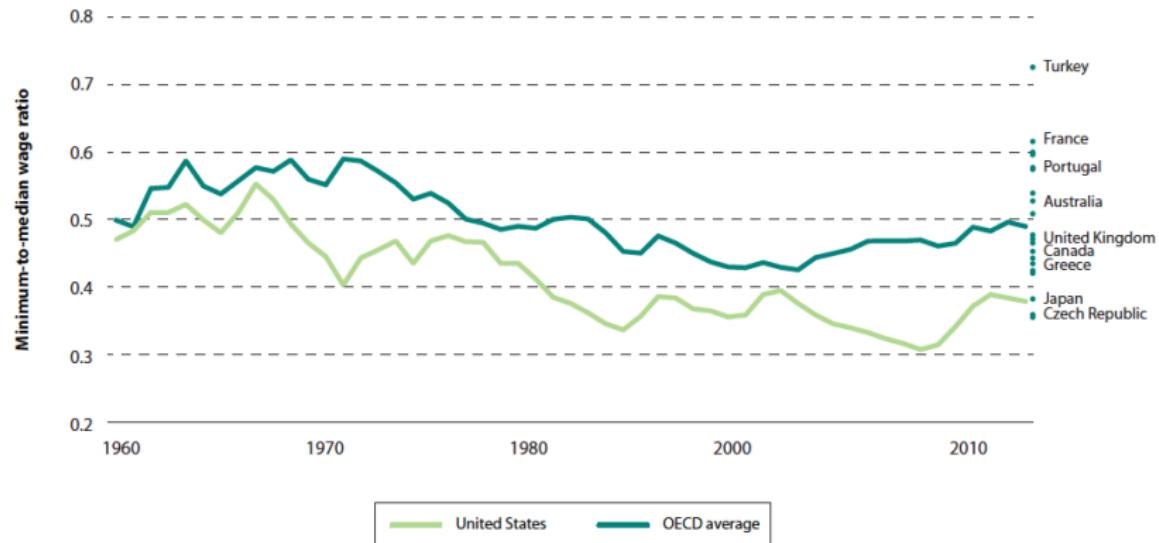
- First minimum wage in Massachusetts (1912)
- 1938 Fair Labor Standard Act established a single federal minimum wage
- Initially applied primarily to manufacturing workers
  - Some states had minimums covering non-tradable sectors
- Coverage expanded over time – federal standard applies legally to vast majority of workers
- Exceptions: agriculture, independent contractors

# Evolution of US real minimum wage: 1960-2013



Source: EPI. Deflated using CPI-U-RS

# Ratio of federal minimum wage to median wage for FT workers: 1960-2012

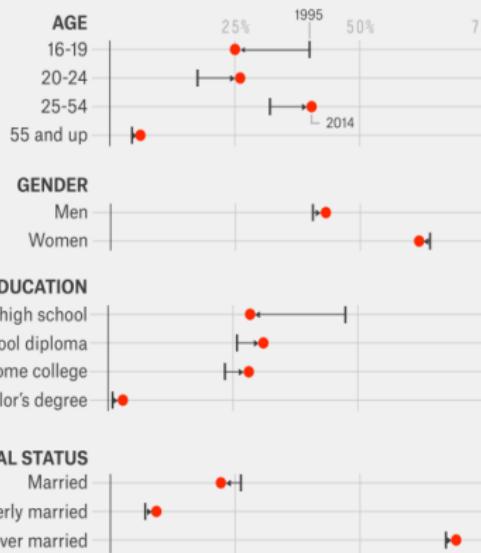


Source: Dube (2014), based on OECD statistics

# Changing face of minimum wage workers

## Who Earns The Minimum Wage?

Percentage of all minimum-wage workers in 1995 and 2014



## Older Workers Are Stuck Earning Low Wages

Share of minimum-wage workers still earning near the minimum wage three years later, by age



## Minimum-Wage Workers Are Not Gaining Ground

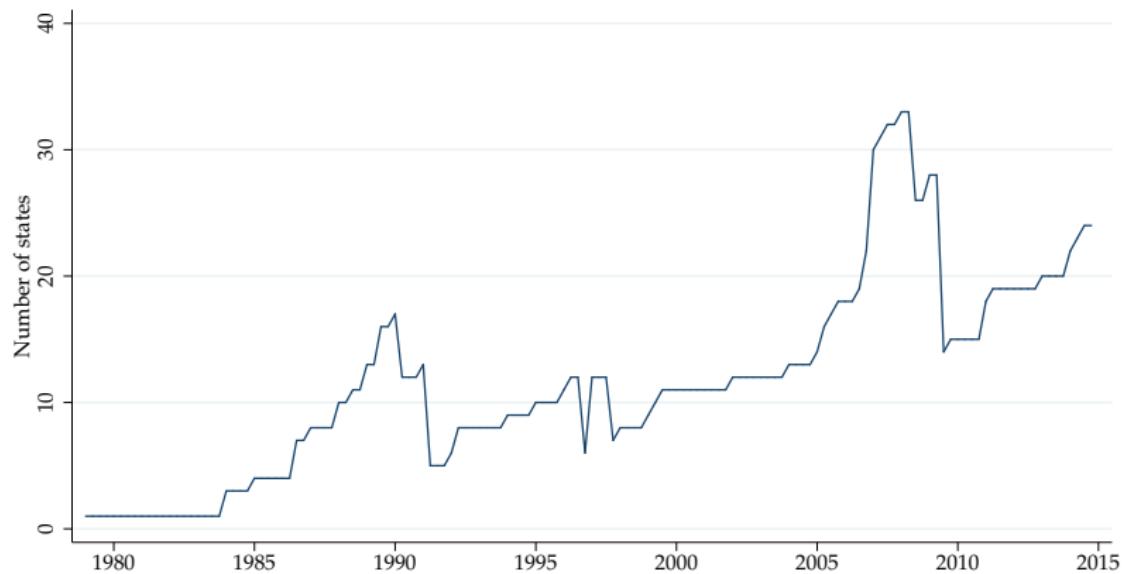
Share of workers still earning near the minimum wage one year later versus those earning more



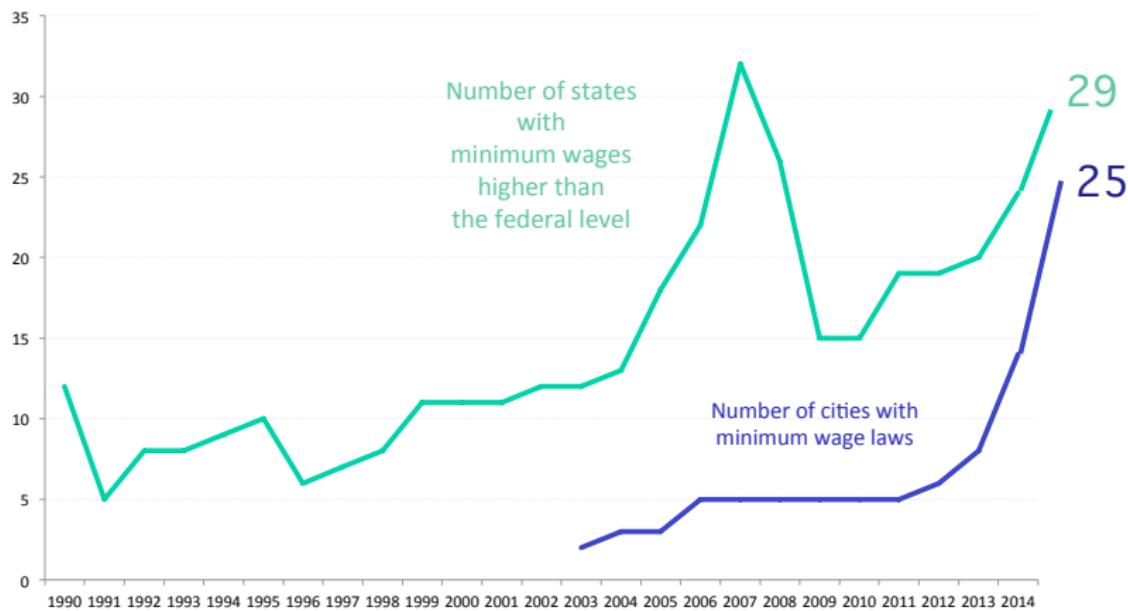
Source: Ben Cassellman ([www.538.com](http://www.538.com)) analysis of CPS, SIPP data

