Estimating the Incidence of Government Spending

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Who benefits from government spending in the long-run?

- Measure effects on the welfare of three types of agents:
  - Skilled workers, unskilled workers, and landowners
- Analyze local incidence in spatial equilibrium
  - Worker mobility equilibrates inter-regional utility differentials
  - Imperfect mobility: local workers may capture some economic benefits
  - Show that incidence of spending depends on workers' valuation of government services
- Answering question is important for
  - Long-run level of government spending at local level
  - Distribution of funds across localities

Challenges for the Measurement of Incidence

1. Federal spending is endogenous to local economic conditions
   - Automatic stabilizers and targeting bias
2. Worker utility might depend on government services
   - E.g. Health care (Medicaid), education (Title I), local amenities (Community Development Block Grants)
   - Need marginal marginal valuation of government services
3. Account for effects of spending on several sectors
   - Spending might affect firms, workers, and housing sector
   - Need a sufficiently rich general equilibrium approach

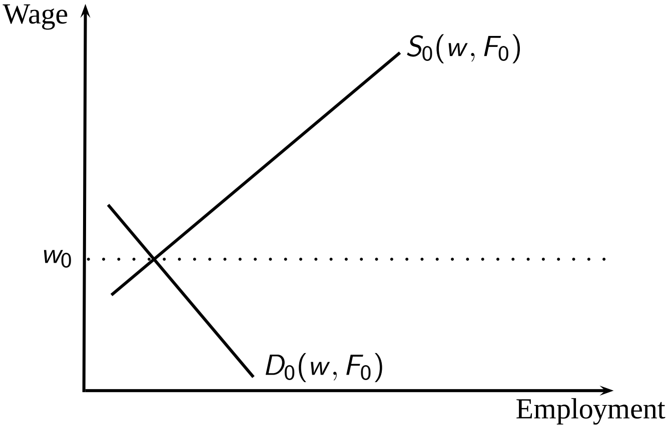
Contributions to the Literature

1. Estimate long-run effects of spending
2. Test for workers have positive valuations of government services
3. Estimate fully-specified model including workers' marginal valuation of government services
   - Show that incidence on workers may justify increasing spending
   - Provide guidance on distribution of spending across localities based on local skill shares

Preview of Results 1: Long-run Effects

- Census Shock instrument isolates geographic variation in federal formula-based spending at local level (Suárez Serrato and Wingender (2011))
- Persistent effects of sustained spending on wage and migration
  - Large population response, larger for skilled workers
  - Wages of high skilled are more affected
- Substantial differences with effects of local demand shocks (Bartik (1991), Bound and Holzer (2000), Notowidigdo (2011))
- Empirical puzzle: skilled wages are more affected but skilled workers are more mobile

Preview of Model



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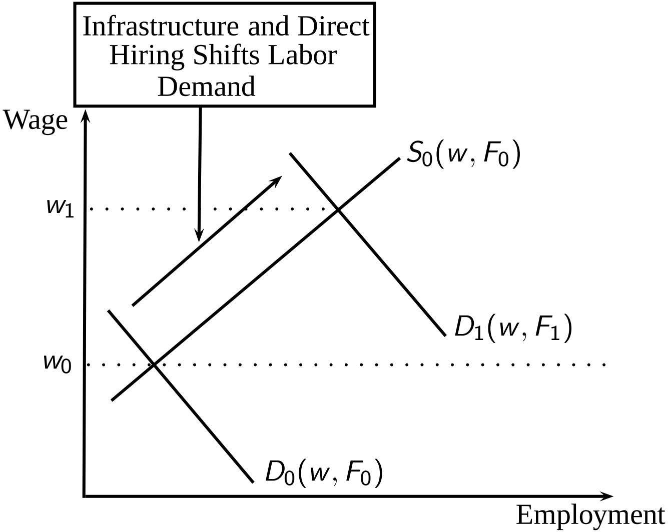
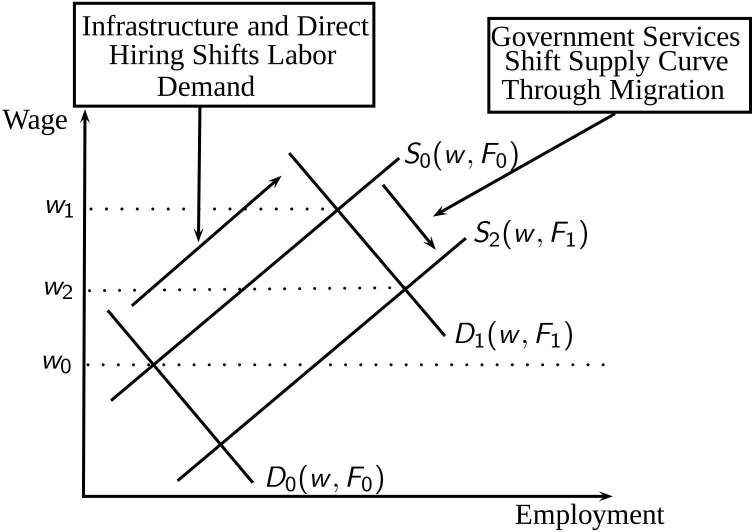
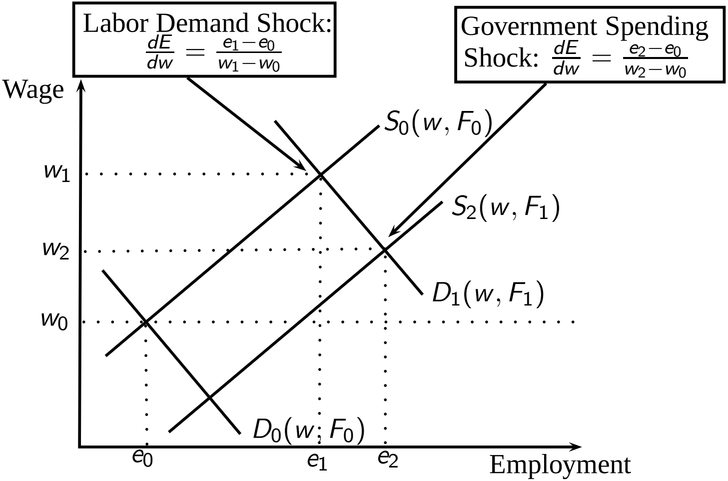


