Graduate Labor Economics

Lecture 18: Regional Evolutions

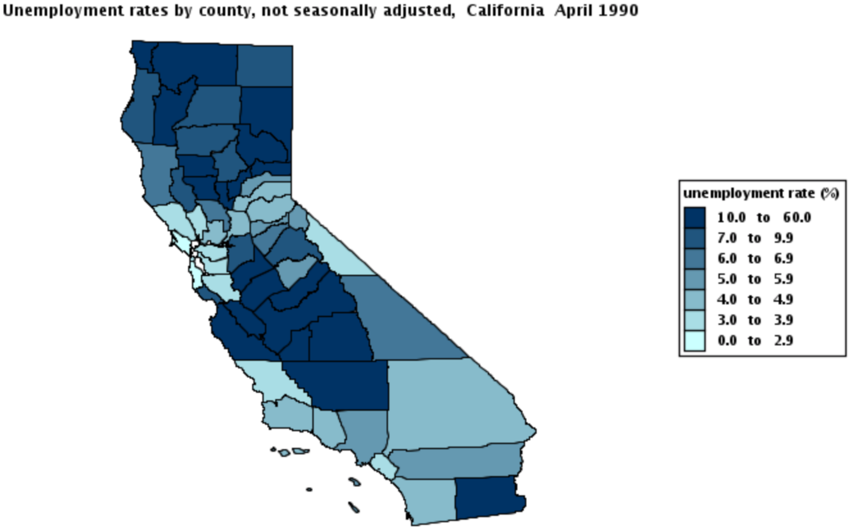
Brendan M. Price*
Federal Reserve Board

 Email: brendan.m.price@frb.gov. These notes are adapted from UC Davis course ECN 250A, which I taught in Winter 2018 and Spring 2019. Any views or opinions expressed here are my own and do not necessarily represent the views or policies of the Board of Governors of the Federal Reserve System or its staff. This version: March 21, 2020.

Today's lecture

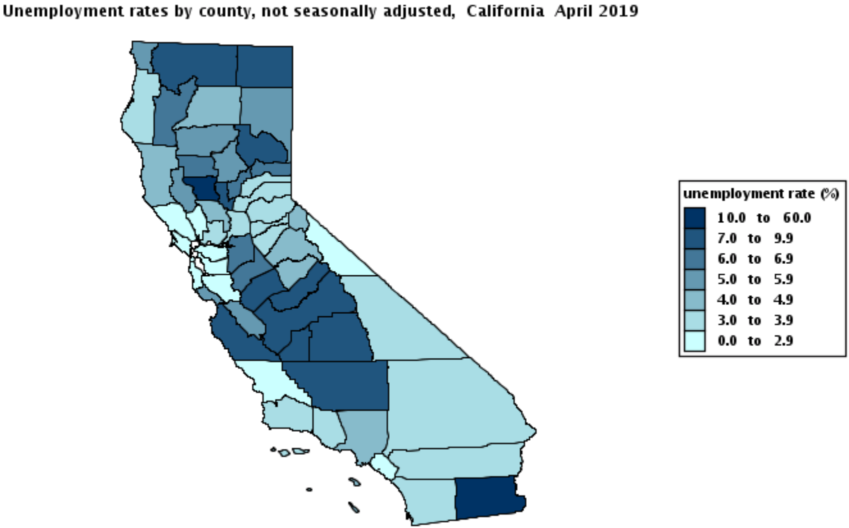
- Economic geography
- The Roback model
- Amior and Manning (2018)

Persistence in local unemployment: California in 1990



(BLS Local Area Unemployment Statistics)

Persistence in local unemployment: California in 2019



(BLS Local Area Unemployment Statistics)

The importance of place

- Geography is a hot topic in economics
  - Local effects of trade shocks, fracking, bank closures
  - Neighborhood differences in social mobility (Chetty et al. agenda)
- Reason #1: places matter
  - Job opportunities
  - School quality
  - Health care access and affordability
- Reason #2: local variation is often quite useful
  - Hold (many) institutions, aggregate shocks constant
  - Exploit treatments that vary across places
- Localized treatments are used in many recent job market papers

Spatial equilibrium models

- Place-based papers often build on a spatial equilibrium model
- Basic ingredients:
  - Places vary in desirability as places to live
  - Places also vary in productive characteristics
  - Firms/workers decide where to operate/reside
  - Wages and house prices adjust to clear markets
- Most are intellectual descendents of the "Rosen-Roback model"

Roback (1982)

- Economy consists of many (small) cities:
  - Fixed amount of land $\overline{L}$, used in both consumption & production
  - Amenity level s, can affect utility and/or productivity
- Each city produces/consumes a single tradable good X
  - Treat as numeraire (price $= 1$)
  - No trade barriers
- Labor and capital are perfectly mobile
  - Workers can costless migrate between cities
  - Workers must live/work in the same city
  - Capital elastically supplied on world market
- Each worker inelastically supplies one unit of labor
- Question: how do amenities affect wages and rents?