# State minimum wages above federal standard

Panel A: States with minimum wages exceeding the federal floor

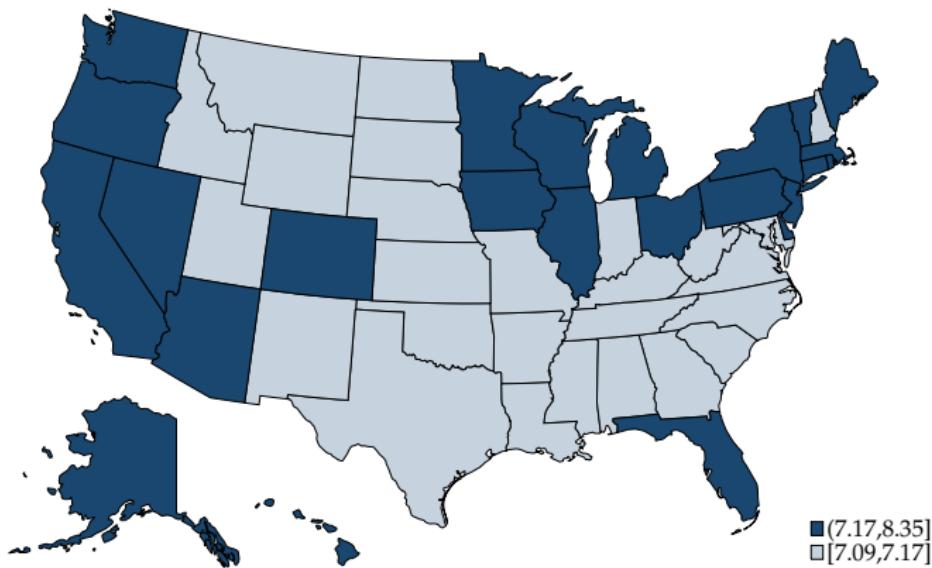


# Increasing role of high minimum wages in major cities



# US Data: Spatial Clustering of State Policy

Differences in: politics, unionization, sectoral mix, business cycle



Not all states without minimum wage increases are good control groups for a minimum wage treatment

**Neumark and Wascher 1992: national panel study**

*Method:* panel data by states and year

*Finding:* resurrected elasticity between -0.1 and -0.3 (for teens)

**Card and Krueger 1994, 2000: local case study**

*Method:* compare border areas in PA with NJ

*Finding:* no negative employment changes among fast food chains -  
- Criticism from Neumark and Wascher (2000) addressed by using  
administrative data

**Dube, Lester and Reich 2010, 2015: reconciles national  
panel, local studies**

*Method:* all contiguous border counties in US, 1990-2006

*Finding:* small employment changes in restaurants, teens

# Key current controversies

## ① Effects on teen employment

- Allegretto, Dube, Reich (2011); Allegretto, Dube, Reich Zipperer (2015); Dube and Zipperer (2015)
- Neumark, Salas and Wascher (2014)
- Totty (2015)
- Gittings and Schmutte (2015)

## ② Effects on aggregate employment

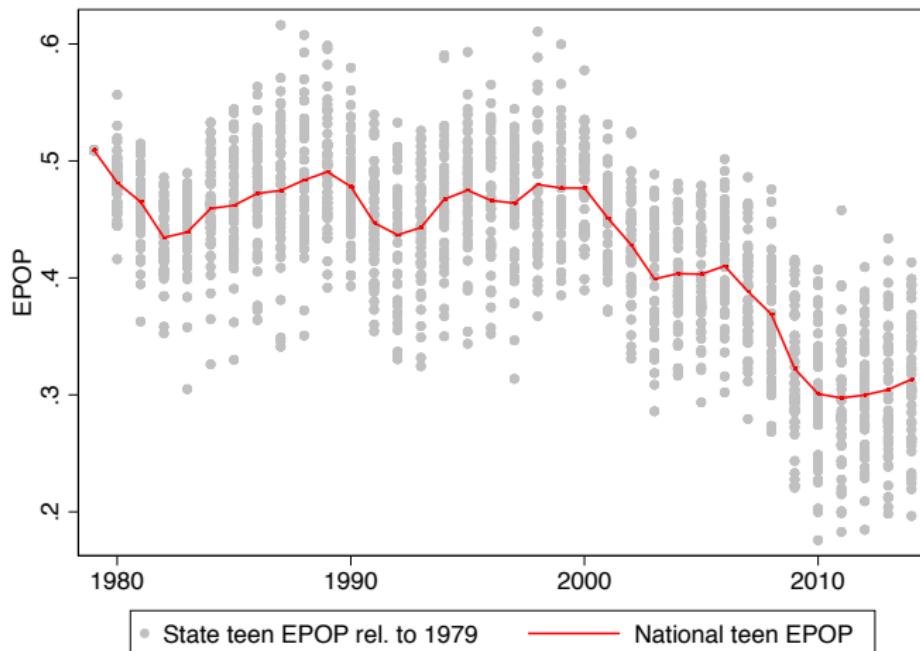
- Meer and West (2015)

## ③ Effect on high impact sectors (restaurant) - surprisingly, much less controversy

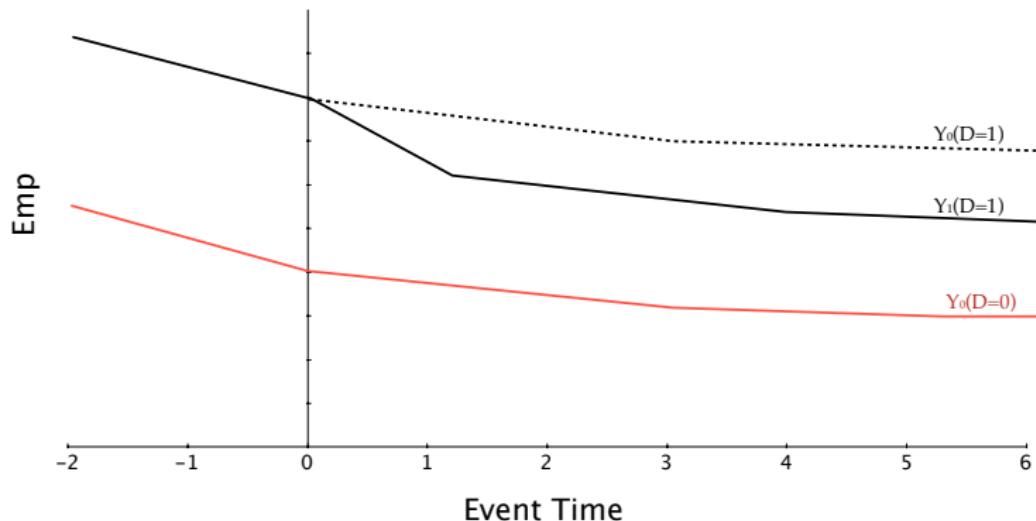
## Teen employment in perspective

- Around 23% of workers earning within 10% of minimum wage are 16-19 year olds
- Among 16-19 year olds, 40% of workers earned within 10% of statutory minimum
  - makes it easy to detect MW effects
  - also a low skill group ... more likely to see L-L substitution away from teens than other workers
- No exemption in most states for teens
  - but there is a federal training wage (\$3 below) for first 90 days for those under 20
  - seldom used by employers