Preview of Model



Preview of Model



Preview of Results 2: Incidence

- Test for positive valuation of government services
  - Find positive valuation that is larger for unskilled workers
  - Reconciles empirical puzzle in comparison with demand shocks
- Estimate fully-specified model and recover marginal valuation of government services
  - \$1 of additional spending raises welfare by \$1.45
  - Ignoring workers' valuation yields only \$0.60
  - Provide guidance for distribution of funds by skill-share
  - Supply components explains about half of total effect on wages for unskilled

Outline

- Relation to previous work
- Data and Identification
- Long-run Effects of Spending
- Test of Valuation of Government Services
- Structural Estimation
- Cost-Benefit Analysis

State of the Literature

- Labor, housing, and amenity markets are integrated in spatial equilibrium (Roback (1982), Moretti (2011))
  - Perfect mobility: Owners of land benefit from amenities
  - Fiscal conditions affect wage differentials (Gyourko and Tracy (1989))
  - Imperfect mobility: Incidence of amenities may fall on workers
  - We provide first estimates of the incidence of spending accounting for workers' valuation of government services

State of the Literature

- Place-based policies
  - Suspicion that place-based policies are not good policy (Glaeser and Gottlieb (2010), Albouy (2010))
  - Empowerment Zones improve labor market conditions with modest deadweight-loss (Busso et al. (2010))
  - Big-push policies motivated by agglomeration externalities (Kline and Moretti (2011))
- Interactions of taxation and transfer programs in local economies
  - Distribution of tax burden may be distorted by local prices (Albouy (2009))
  - Taxes may distort the equilibrium value of amenities (Albouy (2010))
  - Welfare transfers respond indirectly to demand shocks (Notowidigdo (2011))

Data

- Use micro-data from 1980, 1990, and 2000 Census and 2009 American Community Survey for outcomes:
  - Population, employment, income, wages, and rents
  - Calculate composition-constant adjusted wages and rents
- County group level (493 county groups)
  - Smallest consistently identifiable groups
  - Groups states into 42 states for fixed effects
- Welfare aggregates from Bureau of Economic Analysis at county level

Data

- Federal Spending Data
  - Consolidated Federal Funds Report (CFFR)
  - Distribution of federal spending by county for years 1978-2009
  - Spending by agency (680 in 2009) and program (over 1500 in 2009)
  - Excludes security spending (CIA, NSA, etc..), international transfers, and debt servicing
- Population Data
  - Decennial Census estimates
  - Post-censal estimates: contemporaneous population estimates from 1970 to 2009 published by the Census Bureau
  - No estimates published in 1979, 1980, 1989, and 1990
  - Administrative data from Vital Statistics and IRS County-to-County migration data

Identification Strategy: Census Shock

- Large number of federal programs depend on local population estimates to allocate spending
  - Medicaid, Title I Education Grants, Community Development Block Grants, Mass Transportation Services Grants, Social Services Block Grants use population-based formulas
  - Blumerman and Vidal (2009): 140 programs in 2007, $440 billion, 15% of federal outlays
- Census Bureau switches between two population estimation methodologies:
  - Decennial Census estimates
  - Postcensal estimates produced annually

Identification Strategy

- Postcensal (PC) population estimated using births, deaths, and migration data
  $Pop^{PC}_{c,t} = Pop^{PC}_{c,t-1} + (B_{c,t} - D_{c,t} + M_{c,t})$

- The decennial Census counts (C) are physical counts of the population; they replace previous estimates once final results are released

- Instrument is the difference in population between Census count (C) and the administrative estimate (PC)

- Identification comes from the measurement errors in two population estimates $Pop^{C}_{c,t}$ and $Pop^{PC}_{c,t}$; not population growth

Identification Strategy

- As an example consider Monterey County, CA:

Table: Population and Instrument for Monterey

Year	Population (Post-Censal) (000's)	Population (Decennial Census) (000's)	Census: Shock (% Diff)
1980	286	290	1.62
1990	362	357	-1.43
2000	374	402	6.87

Census Shock is Not Serially Correlated

Census Shock and Government Spending

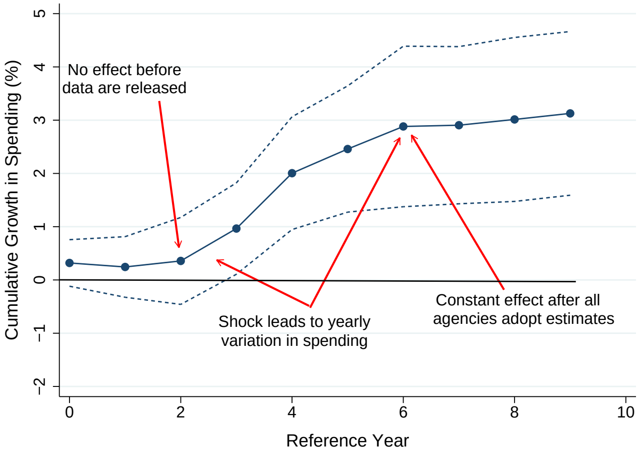
- Estimate the impact of Census shock on subsequent federal spending growth separately by year

$$\Delta F_{c,t} = \mu_{s,t} + \delta_t CS_{c,\text{Census}} + \epsilon_{c,t}$$

  where $\Delta F_{c,t}$ is federal spending growth and $\mu_{s,t}$ state by year fixed effects
- Plot cumulative effect for year $T = \sum_{t=1}^{T} \delta_t$

