Gross Migration, Housing and Urban Population Dynamics

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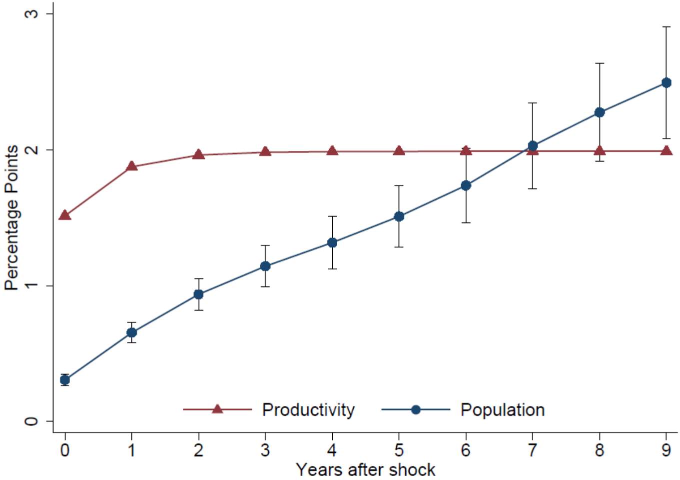
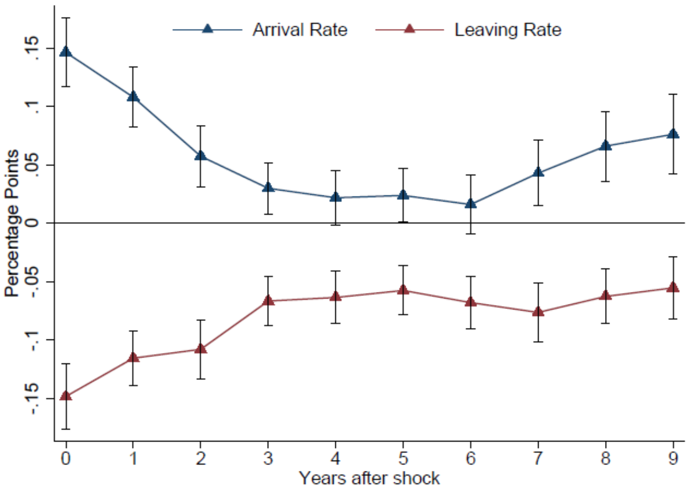


- TFP shocks near random walk.
- Population is slow to respond

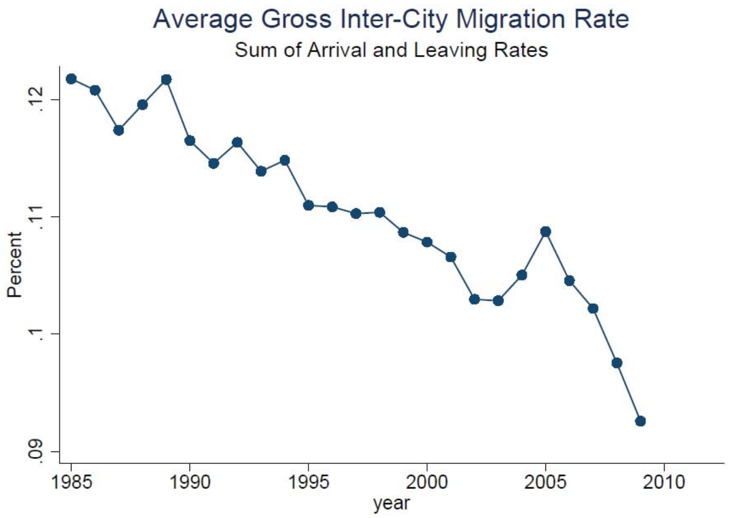


- Arrivals and departures both adjust
- Goal: Understand population dynamics at MSA level