Workers

- Given choice of location, worker solves:

$$\max_{x, l^c} u(x, l^c; s) \quad \text{s.t.} \;\; x + l^c r \leq w + y_0$$

  where l^c is land used for consumption, y_0 is non-labor income

- Workers are assumed to be homogeneous
- Spatial arbitrage: all cities must yield same indirect utility:

$$V(w, r; s) = k \quad \forall s$$

  where k is equilibrium utility

Firms

- Firms produce consumption good using labor and land:

$$X = f(l^p, N; s)$$

where l^c is land used for production, N is population ($\equiv$ emp)

- Technology is assumed to be constant returns to scale
- Zero profit: firms in all cities must break even

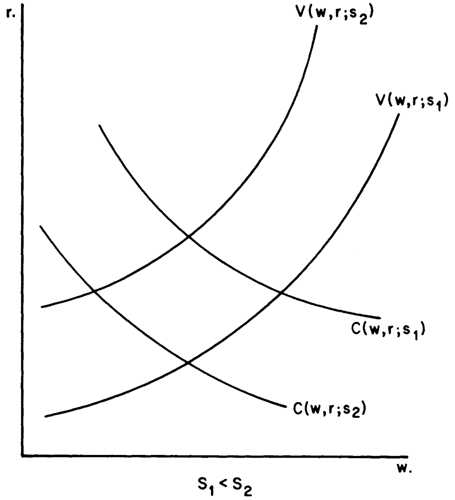
$$C(w, r; s) = 1 \quad \forall s$$

where $c(\cdot)$ is the unit cost function

Amenities

- Normalize amenities to be desirable for workers ($V_s > 0$):
  - Sunny weather
  - Absence of traffic
- Amenities may be "productive" or "unproductive":
  - Unproductive amenity ($C_s > 0$): clean air regulations
  - Productive amenity ($C_s < 0$): absence of snowstorms

Graphical illustration of an unproductive amenity ($s_1 < s_2$)



(Roback 1982, Figure 1)

Main result: comparative statics

- Equilibrium conditions:

$$V(w, r; s) = k$$
$$C(w, r; s) = 1$$

- Totally differentiate, solve for $\frac{dw}{ds}$ and $\frac{dr}{ds}$
  - Unproductive amenity: $\frac{dw}{ds} < 0$, $\frac{dr}{ds} \gtrless 0$
  - Productive amenity: $\frac{dw}{ds} \gtrless 0$, $\frac{dr}{ds} > 0$
- Intuition: wages/rents must adjust to clear labor/land markets

Extensions to the Roback model

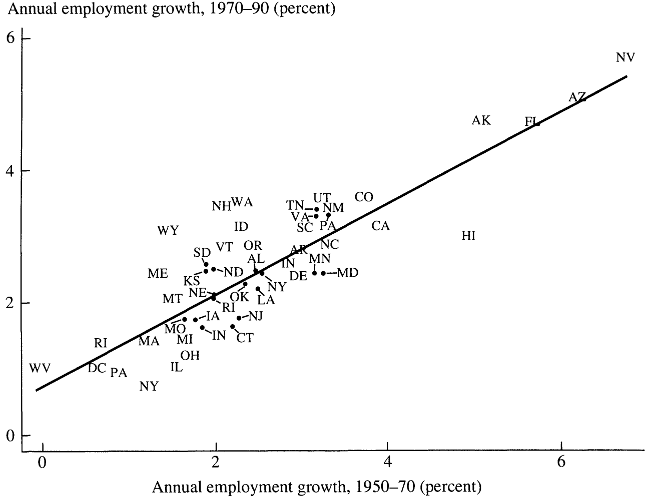
- Baseline Roback model is highly restrictive
- Lots of generalizations:
  - Multiple skill groups, heterogeneous preferences, mobility costs
  - Upward sloping housing supply, cities differ in elasticity
  - Allow workers to live/work in different communities
  - Incorporate production of non-tradable services
- Spatial equilibrium: workers are indifferent *on the margin*
- Often accompanied by structural (discrete-choice) estimation
  - Strong assumptions
  - But possible to make statements about welfare gains/losses