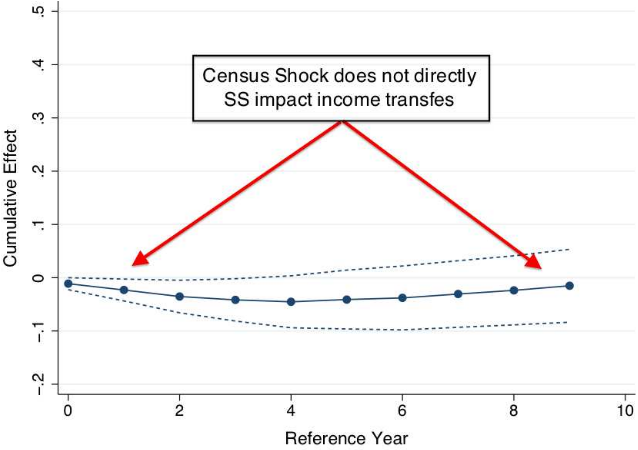
Cumulative Effect of Census Shock on Spending

Figure: Cumulative Impact of a 10% CS on Federal Spending



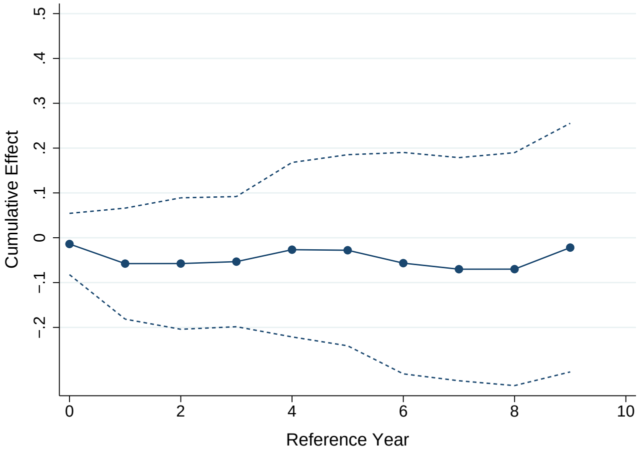
Census Shock and Income Transfers

Figure: Cumulative Impact of a 10% CS on SS Income Transfers



Census Shock is Not Related to Past Spending

Figure: Cumulative Effect of Future Census Shock on Spending



Assessing the Instrument

- Census shock:
  - impacts federal spending only after final data is released
  - does not impact transfers to individuals (e.g. social security)
  - is not related to past growth in spending
  - is not serially correlated across decades
  - is not geographically correlated (5% of variation)

- Potential confounders
  - Population estimates may be correlated with local shocks
  - Confounder would need to be consistent with timing
  - Not consistent with evidence of responses to shocks (e.g. Blanchard and Katz (1992))
  - Use fixed effects in growth rates and observable shocks
  - GMM model to generate instrument independent of shocks and covariates

Labor Demand Shock

- Reduced-form test compares migration response across shocks
- Fully-specified model combines spending shock and labor demand shock to estimate valuation of government services
- Use Bartik's (1991) shift-share employment shock (Blanchard and Katz (1992), Bound and Holzer (2000), Notowidigdo (2011))

$$\text{Bartik}_{c,t} = \sum_i \Delta\text{Emp}_{US,t}^{\text{Industry}_i} \times \frac{\text{Emp}_{\text{c,t}-10}^{\text{Industry}_\text{i}}}{\text{Emp}_{c,t-10}}$$

Long-run Effects of Government Spending

- For given outcome y we estimate

$$\Delta y_{c,t} = \alpha_{s,t} + \beta \Delta F_{c,t} + \varepsilon_{c,t},$$

where Δ is log first-difference, $\alpha_{s,t}$ are state group-year fixed effects and $\varepsilon_{c,t}$ are clustered at county group level.

- Instrument for government spending using

$$\Delta F_{c,t} = \delta_{s,t} + \gamma CS_{c,t-1} + \epsilon_{c,t},$$

where $\delta_{s,t}$ are state group-year fixed effects and $\epsilon_{c,t}$ are clustered at county group level.

Census Shock and Government Spending Over a Decade

	(1) Federal Spending	(2) Federal Spending
Census Shock	0.497***	0.493***
	(0.141)	(0.142)
Bartik		0.026
		(0.092)
F-Stat Instr	12.46	12.03

Notes: 1,479 county group-decade observations. State group-year fixed effects included. Standard errors clustered at the county group level in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

OLS Results: Effects of Federal Spending

	(1) Pop	(2) Wage	(3) Adj. Wage	(4) Transfers Per-Adult
All Workers				
Fed Spend	0.262^{***}	0.018	0.007	
	(0.037)	(0.011)	(0.009)	
Skilled Workers				
Fed Spend	0.296^{***}	0.018	0.019^{*}	
	(0.047)	(0.012)	(0.011)	
Unskilled Workers				
Fed Spend	0.248^{***}	0.010	0.005	-0.005
	(0.034)	(0.011)	(0.010)	(0.040)

Notes: 1,479 county group-decade observations. State group-year fixed effects included. Standard errors clustered at the county group level in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