# US Data: Teen EPOP



# Illustration - Difference in Difference



## Panel Data: Two-way Fixed Effects estimator

- Assumes the DGP is:  
 $y_{st} = \beta MW_{st} + X_{st}\Gamma + (\mu_s + \tau_t + \nu_{st})$ , and  $E(\nu_{st}|W_{st}) = 0$
- Allows for an additive “time effect” and “unit effect”
  - only uses relative (across states) changes over time for identification
- Assumes that at a given time  $t$ , conditional on  $X_{st}$ , and a time-invariant heterogeneity  $\mu_s$ , the actual treatment status  $MW_{st}$  is uncorrelated with potential outcome without treatment
- If treatment is binary, this becomes the “Dif-in-Dif” model

# Min. wage elasticities for teens: two-way FE model

Data from Current Population Survey, 1979-2014

Controls for: state & period fixed effects; state unemployment rate, demographic controls

$$Y_{it} = \alpha + \beta MW_{st} + \mathbf{X}_{it}\Lambda + \gamma_s + \delta_t + \nu_{it}$$

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## Panel A: Average teen wage

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Common time FE	0.266***
	(0.038)
N	295,835

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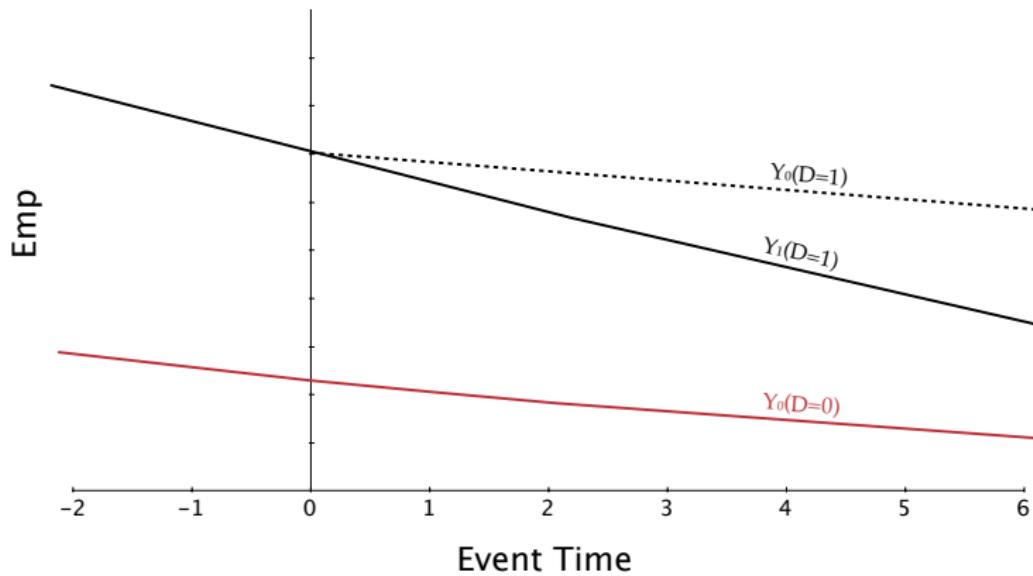
## Panel B: Teen employment

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Common time FE	-0.219***
	(0.043)
N	3,534,924

Source: Allegretto, Dube, Reich and Zipperer, 2015

# Pre-existing trends



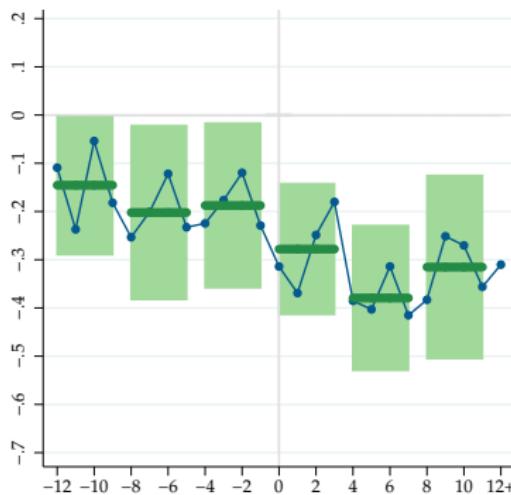
# Detecting pre-existing trends with leads

- Say the correct DGP is  $y_{it} = \beta MW_{st} + X_{it}\Gamma + (\mu_s + \tau_t + \nu_{it})$
- We estimate a distributed-lag model:  
$$y_{it} = \sum_{k=-12}^{12} (\beta_i MW_{s,t-k}) + X_{it}\Gamma + I_s\Psi + J_t\Phi + e_{it}$$
- What should we find?
- The estimated  $E(\hat{\beta}_k) = 0$  for  $k \neq 0$ 
  - in reality, there may be some lagged effects, so  $E(\hat{\beta}_k) \neq 0$  for  $k > 0$
  - but typically we expect leading terms  $E(\hat{\beta}_k) = 0$  for  $k < 0$
  - Note:  $\hat{\beta}_{-1}$  is coefficient for the 1-period lead,  $MW_{st+1}$
- Treatment usually shouldn't affect past outcomes, barring anticipation effects

## Min. wage elasticity for teen emp - timing of effects

$$Y_{it} = \alpha + \sum_{k=-12}^{12} \beta_k MW_{j,s-k} + \mathbf{X}_{it}\Lambda + \gamma_s + \delta_t + \nu_{it}$$

$$\rho_\tau = \sum_{k=-12}^{\tau} \eta_k = \frac{1}{\bar{Y}} \sum_{k=-12}^{\tau} \beta_k$$



Source: Allegretto, Dube, Reich and Zipperer, 2015.

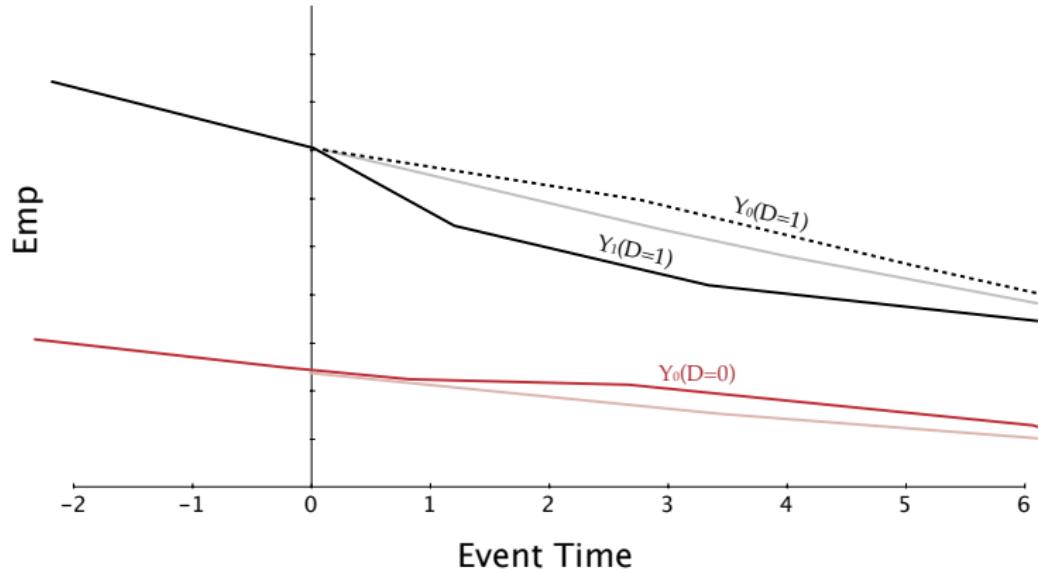
- ① Parametric trends, regional control
- ② Border discontinuity design
- ③ Synthetic control and factor models