Framework

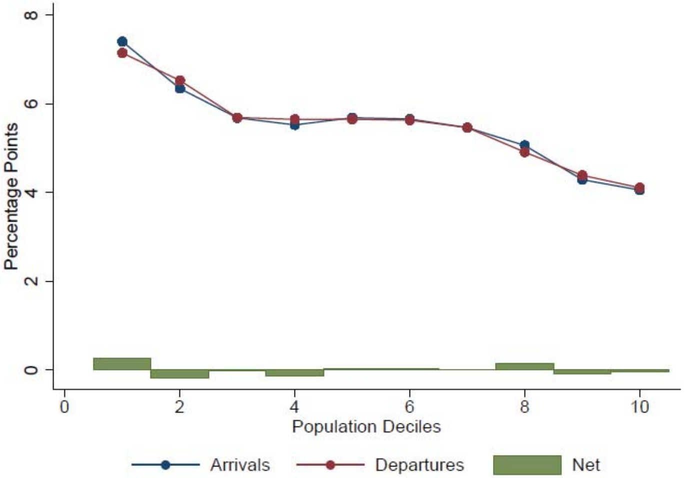
- Neoclassical macro model with cities
  Gross Migration, Housing and Labor Supply
- Exactly identified estimation with aggregate and micro data
- Counterfactual experiments:
  - Costs of attracting workers key
  - Housing has a surprisingly limited role
  - Migration frictions contribute to persistent urban decline

- Start by discussing arrival and departure rates (arrivals/population and departures/population)
- Key to understanding net migration
- Need procedure to account for
  - Aggregate time trends
  - City fixed effects (related to size)



Average Gross Inter-City Migration Rate
Sum of Arrival and Leaving Rates
Percent
.09
.1
.11
.12
1985
1990
1995
2000
2005
2010
year

Figure 2: Gross Migration Rates by Population Decile



Procedure

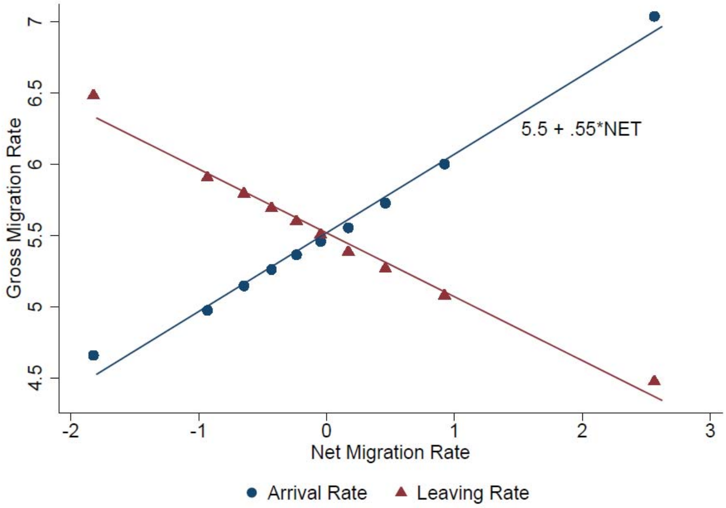
- First remove aggregate

$$\tilde{x}_{it} = x_{it} - (1/N)\sum_{j=1}^{N} x_{jt}$$

- Then remove city averages

$$\hat{x}_{it} = \tilde{x}_{it} - (0.5/T)\sum_{t=1}^{T}\left(\tilde{a}_{it} + \tilde{d}_{it}\right)$$

Detrended: Gross versus Net Migration



(time-series average added back in)

Simple Model of Gross and Net Migration

- Start with a simple static model to gain intuition
- Consumption good produced in each city: sp^{θ}
- Representative household, each member consumes and supplies one unit of labor
- Timing
  - Initial distribution μ exogenous
  - Decide to leave
  - Decide where to go
  - Work, produce, consume

Functional Forms

- Denote $z = (s, x)$
- Total costs (city of size x) for gross leavers

$$\left[-\psi_1\left(\frac{l(z)}{x}\right)+\frac{\psi_2}{2}\left(\frac{l(z)}{x}\right)^2\right]x$$

- Total costs (city of size x) for new arrivals

$$\underbrace{\frac{A}{2}\left(\frac{a(z)}{x}\right)^2 x}_{\text{Directed}} + \underbrace{\tau\Lambda}_{\text{Undirected}}$$

Planning Problem

$$\max_{C,\Lambda,a(z),l(z),p(z)} \left\{ \ln C - \int \left[\frac{A}{2} \left(\frac{a(z)}{x} \right)^2 x + \left(-\psi_1 \left(\frac{l(z)}{x} \right) + \frac{\psi_2}{2} \left(\frac{l(z)}{x} \right)^2 \right) x \right] d\mu - \tau \Lambda \right\}$$

subject to

$$\begin{aligned} p(z) &\leq x + a(z) + \Lambda x - l(z), \forall z \\ \int [a(z) + \Lambda x] \, d\mu &\leq \int l(z) d\mu \\ C &\leq \int sp(z)^{\theta} \, d\mu \end{aligned}$$