IV Results: Effects of Federal Spending

	(1) Pop	(2) Wage	(3) Adj. Wage	(4) Transfers Per-Adult
All Workers				
Fed Spend	1.463***	0.290***	0.251***	
	(0.314)	(0.106)	(0.091)	
Skilled Workers				
Fed Spend	1.335***	0.431***	0.313**	
	(0.397)	(0.160)	(0.130)	
Unskilled Workers				
Fed Spend	1.265***	0.132	0.163*	0.839*
	(0.294)	(0.096)	(0.087)	(0.488)

Notes: 1,479 county group-decade observations. State group-year fixed effects included. Standard errors clustered at the county group level in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

Test of Positive Valuations

- Is government spending a pure labor demand shock?
- If workers value GS, they will accept a lower wage to relocate to area with higher services
  - Population will be more responsive to an increase in the real wage from a government spending shock
- Real wages are given by

$$\Delta \text{Real Wage}_c^i = (1 - s^{i,t})\Delta w_c^i + s^{i,t}\Delta t_c^i - s^{i,r}\Delta r_c,$$

- Substitute parameters:
  - Expenditure Shares on Housing $s^{r,U} = s^{r,S} = 30\%$
  - Expenditure Shares on Income Transfers $s^{t,U} = 5\%$

Test of Positive Valuations

- Estimate IV regression

$$\Delta Pop_{c,t} = \alpha_{s,t} + \beta \Delta \text{Real Wage}^i_c + \varepsilon_{c,t}$$

- Instrument $\Delta \text{Real Wage}^i_c$ with Bartik and Census Shock

	(1) IV Pop	(2) IV Pop
Instrument	Bartik	Census Shock
All Workers		
Real Wage	1.584***	6.698***
	(0.251)	(2.166)
Skilled Workers		
Real Wage	2.463***	4.474**
	(0.587)	(1.987)
Unskilled Workers		
Real Wage	1.024***	6.870**
	(0.360)	(2.941)

Structural Estimation

- Ideally, we'd like to
  - Know relative size of demand and supply components
  - Evaluate welfare impacts of government spending
- Reduced-form analysis is limited by two problems
  - We don't observe changes in government services
  - Need to isolate supply component of government spending
- Propose a structural model solves these problems
  - Estimate labor supply and demand curves
  - Estimate valuation of government services

Components of Model

- C localities; each with a population of measure N_c
- Total population is normalized to unity
- Population is divided into skilled and unskilled workers: N_c^S and N_c^U
- Economy has following components:
  1. Government Sector
  2. Firms
  3. Income transfers
  4. Workers
  5. Production of Housing

Government Sector

- Federal spending is determined by a statutory formula

$$F_c = f(X_c, \tilde{N}_c),$$

of X_c, population characteristics, and population estimates:

$$\tilde{N}_c = N_c + CS_c,$$

where CS_c are mistakes in population measurement.

Government Sector

- These funds have three different uses:
  1. Provision of Infrastructure: $\bar{Z} = g^z F_c$
  2. Hiring of local workers

$$L_c^{GD,i}(w_c^i) = \frac{g^i F_c}{w_c^i}$$

     Note $g^z + g^S + g^U = 1$.
  3. Provision of Public Goods and Services

$$GS_c = (L_c^{GD,S})^{\theta}(L_c^{GD,U})^{1-\theta},$$

     where $\theta = \frac{g^S}{g^S + g^U} \in (0,1)$.
- F_c shifts demand through (1) and (2) and shifts supply through (3)
- The supply component depends on the worker's valuation of government services

Workers

- Maximize utility by choosing location c:

$$\begin{aligned} u^i_{jc} &= \log(w^i_c + t^i_c) - s^{i,r}\log(r_c) + \log(A_c) + \phi^i \log(GS_c) + \sigma^i \varepsilon^i_{jc} \\ &= v^i_c + \sigma^i \varepsilon^i_{jc}, \end{aligned}$$

  where $s^{i,r}$ is share of rent and ϕ^i is valuation of GS_c
- Heterogeneity in idiosyncratic term σ^i leads to rents and differential mobility by skill
- Population in area c is given by

$$N^i_c = \mathbb{P}r\left(u^i_{jc} = \max_{c'} \; u^i_{jc'}\right)$$

Workers: Labor Supply

- Assuming ε^{i}_{jc} are multinomial logit, labor supply is given by:

$$\frac{d \log N^{i}_{c}}{(1 - N^{i}_{c})} = \frac{d \log \mathrm{Real\ Wage}^{i}_{c}}{\sigma^{i}} + \frac{\phi^{i}}{\sigma^{i}} d \log GS_{c} + \frac{d \log A_{c}}{\sigma^{i}},$$

- Supply of labor for a given area is an upward-sloping function of the wage
- As workers value GS_c, an increase in GS_c leads to a decrease in equilibrium wages

Structural Estimation: Labor Supply

Problem 1: We don't observe changes in government services

- Model yields following relation:

$$\Delta GS_c = \Delta F_c - (\theta^S \Delta w_c^S + \theta^U \Delta w_c^U)$$

- Government Skilled Labor Demand Shares $\theta = 40\%$
- Estimate labor supply equation:

$$(LS^i) : \Delta N_{c,t}^i = \mu_{s,t}^{LS,i} + \frac{\Delta \text{Real Wage}_{c,t}^i}{\sigma^i} + \frac{\phi^i}{\sigma^i} \Delta GS_{c,t} + \Delta e_{c,t}^{LS,i}$$

- $\Delta e_{c,t}^{LS,i}$ is an amenity shock
- OLS may bias σ upward
- Instrument using Bartik and Census Shock