## Controlling for trend differences

- One solution is to allow units to vary not just by levels but also (long run) trends
- A two-parameter model of heterogeneity - level and long-run trend differences allowed between units

$$y_{it} = \beta MW_{st} + X_{it}\Gamma + (\mu_s + \tau_t + \eta_s t + \nu_{it})$$

# Controlling for trends differences - illustration

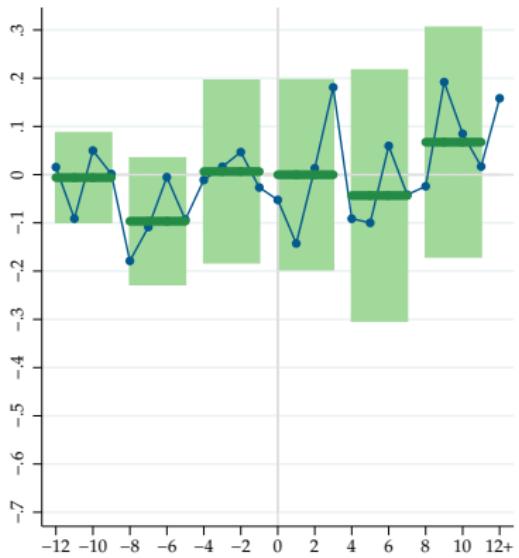


# Min. wage elasticity for teen emp - parametric trend controls

Panel A: Average teen wage				
Common time FE	0.266*** (0.038)	0.228*** (0.020)	0.226*** (0.022)	0.271*** (0.032)
N	295,835	295,835	295,835	295,835
Division-period FE	0.245*** (0.036)	0.253*** (0.033)	0.232*** (0.037)	0.227*** (0.037)
N	295,835	295,835	295,835	295,835
Panel B: Teen employment				
Common time FE	-0.219*** (0.043)	-0.065 (0.041)	-0.044 (0.061)	-0.066 (0.066)
N	3,534,924	3,534,924	3,534,924	3,534,924
Division-time FE	-0.130* (0.077)	0.006 (0.047)	-0.012 (0.048)	-0.023 (0.040)
N	3,534,924	3,534,924	3,534,924	3,534,924
State-specific trend type:				
Linear		Y	Y	Y
Quadratic			Y	Y
Cubic				Y

Source: Allegretto, Dube, Reich and Zipperer, 2015

# Min. wage elasticity for teen emp - timing of effects with trend controls

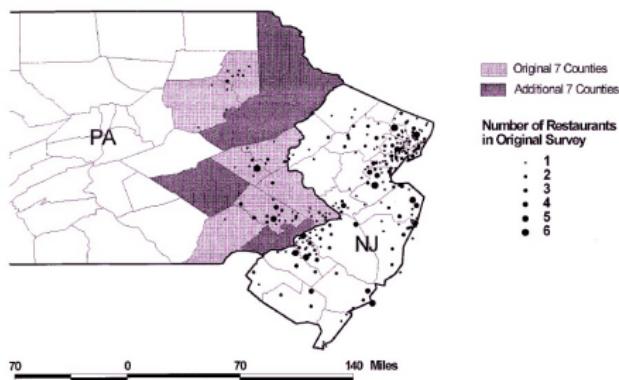


Source: Allegretto, Dube, Reich and Zipperer, 2015. Controls for State-specific linear trends, division-period FE

- ① Parametric trends, regional control
- ② **Border discontinuity design**
- ③ Synthetic control and factor models

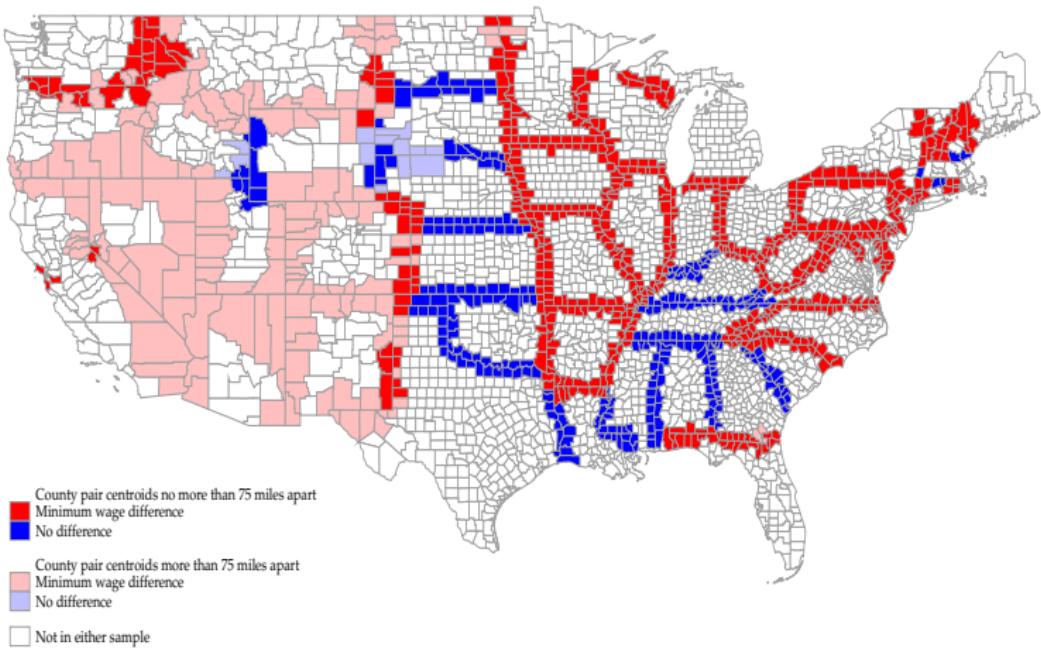
# Leveraging proximity: Card and Krueger (1994, 2000)

- Card and Krueger (1994, *American Economic Review*) studied NJ and PA fast food restaurants
  - NJ raised minimum wage, PA did not
  - Self-collected survey
  - Small positive/no effect on jobs
- Reanalysis (2000, *AER*) using representative payroll records from UI filings
  - **No effect** on jobs



Source:  
Card and Krueger (2000)

# US border county sample (2000-2011): Dube, Lester and Reich (2010, 2015)



# Contiguous counties are more alike

Mean Absolute Differences in Covariates between Contiguous and Random Pairs (DLR 2015)