and non-negativity constraints on the choice variables

Results

- Trade off of leaving costs and directed arrivals

$$A\frac{a(z)}{x} = \psi_1 - \psi_2\frac{l(z)}{x}$$

- Linear relationship of gross and net flows

$$\frac{a(z)}{x} + \Lambda = \frac{\psi_1}{A+\psi_2} + \frac{A}{A+\psi_2}\Lambda + \frac{\psi_2}{A+\psi_2}\left(\frac{p(z)-x}{x}\right)$$
$$\frac{l(z)}{x} = \frac{\psi_1}{A+\psi_2} + \frac{A}{A+\psi_2}\Lambda - \frac{A}{A+\psi_2}\left(\frac{p(z)-x}{x}\right)$$

Simple Model of Housing

- Can housing cause slow net migration in response to shocks?
  - Costly to build quickly (+ shock)
  - Depreciates slowly (− shock)
- Solve a simplified version of model without migration costs
- Check the role of housing

City Planner

$$V(h,s) = \max_{p,p_y,p_h,h'} \left\{ s p_y^{\theta} + H \ln\left(\frac{h^{\zeta}}{p}\right) p - \eta p + \beta V(h',s') \right\}$$

subject to

$$\begin{aligned} p &= p_y + p_h \\ h' &= (1-\delta_h) h + p_h^{\alpha} \end{aligned}$$

Housing affects rate of population adjustment when

- Housing is immobile
- Slow adjustment of housing in response to TFP

Quantitative Model

- Cities: $z = (h, x, s, s_{-1})$, measure μ
  - Intermediate goods: $y = s n_y^{\theta} k_y^{\gamma}$
  - Construction: $h' = (1 - \delta_h) h + n_h^{\alpha} k_h^{\vartheta} b_h^{1-\alpha-\vartheta}$
  - Housing: $h^{1-\zeta} b_r^{\zeta}$.
- Tradeable final goods: $C + K' - (1 - \delta_k) K = \left[\int y(z)^{\chi} \, d\mu\right]^{\frac{1}{\chi}}$
- Representative household
  - Preferences for consumption and housing
  - Additional labor disutility shock (choose emp/pop ratio)
  - Dynamic migration decisions, $x' = p$

City Planner's Problem

City planner chooses $n_y, n_h, k_y, k_h, h', b_r, b_h, p, a, l$ to maximize

$$\lambda \frac{1}{\chi} Y^{1-\chi} \left[s n_y^{\theta} k_y^{\gamma} \right]^{\chi} + H \ln \left(\frac{h^{1-\zeta} b_r^{\zeta}}{p} \right) p - \phi \left(n_y + n_h \right)^{\pi} p^{1-\pi}$$
$$- \frac{A}{2} \left(\frac{a}{x} \right)^2 x - \left[-\psi_1 \left(\frac{l}{x} \right) + \frac{\psi_2}{2} \left(\frac{l}{x} \right)^2 \right] x - \lambda r_k \left(k_y + k_h \right) - \lambda \eta \left(a + \Lambda x - l \right)$$
$$+ \beta \int_{s'} V \left(z' \right) dQ \left(s'; s, s_{-1} \right)$$

subject to

$$\begin{aligned} p &= x + a + \Lambda x - l \\ n_y + n_h &\leq p \\ b_r + b_h &= 1 \\ x' &= p \\ h' &= \left(1 - \delta_h \right) h + n_h^{\alpha} k_h^{\vartheta} b_h^{1-\alpha-\vartheta} \end{aligned}$$

Estimation: First Moments using Aggregate Data

β	Discount factor
θ	Labor share, intermediate goods
γ	Equipment share, intermediate goods
α	Labor share, construction
ϑ	Equipment share, construction
δ_k	Depreciation rate, equipment
δ_h	Depreciation rate, structures
ζ	Land's share of housing
H	Housing coefficient in preferences
ϕ	Labor disutility