Local booms and busts

- How do regional economies adjust to localized shocks?
  - In-migration, out-migration
  - Job creation, job destruction
  - Wage changes, price changes
- Seminal paper: Blanchard and Katz (1992)
  - Analyze US state-level pop, emp, wages over 1950–1990
  - Instrument for emp using defense contracts and Bartik shocks
  - Long-term divergence in employment, convergence in wages

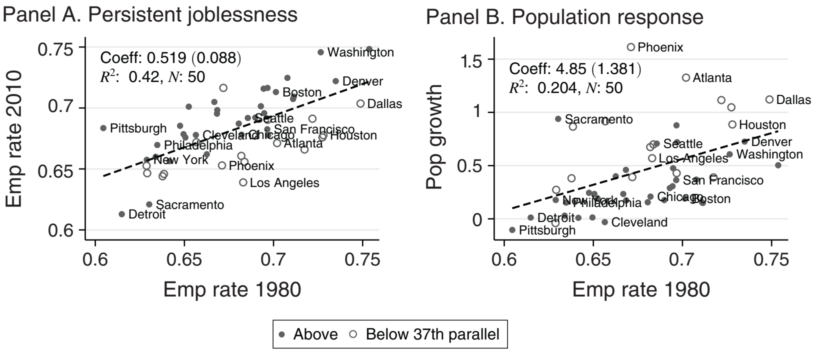
Persistent differences in state-level employment growth

Figure 1. Persistence of Employment Growth Rates across U.S. States, 1950–90



(Blanchard and Katz 1992, Figure 1)

Amior and Manning (2018): motivating facts



(Amior and Manning 2018, Figure 1)

"The persistence of joblessness"

- Why do employment gaps persist across places?
  - Equilibrium phenomenon: demographics, amenities
  - Disequilibrium phenomenon: sluggish adjustment
- Revealed preference: workers prefer high-employment areas
  - Net migration from "bad" places to "good" places
  - Typically some mix of less in-migration, more out-migration
- Puzzle: why do gaps persist despite strong migration response?
  - Amior and Manning: "race" between population and employment
  - Industry structure $\implies$ serially correlated labor demand shocks
  - Population responds, but not fast enough to catch up

Theory

- Spatial equilibrium model with two departures from Rosen-Roback
  - For given population, labor supply is upward sloping
  - Migration response takes time
- Focus on intuition, not technical details
- Everything is in logs, e.g.:

$$n_r - l_r = \log N_r - \log L_r = \log\left(\frac{N_r}{L_r}\right) = \log(\text{emp rate})$$

Housing demand and supply

- Workers in region r purchase housing + consumption good
- Demand for housing depends on earnings and on house prices:

$$h_r^d = \underbrace{w_r - p}_{\text{real wage}} + \underbrace{l_r}_{\text{pop}} + \kappa \underbrace{(n_r - l_r)}_{\text{emp rate}} + \varepsilon^{hd} \quad \underbrace{(p_r^h - p)}_{\text{price of housing}}$$

- Supply of housing depends on local elasticity (Saiz 2010):

$$h_r^s = \varepsilon_r^{hs}(p_r^h - p)$$

- Positive shock to earnings will drive up house prices

Labor demand and supply

- Demand for labor depends on wages and on productivity shifters:

$$n_r^d = \varepsilon^{nd}(w_r - p) + z_r^d$$

- Supply of labor depends on wages and on supply shifters:

$$n_r^s = l_r + \varepsilon^{ns}(w_r - p) + z_r^s$$

- Positive demand shift will increase both wages and employment

Short-run equilibrium

- Expected utility depends on share employed, real wages, amenities:

$$u_r = \sigma(n_r - l_r) + (w_r - p_r) + a_r$$

- Use labor supply curve to eliminate wage from this equation:

$$u_r = \left(\sigma + \frac{1}{\varepsilon^{ns}}\right)(n_r - l_r) + a_r - \frac{1}{\varepsilon^{ns}} z_r^s$$

- AM argue that local employment is a sufficient statistic for welfare
- Why rely on local employment rather than local real wage?
  - Hard to measure local price deflators
  - Hard to measure the local wage *per efficiency unit*
  - Expresses both labor side and population in common units

Transitional dynamics

- Instantaneous convergence runs counter to the evidence
- Instead: population responds gradually to utility differences

$$\frac{\partial l_r(t)}{\partial t} = \gamma[\tilde{a}_r(t) + n_r(t) - l_r(t)]$$