		Non-contiguous pair	Contiguous pair	Gap	Percent gap
<b>Levels:</b>	Log employment	1.744 (0.026)	1.233 (0.027)	0.511*** (0.033)	41
	Log population	0.042 (0.001)	0.039 (0.001)	0.003*** (0.001)	8
	EPOP	0.229 (0.004)	0.170 (0.004)	0.060*** (0.004)	35
	Log earnings	1.518 (0.023)	0.964 (0.023)	0.554*** (0.029)	57
	Turnover rate	0.057 (0.001)	0.048 (0.001)	0.009*** (0.001)	18
	Teen share	0.006 (0.0001)	0.005 (0.0001)	0.001*** (0.0001)	22
<b>3-year differences:</b>	Log employment	0.099 (0.001)	0.091 (0.002)	0.008** (0.001)	8
	Log population	0.069 (0.001)	0.066 (0.002)	0.004*** (0.001)	5
	EPOP	0.037 (0.001)	0.027 (0.001)	0.001*** (0.001)	36
	Log earnings	0.018 (0.0003)	0.017 (0.0004)	0.001*** (0.0003)	8
	Turnover rate	0.003 (0.000)	0.002 (0.000)	0.001*** (0.000)	25
	Teen share	0.045 (0.001)	0.041 (0.001)	0.004*** (0.001)	9

## Border discontinuity design - contiguous counties

- County-pair database - stack by pairs
  - a county can be part of multiple pairs
  - cluster SE at border-pair and state levels
- Pair-specific fixed effects

$$Y_{jt} = \alpha + \beta MW_{jt} + \mathbf{X}_{jt}\Lambda + \gamma_j + \tau_{pt} + \nu_{jpt} \quad (1)$$

- Washes out variation between pairs; only use within-pair variation
- Dube Lester Reich (2015, forthcoming *Journal of Labor Economics*)
- Quarterly Workforce Indicators sample for teen employment, 2000-2011

# Minimum wage elasticities for teens - border discontinuity design

	Teens	
	(1)	(2)
<i>Earnings</i>	0.177*** (0.036) 83,462	0.222*** (0.047) 83,462
<i>Employment</i>	-0.173** (0.071) 84,702	-0.059 (0.084) 84,702
<i>Hires</i>	-0.515*** (0.094) 80,944	-0.219** (0.094) 80,944
<i>Separations</i>	-0.552*** (0.100) 74,952	-0.233** (0.098) 74,952
<i>Turnover Rate</i>	-0.377*** (0.061) 74,509	-0.204*** (0.072) 74,509
<u>Controls:</u>		
Common time effects	Y	
Pair-specific time effects		Y

# Checking for pre-existing trends in border discontinuity design

	Teens					
	(1)	(2)	(3)	(4)		
				$\ln MW_{t+4}$	$\ln MW_t$	$\ln MW_{t-4}$
<i>Earnings</i>	0.185***	0.215***	0.225***	-0.058	0.207***	-0.043
	(0.062)	(0.048)	(0.047)	(0.040)	(0.057)	(0.049)
	83,462	83,462	81,757		83,462	
<i>Employment</i>	-0.003	-0.059	-0.051	0.084	-0.052	0.098
	(0.084)	(0.084)	(0.079)	(0.067)	(0.112)	(0.067)
	84,702	84,702	83,470		84,702	
<i>Hires</i>	-0.180*	-0.164**	-0.241**	-0.005	-0.252*	0.080
	(0.103)	(0.072)	(0.100)	(0.084)	(0.130)	(0.101)
	80,944	80,944	79,146		80,944	
<i>Separations</i>	-0.225**	-0.183**	-0.239**	0.049	-0.236	0.076
	(0.103)	(0.072)	(0.095)	(0.090)	(0.148)	(0.083)
	74,952	74,952	73,426		74,952	
<i>Turnover Rate</i>	-0.212***	-0.146***	-0.202***	-0.085	-0.258***	0.021
	(0.071)	(0.047)	(0.073)	(0.064)	(0.098)	(0.056)
	74,509	74,509	71,917		74,509	
<b>Controls and Samples:</b>						
County trends	Y					
Overall outcome		Y				
Undistorted data			Y			

- ① Border discontinuity design
- ② Parametric trends, regional control
- ③ **Synthetic control estimator**
- ④ Factor models (Bai Interactive Fixed Effects)

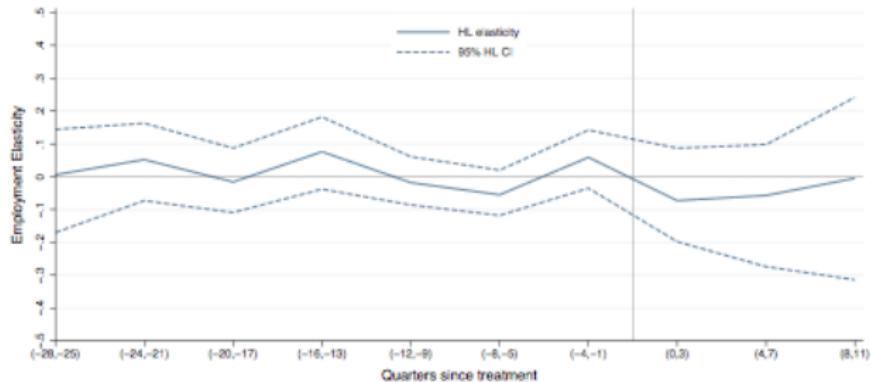
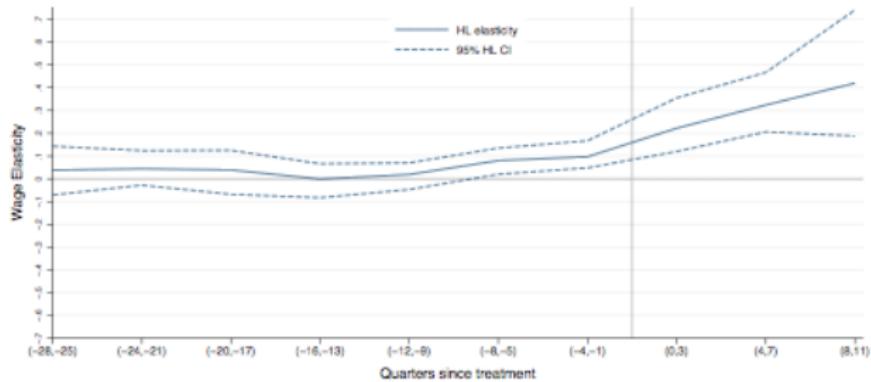
## Pooled synthetic control estimates for teens

- Dube and Zipperer (2015) pool across 29 state minimum wage increases between 1979-2013
- DGP:  $Y_{st} = \alpha + \beta MW_{st} + \mathbf{X}_{st}\Gamma + \Lambda_s \mathbf{F}_t + \nu_{st}$
- Abadie et al. (2010): find “donors” to match pre-intervention outcomes in treated unit