Structural Results: Labor Supply

	(1) Labor Supply Unskilled		(2) Labor Supply Skilled	
	Mobility: σ^U	Valuation of GS: ϕ^U	Mobility: σ^S	Valuation of GS: ϕ^S
OLS	1.882***	0.401***	2.552***	0.536***
	(0.261)	(0.056)	(0.631)	(0.127)
IV	0.399***	0.502***	0.350***	0.267***
	(0.108)	(0.131)	(0.082)	(0.092)
Instruments		B & CS		B & CS
Overid P-Val		0.220		0.020
Endog P-Val				

$$(1) \textit{ and } (2)\ LS^i:\ \Delta N^i_{c,t} = \mu^{LS,i}_{s,t} + \frac{\Delta \text{Real Wage}^i_{c,t}}{\sigma^i} + \frac{\phi^i}{\sigma^i}\Delta GS_{c,t} + \Delta e^{LS,i}_{c,t}$$

Firms

- Two types of firms that hire either skilled or unskilled workers with technology:

$$y_c^i = B_c (L_c^i)^{\alpha_i} (\bar{Z}_c)^{1-\alpha_i}$$

- Differentiating total demand for skill i in county c we get

$$\begin{aligned} d\log L_c^{D,i} &= d\log \bar{Z}_c - \left(\kappa^{GD,i} + \frac{\kappa^{PD,i}}{(1-\alpha_i)} \right) d\log w_c^i \\ &+ \frac{\kappa^{PD,i}}{(1-\alpha_i)} d\log B_c^i, \end{aligned}$$

where $\kappa^{GD,i}$ is the share of employment by the government.

Structural Estimation: Labor Demand

Problem 2: Need to isolate supply component of government spending

- Assume hiring and infrastructure captures demand component
- Supply component of shock identifies labor demand curve

$$(LD^i) : \Delta N^i_{c,t} - \Delta \bar{Z}_{c,t} = \mu^{LD,i}_{s,t} - \left(\kappa^{GD,i} + \frac{\kappa^{PD,i}}{(1-\alpha_i)} \right) \Delta w^i_{c,t} + \xi \mathrm{Bartik}_{c,t} + \Delta e^{LD,i}_{c,t}$$

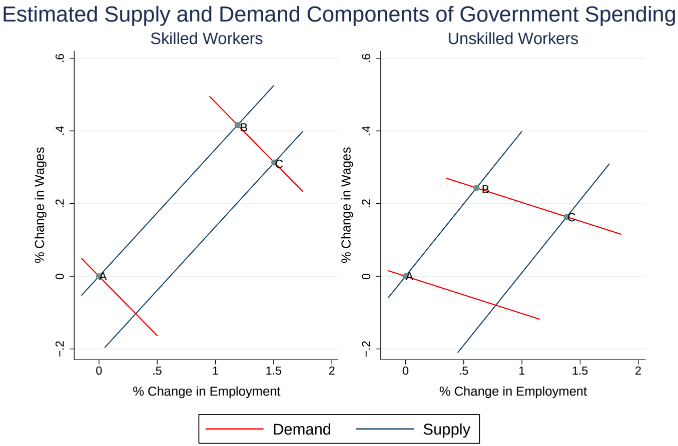
- Public Sector Employment Shares $\kappa^{G,S} = 10\%$, $\kappa^{G,U} = 8\%$
- Control for demand shocks: $\Delta e^{LD,i}_c$ is a productivity shock
- OLS may bias α_i upward; upward-sloping demand if $\alpha_i > 1$.
- Instrument $\Delta w^i_{c,t}$ using Census Shock

Structural Results: Labor Demand

	(6) Labor Demand Unskilled	(7) Labor Demand Skilled
	Output Elasticity: α^U	Output Elasticity: α^S
OLS	2.828***	3.593***
	(0.558)	(1.006)
IV	0.903***	0.674**
	(0.186)	(0.300)
Instruments	CS	CS
Overid P-Val	0.396	0.840
Endog P-Val		

$$(6) \textit{ and } (7)\ LD^i:\ \Delta N^i_{c,t} - \Delta \bar{Z}_{c,t} = \mu^{LD,i}_{s,t} - \left(\kappa^{GD,i} + \frac{\kappa^{PD,i}}{(1-\alpha_i)}\right)\Delta w^i_{c,t} + \xi \mathrm{Bartik}_{c,t} + \Delta e^{LD,i}_{c,t}$$

Decomposition of a 1% Increase in Government Spending



- Skilled: Supply Shift explains 19% of ΔN_c^S and 32% of Δw_c^S
- Unskilled: Supply Shift explains 53% of ΔN_c^U and 46% of Δw_c^U

Housing Market

- Assume a skill-integrated housing market with inverse supply function:

$$r_c = k_c G(H_c)$$

- H_c is the number of housing units.
- $G(\cdot)$ is an upward-sloping function
- k_c represents a shock to the productivity of the housing sector
- In our empirical analysis consider two alternative housing supply functions $G(\cdot)$.

Structural Estimation: Housing Supply

1. Constant elasticity inverse supply of housing :

$$(HM) : \Delta r_{c,t} \;\; = \;\; \mu_{s,t}^{HM} + \eta \Delta H_{c,t} + \Delta e_{c,t}^{HM}$$

2. Durable properties of housing suggest a concave housing supply function (Glaeser and Gyourko (2005))
   Non-linear inverse supply of housing :

$$(HM,2) : \Delta r_{c,t} \;\; = \;\; \mu_{s,t}^{HM,2} + \gamma \frac{(\exp\{\rho \Delta H_{c,t}\} - 1)}{\rho} + \Delta e_{c,t}^{HM,2}$$

- $\Delta e_{c,t}^{HM}$ is a housing-sector productivity shock
- OLS may yield housing supply functions that would be too flat
- Instrument with both Bartik and Census Shock

Income Transfers

- Demand shocks affect wages and have indirect effects on transfers (Notowidigdo (2011))
- Assume skilled population does not receive transfers
- Define transfer as

$$t_c^i = \begin{cases} T_c(w_c^i)^{\psi} & \text{if } i = U \\ 0 & \text{if } i = S. \end{cases}$$

- Income Transfer equation:

$$IT^U : \Delta t_{c,t}^U = \mu_{s,t}^{IT} + \psi \Delta w_{c,t}^U + \Delta e_{c,t}^{IT}$$

- Δe_c^{IT} is a budget shock and is likely independent of Δw_c^i.