- Discretization + approximation yields the estimating equation:

$$\Delta l_{rt} = \beta_0 + \beta_1 \Delta n_{rt} + \beta_2 (n_{rt-1} - l_{rt-1}) + \beta_3 \Delta \tilde{a}_{rt} + \beta_4 \tilde{a}_{rt-1} + \varepsilon_{rt}$$

- Error-correction model: spatial arbitrage + disequilibrium term
    - β_1 captures immediate response to employment shock
    - β_2 captures delayed response to employment shock
    - β_3, β_4 capture immediate/delayed responses to amenity shock
- Focus on decade-to-decade changes (medium run)

Data

- Define regions as the 722 commuting zones (CZs) in mainland US
  - Strong cross-county commuting ties within CZs
  - Weak cross-county commuting ties across CZs
- Decennial Census + American Community Survey
  - Decadal observations over 1950–2010
  - Working-age population/employment (16–64)
- Control for observed amenities (interacted with time effects):
  - Climate, coastline, remoteness
  - Avoid using endogenous amenities (e.g. crime rate)
- Weight observations by lagged local population share
  - Standard practice when the unit of analysis is a locality
  - Yields estimates representative of the US population
  - Reduces influence of measurement error in sparse CZs

Employment rates are autocorrelated at 60-year lags

TABLE 1—THE AUTOCORRELATION FUNCTION OF THE LOG EMPLOYMENT RATE

	Employment rate variant	Lag (1)	(2)	(3)	(4)	(5)	(6)
1.	Emp rate (time-demeaned)	0.86	0.79	0.72	0.62	0.56	0.52
	Subsamples						
2.	Years 1950–1980	0.87	0.81	0.72			
3.	Years 1980–2010	0.85	0.73	0.73			
4.	Labor force	0.55	0.46	0.47	0.39	0.36	0.28
5.	College graduate	0.37	0.25	0.16	0.08	−0.01	−0.05
6.	Nongraduate	0.81	0.72	0.64	0.51	0.43	0.39
7.	Male	0.79	0.71	0.68	0.57	0.51	0.25
8.	Female	0.90	0.78	0.67	0.54	0.40	0.42
9.	Composition-adjusted	0.83	0.74	0.67	0.58	0.47	0.39
10.	CZ amenity controls	0.87	0.81	0.76	0.64	0.57	0.46
11.	Within-state	0.79	0.68	0.58	0.42	0.35	0.28
12.	Collapsed to state	0.82	0.75	0.69	0.58	0.53	0.51
	Within-CZ						
13.	Unadjusted	0.33	−0.08	−0.28	−0.62	−0.48	−0.47
14.	Bias-corrected: $\pi = 0.9$	0.79	0.66	0.58	0.40	0.35	0.31
15.	Bias-corrected: $\pi = 0.5$	0.71	0.53	0.41	0.17	0.10	0.05
16.	Bias-corrected: $\pi = 0$	0.69	0.51	0.38	0.13	0.05	0
17.	Participation rate	0.89	0.82	0.74	0.64	0.57	0.60

(Amior and Manning 2018, Table 1)

Dealing with endogeneity

- Recall the estimating equation:

$$\Delta l_{rt} = \beta_0 + \beta_1 \Delta n_{rt} + \beta_2 (n_{rt-1} - l_{rt-1}) + \beta_3 \Delta \tilde{a}_{rt} + \beta_4 \tilde{a}_{rt-1} + \varepsilon_{rt}$$

- Δn_{rt} and $n_{rt-1} - l_{rt-1}$ reflect a mix of demand & supply conditions
- Instrument using a "shift-share" measure ("Bartik shock"):

$$b_{rt} = \sum_i \phi^i_{rt-1} [n_{i(-r)t} - n_{i(-r)t-1}] \approx \sum_i \frac{n^i_{rt-1}}{n_{rt-1}} \frac{\Delta n_{it}}{n_{it-1}}$$

- Intuition:
    - Imagine local industries grow/shrink at national rates
    - ϕ^i_{rt-1} is local share of workers employed in industry i
    - $n_{i(-r)t} - n_{i(-r)t-1}$ is national growth rate in industry i
    - "Leave-one-out" estimator: omit r to avoid mechanical correlation
- Active debate (e.g., Goldsmith-Pinkham et al., Borusyak et al.)