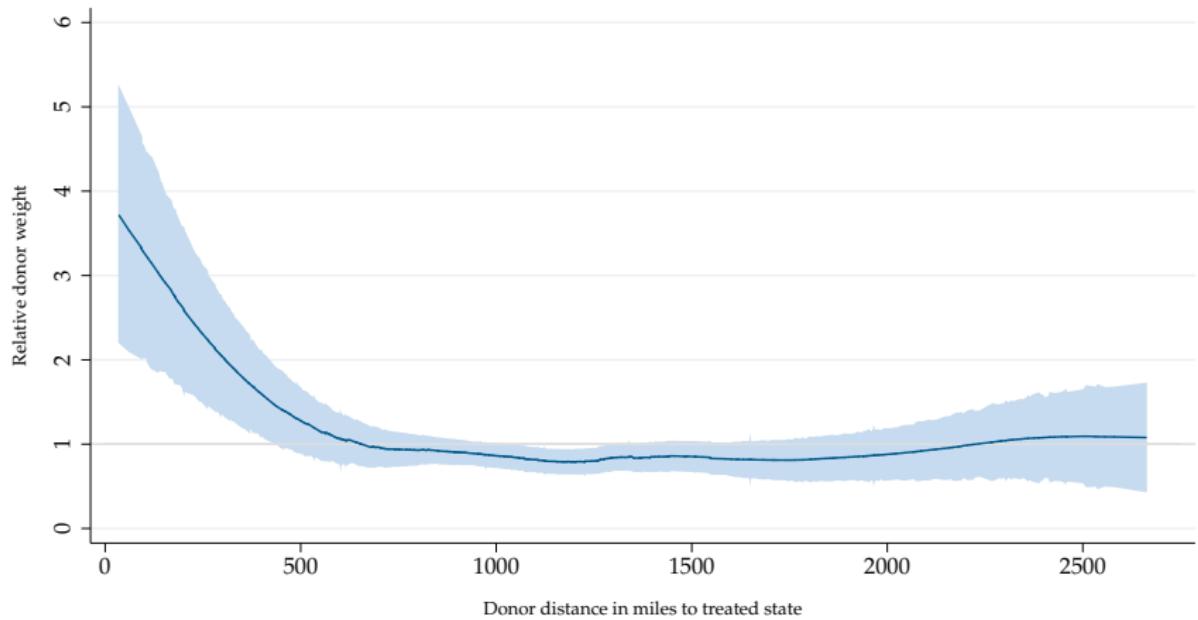
	Wages	Employment
Pooled (HL) Elasticity	0.266	-0.036
Mean percentile rank	0.758***	0.470
Pooled (HL) 95% CI	(0.169, 0.414)	(-0.170, 0.087)

Source: Dube and Zipperer, 2015

# Pooled synthetic control time-paths for teens



# Donor weights



Source: Dube and Zipperer, 2015

- ① Border discontinuity design
- ② Parametric trends, regional control
- ③ Synthetic control estimator
- ④ Factor models (Bai Interactive Fixed Effects)

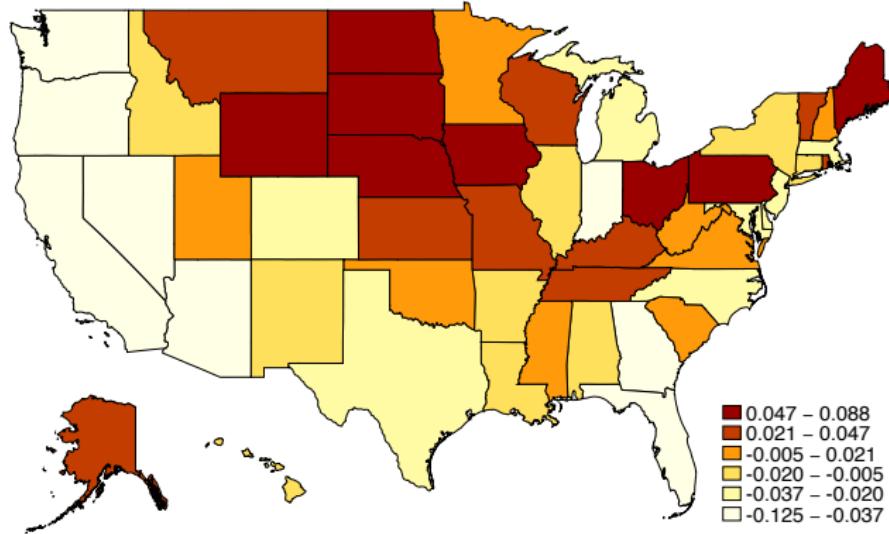
# Interactive fixed effects model estimates for teens

- Originally applied to minimum wage literature in Totty (2015) - teens between 1990-2010  
$$Y_{st} = \alpha + \beta MW_{st} + \mathbf{X}_{st}\Gamma + \Lambda_s\mathbf{F}_t + \nu_{st}$$
- Updated using 1979-2014 data

	Wages	Employment
2-way FE Model	0.342*** (0.037)	-0.199** (0.080)
+ 1 interactive factor	0.231*** (0.027)	-0.035 (0.036)
+ 2 interactive factors	0.242*** (0.028)	-0.009 (0.036)

Source: Own calculations from 1979-2014 annualized CPS state panels. Regressions control for state unemployment rate, teen share of population. Unweighted.

# Spatial distribution of cross-sectional factor



## Taking stock of teen findings

- Most recent studies (Allegretto et al (2011, 2015), Dube Lester and Reich (2015), Dube and Zipperer (2015), Gittings and Schmutte (2015), Totty (2015)) studying teen employment have found small average effects of minimum wages
  - less than -0.1 in magnitude
- In contrast, Neumark Salas and Wascher (2014) “matching estimator” find more negative impact -0.145
  - sample mixes treatment/control distinction: some places are treated, some places see employment loss...but mostly not the same
  - somewhat of an outlier

# Impact on employment in highly affected sector: restaurants

"Food services and drinking places"

- hires 24% of all min. wage workers; 23% of its workers earn within 10% of minimum
- not much current disagreement that employment effects in this sector are small

Preferred estimators from 4 key studies:

- Neumark Salas and Wascher (2014) [Synthetic control "matching estimator"]
- Totty (2015) [Bai, Pesaran factor-model estimators]
- Addison, Blackburn and Cotti (2015) [County-specific trends]
- Dube, Lester and Reich (2010, 2014) [Contiguous border county pairs]

Effect of a **10%** increase in minimum wage:

Earnings increase  $\approx 2\%$

Employment change range across studies  $\approx [-0.7\%, 0.2\%]$

- Most researchers have controlled for overall employment, unemployment when estimating minimum wage effects. (E.g., Neumark et al. 2014, Allegretto et al. 2011, 2014)
- Exception is Meer and West (2015) - they use aggregate employment as outcome
- FD models with 3 annual lags - different from their original “growth on levels” formulation

$$\Delta Y_{st} = \alpha + \sum_{k=0}^3 \eta_k \Delta MW_{s,t-k} + \mathbf{X}_{st} \Lambda + \delta_t + \nu_{st}$$

- Find  $\sum \eta_k \approx -0.07 \dots$  quite substantial since this is total private sector employment

- Lack of controls for overall labor market makes the identification problem even harder than usual
- Their estimated effects show up in “wrong” places:
  - Biggest job losses in high wage sectors with few min. wage workers (Professional Services, Management)
- Their estimated effects don’t show up in “right” places:
  - estimates in Allegretto et al. (2015) for teens using same model produces  $\sum \eta_k \approx +0.07$
- The estimate on total private sector employment are close to zero up with richer time-varying heterogeneity:
  - border county pairs (as in DLR (2010, 2015))
  - Interactive Fixed Effects (as in Totty(2015))
- Raises doubts about causal import of Meer and West’s findings