Structural Results: Housing Values and Transfers

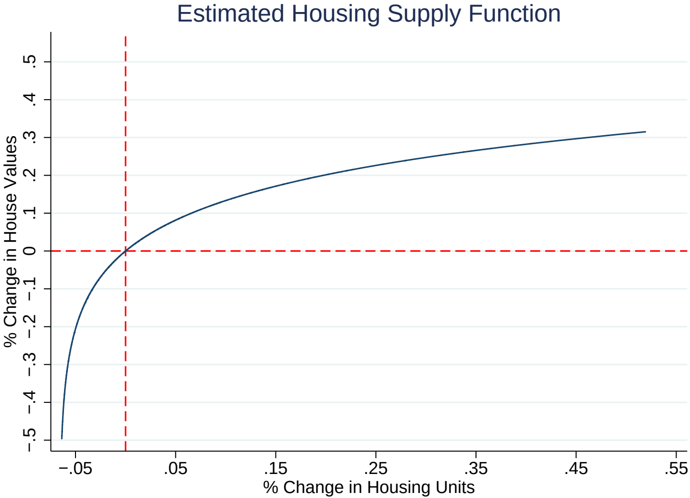
	(3) Housing Supply	(4) Non-linear Housing Supply		(5) Welfare Transfers
	Elasticity of Supply: η	γ	ρ	Elasticity of Transfers: ψ
OLS	0.192***			-1.006***
	(0.038)			(0.093)
IV	0.813***	0.067	6.936***	
	(0.203)	(0.058)	(1.693)	
Instruments	B & CS		B & CS	
Overid P-Val	0.010		0.771	
Endog P-Val				0.100

$$(3)\ HM: \Delta r_{c,t} = \mu_{s,t}^{HM} + \eta \Delta H_{c,t} + \Delta e_{c,t}^{HM}$$

$$(4)\ HM,2: \Delta r_{c,t} = \mu_{s,t}^{HM,2} + \gamma \frac{(\exp\{\rho \Delta H_{c,t}\} - 1)}{\rho} + \Delta e_{c,t}^{HM,2}$$

$$(5)\ IT: \Delta t_{c,t}^{i} = \mu_{s,t}^{T} + \psi \Delta w_{c,t}^{i} + \Delta e_{c,t}^{T}$$

Estimated Housing Supply Function



Policy Experiment # 1: Increasing Spending

Cost Benefit Analysis

- Analyze impact of increasing spending per-adult by $\$1,000$
- Median spending per-adult is $\$10,235$
- Social Welfare given by: $V^S + V^U + R$ where

$$V^i = \mathbb{E}_\varepsilon \left[\max_{c'} \ \{u^i_{jc'}\} \right].$$

- Change in worker utility is given by

$$\begin{aligned} \frac{dV^i}{dv^i_c}\frac{1}{\lambda^i_c} &= N^i_c \frac{dv^i_c}{\lambda^i_c} \\ &= N^i_c \left(dw^i_c + dt^i_c - dr^i_c + \phi^i (w^i_c + t^i_c) \frac{dGS_c}{GS_c} \right) \end{aligned}$$

Policy Experiment # 1: Increasing Spending

Cost Benefit Analysis

	Zero Value for Government Services	Including Value for Government Services
Welfare Effects		
Skilled Worker (25%)	\$363	\$1,012
Unskilled Worker (25%)	-\$92	\$751
Owners of Housing	\$325	\$325
Budget Impacts		
Decrease in Transfers	\$15	\$15
Increase in Taxes	\$290	\$290
Social Welfare	\$650	\$1,445

- An additional \$1 of spending raises welfare by \$1.45
- Ballard et al. (1985) report MCPF between 1.17 and 1.33

Policy Experiment # 2

Distribution of Spending by Skill Share

- The increase in welfare from providing government services depends on
  1. Valuation by skill level ϕ^i
  2. Share of skilled in a given area $\frac{N_c^S}{N_c}$
  3. Relative social value of marginal utilities $\frac{\pi^U}{\pi^S}$
- A locality with a share $\frac{N_c^S}{N_c}$ of skilled workers is

$$\frac{\phi^S \frac{N_c^S}{N_c} + \phi^U \left(1 - \frac{N_c^S}{N_c}\right) \frac{\pi^U}{\pi^S}}{\phi^S \frac{1}{2} + \phi^U \frac{1}{2} \frac{\pi^U}{\pi^S}}$$

as efficient at raising welfare than a locality with even share.