Pop responds to both current & lagged emp shocks

Table 2—Baseline Estimates of Population Response

	OLS			IV		
	Basic (1)	FE (2)	FD (3)	Basic (4)	FE (5)	FD (6)
Panel A. OLS and IV						
Δ log emp	0.814	0.806	0.831	0.702	0.889	0.748
	(0.012)	(0.014)	(0.012)	(0.031)	(0.052)	(0.035)
Lagged log emp rate	0.171	0.513	0.960	0.392	1.223	0.782
	(0.014)	(0.031)	(0.027)	(0.056)	(0.256)	(0.165)
Observations	4,332	4,332	3,610	4,332	4,332	3,610
	Δ log emp			Lagged log emp rate		
	Basic (1)	FE (2)	FD (3)	Basic (4)	FE (5)	FD (6)
Panel B. First-stage						
Current Bartik	0.972	0.930	0.756	0.041	−0.111	−0.020
	(0.074)	(0.079)	(0.071)	(0.040)	(0.035)	(0.028)
Lagged Bartik	0.094	−0.024	−0.118	0.453	0.131	0.150
	(0.059)	(0.059)	(0.072)	(0.046)	(0.035)	(0.022)
Observations	4,332	4,332	3,610	4,332	4,332	3,610

(Amior and Manning 2018, Table 2)

Faster pop responses among college grads & ages 25–44

TABLE 3—HETEROGENEITY IN IV POPULATION RESPONSES

	1950–1980 (1)	1980–2010 (2)	Lab force (3)	College grad (4)	Non grad (5)	16–24s (6)	25–44s (7)	45–64s (8)
Basic specification								
Δ log emp	0.811	0.393	0.880	0.913	0.673	0.613	0.788	0.660
	(0.038)	(0.055)	(0.018)	(0.041)	(0.036)	(0.033)	(0.037)	(0.043)
Lagged log ER	0.247	0.573	1.371	1.037	0.456	0.431	0.506	0.356
	(0.076)	(0.095)	(0.336)	(0.269)	(0.069)	(0.043)	(0.084)	(0.092)
CZ fixed effects								
Δ log emp	0.918	0.428	1.041	0.894	0.855	0.768	0.905	0.881
	(0.042)	(0.065)	(0.114)	(0.048)	(0.071)	(0.058)	(0.039)	(0.097)
Lagged log ER	0.757	0.615	4.539	0.731	1.660	0.923	2.028	1.371
	(0.236)	(0.117)	(3.429)	(0.125)	(0.460)	(0.168)	(0.687)	(0.571)
First differences								
Δ log emp	0.885	0.149	0.883	0.782	0.709	0.619	0.821	0.760
	(0.048)	(0.152)	(0.022)	(0.116)	(0.034)	(0.036)	(0.027)	(0.051)
Lagged log ER	0.500	0.214	1.265	1.176	0.953	0.582	1.388	1.202
	(0.461)	(0.232)	(0.288)	(0.335)	(0.195)	(0.132)	(0.223)	(0.258)
Observations (basic, FE)	2,166	2,166	4,332	4,331	4,332	4,332	4,332	4,332

(Amior and Manning 2018, Table 3)

A feedback loop

- Population growth will in turn spur employment growth
  - Labor supply $\uparrow \implies$ wages $\downarrow \implies$ job creation
  - Increased demand for local nontraded services
- AM derive another error-correction equation:

$$\Delta n_{rt} = \alpha_0 + \alpha_1 \Delta l_{rt} + \alpha_2 (n_{rt-1} - l_{rt-1}) + \alpha_3 b_{rt} + d_t + \omega_{rt}$$

- Instrument for Δl_{rt} using local January temperature
  - People increasingly want to live in places with mild winters
  - Plausibly exogenous to demand ...?