# A recent meta analysis of minimum wage elasticity of employment

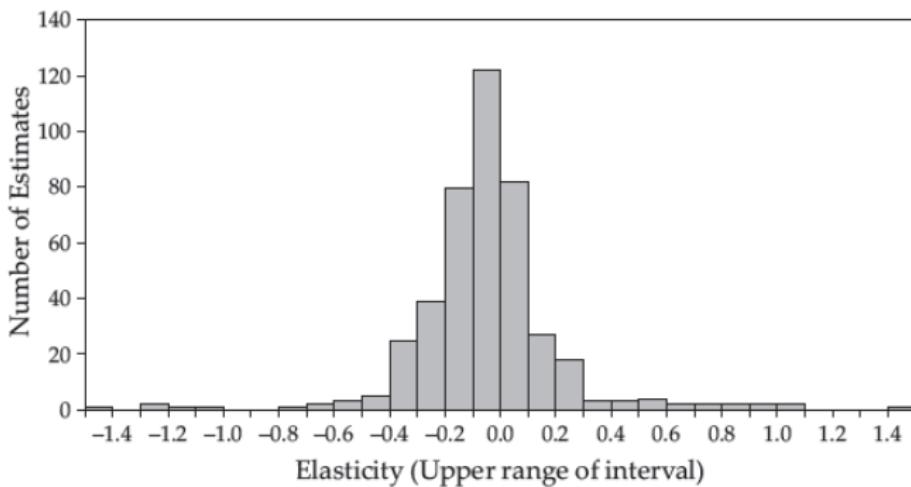
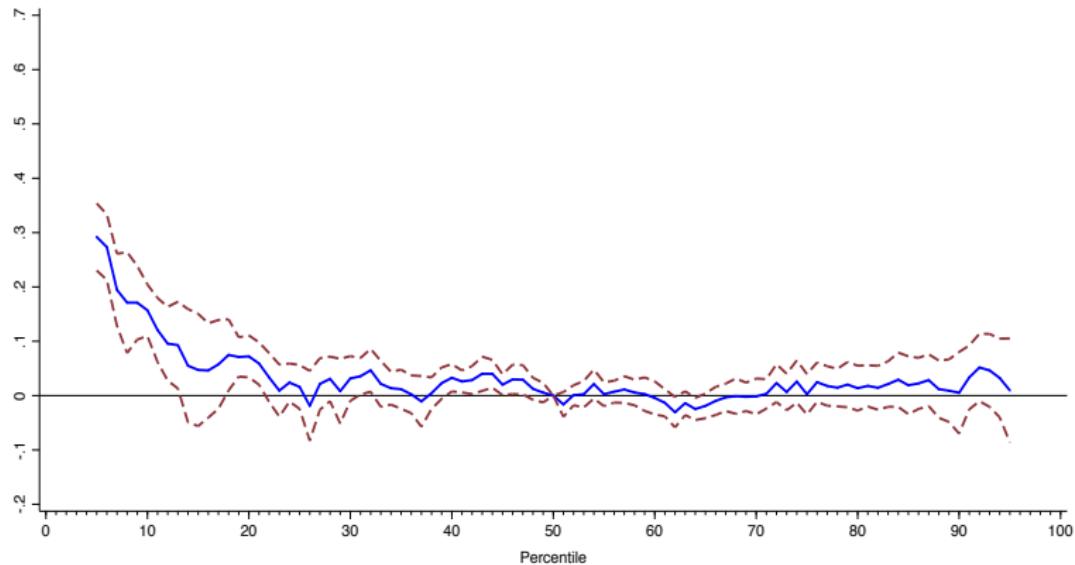


Figure 2. Distribution of Employment and Hours Elasticities (Belman and Wolfson, 2014). Histogram of 439 estimated elasticities of employment or hours with respect to minimum wage, derived from 23 separate studies, as reported in Belman and Wolfson (2014). Median elasticity is -0.05; precision-weighted median is -0.03.

# Changing opinions among (American) economists

- Do minimum wages substantially lower employment among low-wage workers?
  - **1978** AEA Member Survey: **90%** agreed
  - **1992** AEA Member Survey: **72%** agreed
  - **2000** AEA Member Survey: **46%** agreed
  - **2013** IGM Panel (\$9/hr): **34%** agreed
  - **2015** IGM Panel (\$15/hr): **26%** agreed
- Analysis of petition signers (O'Neill 2014):  
Labor economists, recent PhDs *more* likely to support raising minimum wages

# Effect on wage distribution

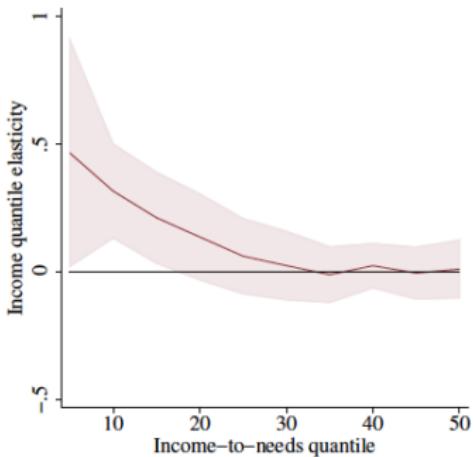


Source: Autor Manning and Smith (2015). 1979-2014 data on overall wage distribution.  
2SLS specification includes state and period FE and state trends).

# Effect on family incomes: Impact of 10% increase in minimum wage

## Family Income (all non-elderly)

- 10<sup>th</sup> pctile income ↑ 3.2%\*
- Poverty rate ↓ 2.4%\*
- SNAP enrollment ↓ 2.4%\*
- Poverty rate net of tax credits and transfers:  
↓ 2.0%\*

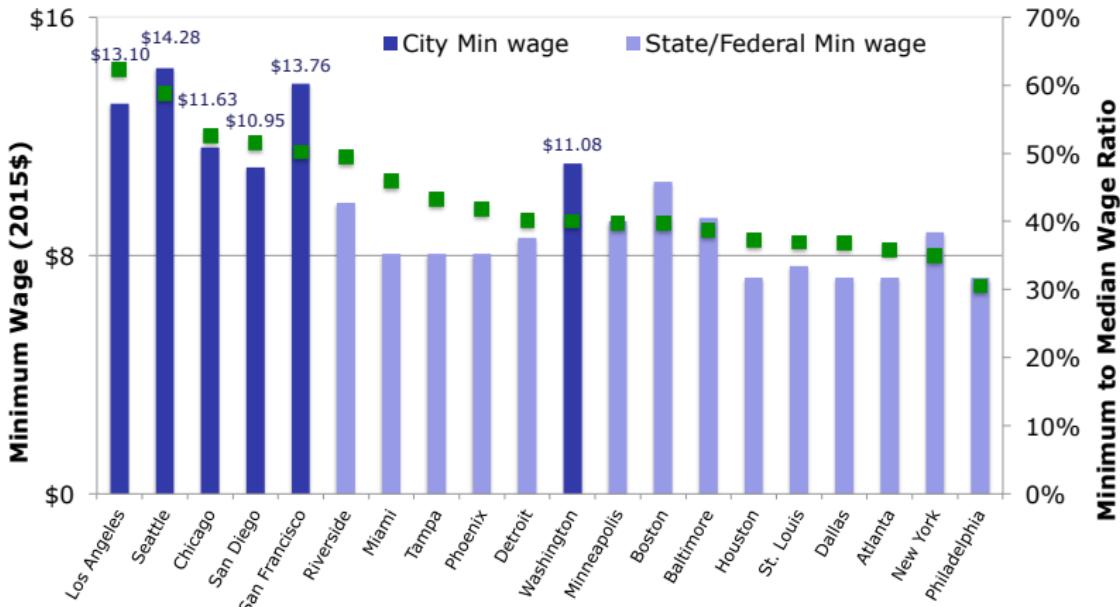


Sources: Dube (2014); Reich and West (2014).  
Statistical significance at 5% level indicated by \*