Policy Experiment # 2

Fund Distribution by Skill Share

Share of Skilled: $\frac{N_c^S}{N_c}$	Relative Social Value of Marginal Utilities $\frac{\pi^U}{\pi^S}$				
	0.53	0.67	1.00	1.50	1.88
10%	1.00	1.09	1.24	1.38	1.45
25%	1.00	1.06	1.15	1.24	1.28
50%	1.00	1.00	1.00	1.00	1.00
75%	1.00	0.94	0.85	0.76	0.72
90%	1.00	0.91	0.76	0.62	0.55

- Only regressive preferences motivate skill-neutral distribution
- With neutral preferences, shifting funds from a
  - 50%- to 25%-locality is 15% more efficient at raising welfare
  - 75%- to 25%-locality is 35% more efficient at raising welfare

Conclusions

- Estimate long-term impacts of government spending
  - Find persistent effects on wages and migration
- Estimate incidence of government spending by skill
  - Supply components of shock explains large mobility responses of the unskilled and lower wage outcomes
  - Incidence on workers may be large enough to motivate spending on utilitarian grounds
  - Heterogenous valuations of government services suggest distribution of funds should target areas with low skill-shares

EXTRA SLIDES

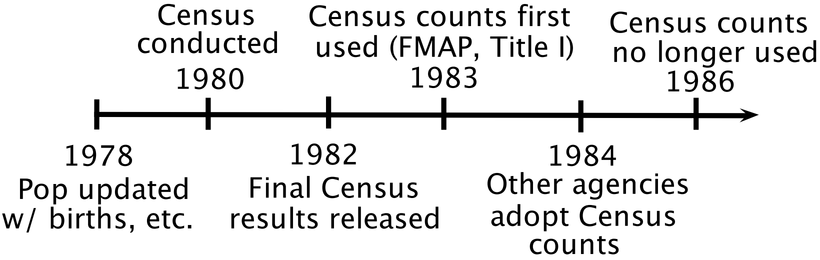
Table: Federal Spending in Top 20 Formula Programs

Rank	Program	% of top 20 Programs	Amount (billions)
1	Medical Assistance Program (Medicaid)	59.50%	$183.20
2	Highway Planning and Construction	10.40%	$31.90
3	Temporary Assistance for Needy Families	5.60%	$17.20
4	Special Education Grants to States	3.30%	$10.10
5	Title I Grants to Local Education Agencies	2.70%	$8.30
6	National School Lunch Program	2.40%	$7.40
7	Head Start	2.10%	$6.60
8	Food Program for Women, Infants, and Children	1.60%	$5.00
9	State Children's Health Insurance Program	1.60%	$4.90
10	Foster Care Title IV E	1.50%	$4.70
11	Federal Transit Formula Grants	1.20%	$3.70
12	Airport Improvement Program	1.10%	$3.40
13	Community Development Block Grants	1.00%	$3.00
14	Child Support Enforcement	0.90%	$2.90
15	Improving Teacher Quality	0.90%	$2.90
16	Child Care and Development Fund	0.90%	$2.70
17	Rehabilitation Services-Vocational Rehabilitation	0.80%	$2.60
18	State Administrative Food Stamp Program	0.80%	$2.50
19	Public Housing Capital Funds	0.80%	$2.50
20	Unemployment Insurance	0.80%	$2.40
Top 20 programs			$307.90
Total 1,172 programs programs			$460.20

Notes: Top 20 formula programs in 2004 as reported by GAO (2008).

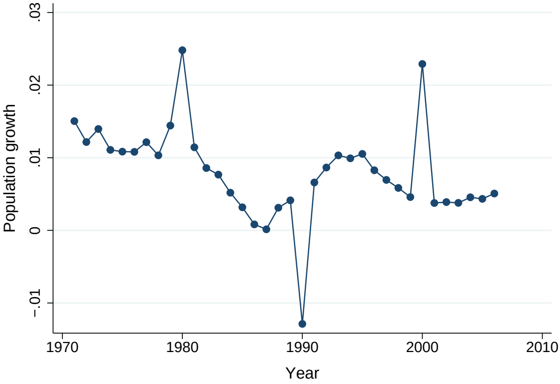
Census Timeline

- Population estimates are adopted by agencies with idiosyncratic lags



- Federal spending should be independent of $CS_{c,t}$ before final estimates are released; a powerful test

Average Census Shock by Year



IV Housing Market Results

	(1) Gross Rent	(2) Adj. Gross Rent	(3) Home Value	(4) Adj. Home Value
All Workers				
Fed Spend	0.139	0.117	0.248	0.207
	(0.143)	(0.158)	(0.261)	(0.247)
Skilled Workers				
Fed Spend	0.223	0.120	0.203	0.081
	(0.194)	(0.208)	(0.246)	(0.240)
Unskilled Workers				
Fed Spend	0.071	0.038	0.198	0.134
	(0.142)	(0.158)	(0.264)	(0.247)

Notes: 1,479 county group-decade observations. State group-year fixed effects included. Standard errors clustered at the county group level in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

IV Aggregate Results

	(1) Emp	(2) Earnings	(3) Income	(4) Welfare Inc.	(5) Pop
All Workers					
Fed Spend	1.629***	1.972***	1.803***		1.463***
	(0.350)	(0.443)	(0.419)		(0.314)
Skilled Workers					
Fed Spend	1.506***	1.992***	1.888***		1.335***
	(0.423)	(0.517)	(0.497)		(0.397)
Unskilled Workers					
Fed Spend	1.385***	1.517***	1.351***	2.104***	1.265***
	(0.333)	(0.400)	(0.385)	(0.588)	(0.294)
Observations	1,479	1,479	1,479	1,479	1,479

IV Local Public Finance Results

	(1) Taxes	(2) Property Tax	(3) Local Expend	(4) Oper Budget
All Workers				
Fed Spend	-3.242**	-1.641**	-2.363**	-2.223**
	(1.332)	(0.828)	(1.083)	(0.959)
Observations	1,479	1,479	1,479	1,479

- Convert elasticities to median marginal effects:

	Taxes Per Adult	Local Expenditure Per Adult
Marginal	-0.211**	-0.267**
Effect	(0.086)	(0.122)

Cost Benefit Analysis: Skilled Workers

- Policy experiment and contributions to utility:

2- Skilled Workers	Zero Value for GS	ϕ^i Value for GS
Annual Wage Earnings	$1,409	$1,409
Taxes (30%)	-$423	-$423
Annual Rent	-$624	-$624
Government Services	$0	$649
Welfare Per Skilled Worker	$363	$1,012

Cost Benefit Analysis: Unskilled Workers

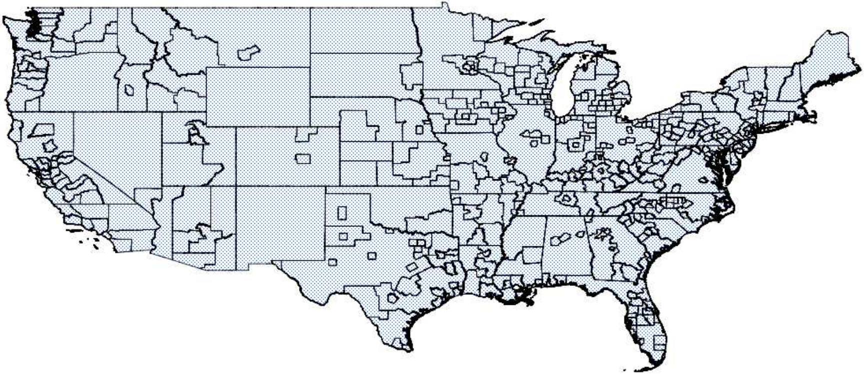
- Policy experiment and contributions to utility:

3- Unskilled Workers	Zero Value for GS	ϕ^i Value for GS
Annual Wage Earnings	\$398	\$398
Taxes (15%)	-\$60	-\$60
Transfer Payments	-\$20	-\$20
Rent	-\$410	-\$410
Government Services	\$0	\$843
Welfare Per Unskilled Worker	-\$92	\$751

Cost Benefit Analysis: Net Benefit

4- Net Benefit	Zero Value for GS	ϕ^i Value for GS
Weighted Skilled Welfare (25%)	$91	$253
Weighted Unskilled Welfare (75%)	-$69.20	$563.24
Decrease in Transfers	$15	$15
Housing Owner Welfare	$325	$325
Increase in Taxes	$290	$290
Gross Benefit	$650	$1,445

- An additional $1 of spending raises welfare by $1.45
- Shoven et al. (1986) report MCPF between 1.17 and 1.33



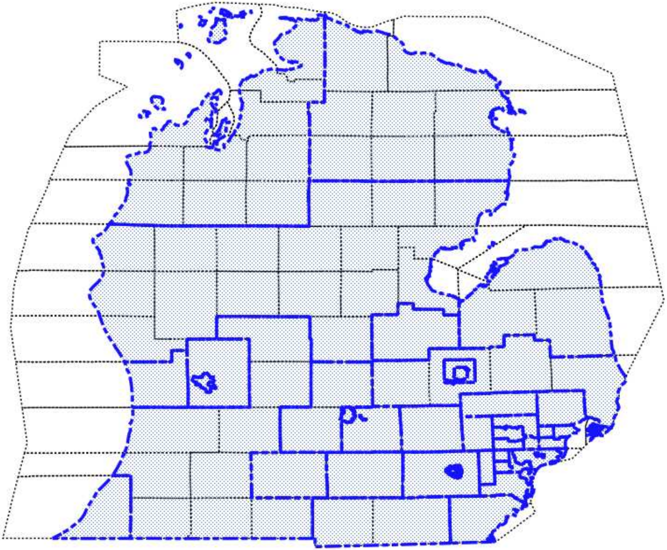


Table: County Groups and Fixed Effect Groups by State

State	Number of Counties	Number of County Groups	Fixed Effect State Group
Arizona	15	7	AZ, NM
Colorado	63	3	CO, WY
District of Columbia	1	1	VA, DC
Maine	16	1	VT, ME, NH
Montana	56	4	MT, ND
Nebraska	93	5	NE, SD
New Hampshire	10	1	VT, ME, NH
New Mexico	33	1	AZ, NM
North Dakota	53	1	MT, ND
South Dakota	66	2	NE, SD
Vermont	14	1	VT, ME, NH
Virginia	135	13	VA, DC
Wyoming	23	1	CO, WY
Totals: 49	3109	493	42

Welfare Analysis of Government Services

The consumer's problem is to maximize

$$\begin{aligned} u_i(X, GS, L, H) &= x + \phi GS_c + \varepsilon_{ic} \text{ subject to} \\ & x + r_c H = (1-t) w_c L - t_c + y \\ & H = L = 1, \end{aligned}$$

The government selects the allocation of public goods in area c, GS_c, to maximize social welfare:

$$\mathbb{E}[\max_c v_{ic}] - \mu g(X),$$

where μ is a Lagrange multiplier, $g(X)$ is the economy's production function, and $X = Nx$. Given constant-returns to scale technology, there are no profits; so $y = 0$.

Welfare Analysis of Government Services

The first order condition with respect to GS_c is given by

$$N_c\phi - \mu\left(f_{GS} + \sum_{c'} f_{N_{c'}}\frac{\partial N_{c'}}{\partial GS_c} + f_X\sum_{c'}\frac{\partial X_{c'}}{\partial GS_c} + \sum_{c'} f_{H_c}\frac{\partial N_{c'}}{\partial GS_c}\right) = 0.$$

Using consumer and firm optimization and the production efficiency theorem we substitute in prices. Differentiating budget constraint and substituting gives

$$N_c\phi - \mu\left(\frac{f_{GS}}{f_X} - \sum_{c'} t_{c'}\frac{\partial N_{c'}}{\partial GS_c}\right) = 0$$