“Supply-side” pop shock yields employment response

Table 5—Estimates of Employment Response

	OLS			IV		
	Basic (1)	FE (2)	FD (3)	Basic (4)	FE (5)	FD (6)
Panel A. OLS and IV						
Δ log pop	1.027	1.023	1.032	0.788	−0.297	3.319
	(0.011)	(0.015)	(0.014)	(0.052)	(0.763)	(4.002)
Lagged log emp rate	−0.122	−0.646	−1.172	−0.207	0.176	−1.586
	(0.012)	(0.044)	(0.038)	(0.056)	(0.587)	(1.676)
Current Bartik	0.177	0.111	0.160	0.425	1.155	−1.092
	(0.024)	(0.035)	(0.023)	(0.055)	(0.621)	(2.209)
Observations	4,332	4,332	3,610	4,332	4,332	3,610
	Δ log pop			Lagged log emp rate		
	Basic (1)	FE (2)	FD (3)	Basic (4)	FE (5)	FD (6)
Panel B. First stage						
Max temp January	0.359			−0.005		
	(0.082)			(0.056)		
Max temp January × time	−0.005	−0.008	−0.025	−0.043	−0.041	−0.045
	(0.014)	(0.015)	(0.019)	(0.015)	(0.013)	(0.013)
Lagged Bartik	0.249	0.152	0.037	0.452	0.136	0.158
	(0.056)	(0.051)	(0.061)	(0.044)	(0.035)	(0.022)
Current Bartik	0.697	0.692	0.549	0.044	−0.107	−0.009
	(0.064)	(0.064)	(0.055)	(0.039)	(0.034)	(0.027)
Observations	4,332	4,332	3,610	4,332	4,332	3,610

(Amior and Manning 2018, Table 5)

Jointly modeling employment and population

- Combine the two error-correction models:

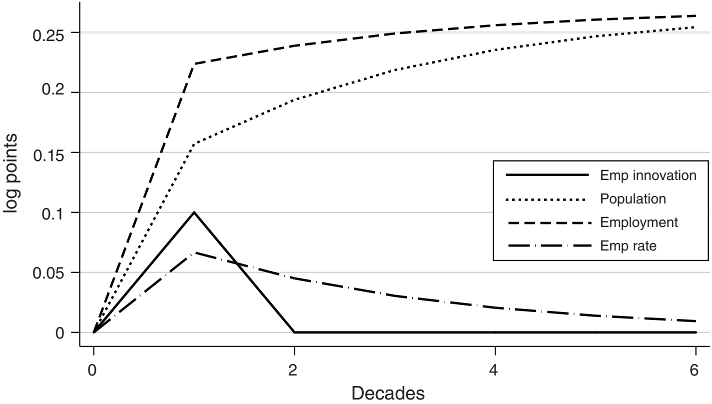
$$\Delta n_{rt} = \alpha_0 + \alpha_1 \Delta l_{rt} + \alpha_2 (n_{rt-1} - l_{rt-1}) + \alpha_3 b_{rt} + d_t + \omega_{rt}$$
$$\Delta l_{rt} = \beta_0 + \beta_1 \Delta n_{rt} + \beta_2 (n_{rt-1} - l_{rt-1}) + \beta_3 \Delta \tilde{a}_{rt} + \beta_4 \tilde{a}_{rt-1} + \varepsilon_{rt}$$

- Implies that employment follows an AR(1) process
- Deviation of employment rate from steady-state:

$$x_{rt} = \theta_1 x_{rt-1} + \theta_2 \Delta z^d_{rt}$$

- Focus on impulse-response function:
  - θ_1 captures shock persistence
  - θ_2 captures initial amplification

Impulse response functions (0.1 log point shock to z^d_{rt})

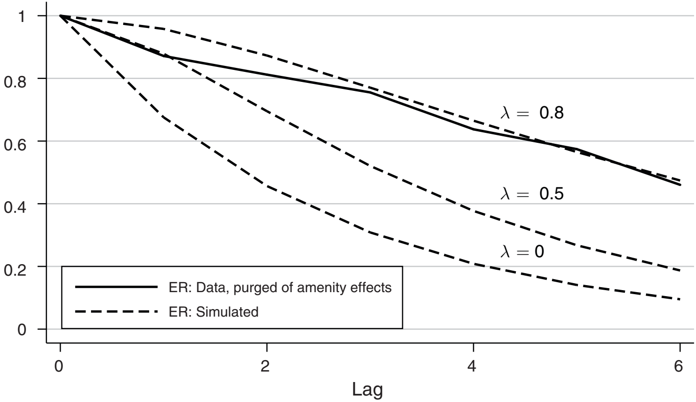


(Amior and Manning 2018, Figure 3)

What's missing?

- Model captures some rich local dynamics:
  - Initial demand shock increases both employment and population
  - Population growth spurs additional employment growth
  - Employment jumps up, continues to grow slowly
  - Population gradually catches up to employment
- But employment rate returns to steady-state too quickly
  - Data show persistence even after 6 decades
  - Model predicts only modest persistence after first few decades
- Possible resolution: *demand shocks are serially correlated*
  - Local industry composition is highly persistent over time
  - Long-term decline in agriculture, manufacturing
  - Long-term growth in professional and technical services
- Population may never catch up with employment

Persistent demand shocks can rationalize sluggish response



(Amior and Manning 2018, Figure 4)