# But ... how high?



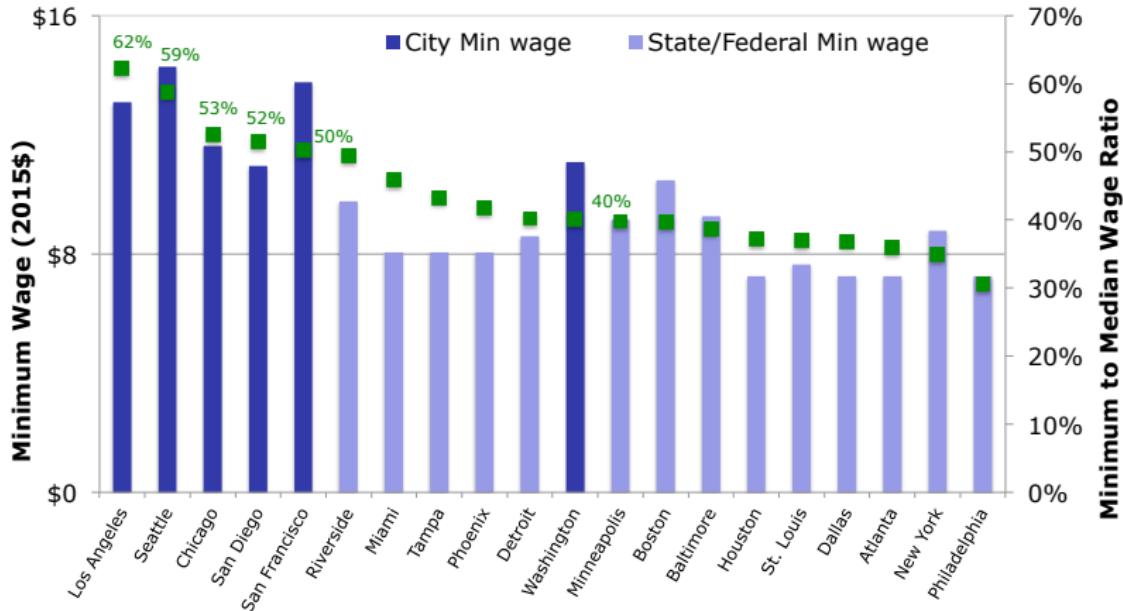
# Minimum wages in biggest metro areas



Sources: American Community Survey Data; state/fed MW from NCSL; city MW from UC Berkeley CLRE.

Assumes a 2.5% inflation rate for converting future wages to 2015\$

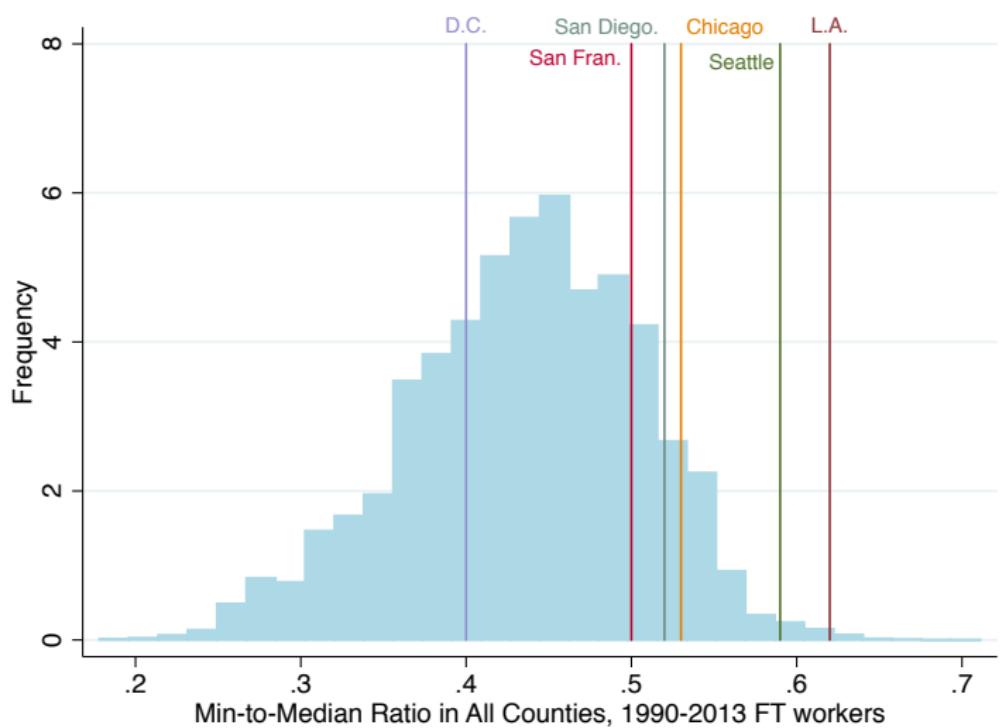
# Minimum wages in biggest metro areas



Sources: American Community Survey Data; state/fed MW from NCSL; city MW from UC Berkeley CLRE.

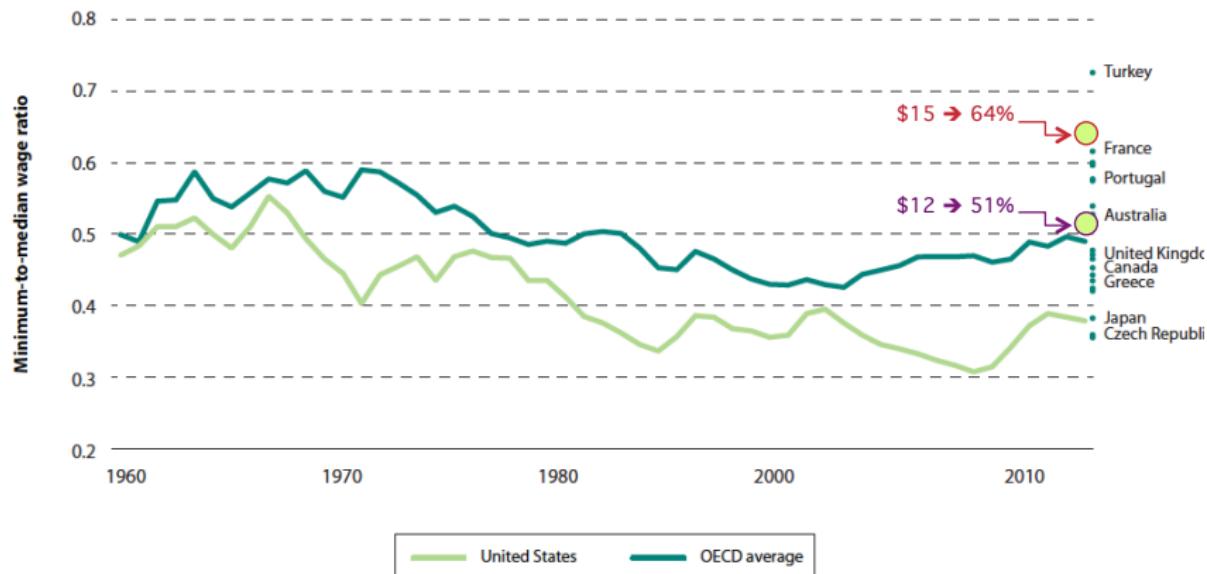
Assumes a 2.5% inflation rate for converting future wages to 2015\$

# New city minimums and evidence base



# Federal minimum wage proposals \$12 or \$15 by 2020

The Ratio of Minimum to Median Full-Time Wage: United States and OECD Countries, 1960–2012



# Conclusions

- Controversies remain ... but we have made progress
- Much better appreciation today of non-random selection of minimum wage policies
  - better identification strategies
- In sectors hiring 2/3 of minimum wage workers (Accommodation & Food Services, Retail), recent evidence mostly point to at most small effects.
- For higher impact demographic groups (esp. teens) we have greater disagreement. However, best-identified estimates suggest small effects, under -0.1.
- Need more work on obtaining aggregate employment effects
- New slate of minimum wage policies - especially in Seattle, Los Angeles - are “out of sample” , as are some of the federal proposals (like \$15/2020)