Other parameters

- Define a "hatted" variable as follows

$$\hat{x}_{it} = \ln x_{it} - \frac{1}{N}\sum_{j=1}^{N} \ln x_{jt}$$

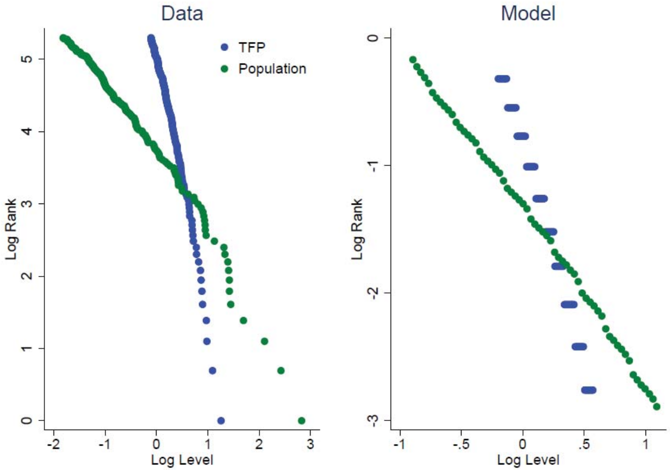
- Given $\chi = 0.9$, we uncover the change in city TFP as

$$\Delta \hat{s}_{it} = \frac{1-\gamma\chi}{\chi}\Delta \hat{w}_{it} + \frac{1-\theta\chi-\gamma\chi}{\chi}\Delta \hat{n}_{it}$$

- Estimate $\rho = 0.24$ and $SD(e) = 0.015$

$$\Delta \hat{s}_{it} = \rho\Delta \hat{s}_{it-1} + e_{it}$$

Use χ and g to match Zipf's Law



$$\ln s_{t+1} = \max\left\{g + (1+\rho)\ln s_t - \rho \ln s_{t-1} + \epsilon_{t+1}, 0\right\}$$

Estimating Labor Supply Elasticity

- Model implies

$$(1-\pi)\left[\Delta\left(\widehat{n_y+n_h}\right)-\Delta\hat{p}\right]+\Delta\hat{w} \quad = \quad 0$$

- Measure dynamic response of $\Delta\left(\widehat{n_y+n_h}\right)$, $\Delta\hat{p}$ and $\Delta\hat{w}$ to a local TFP shock

- Calibrate π so the above eqn holds in the period of a shock

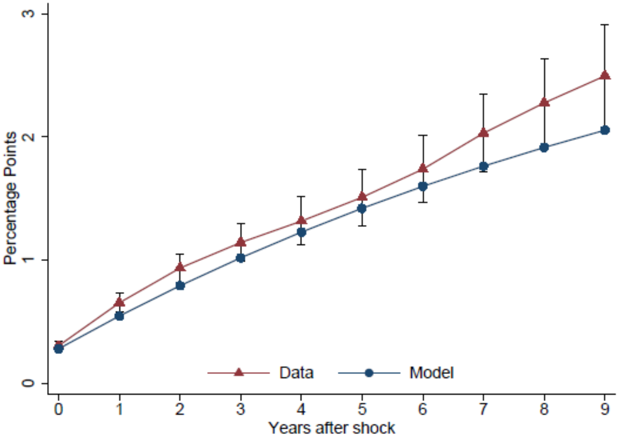
Estimating Migration Costs

- Avg. flow benefits of migration = 1.9 x avg. wages (Kennan and Walker 2011)

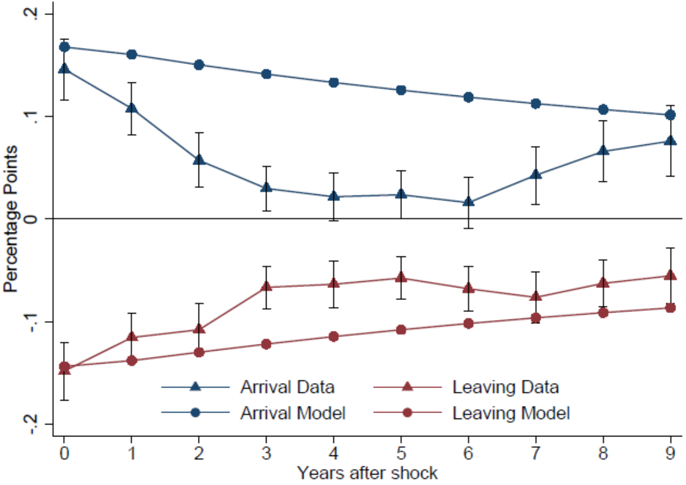
- Level of arrivals, slope of arrivals wrt net migration

$$\begin{aligned} \frac{\psi_1}{A+\psi_2} + \frac{A}{A+\psi_2}\Lambda &= 5.5 \\ \frac{\psi_2}{A+\psi_2} &= 0.55 \end{aligned}$$

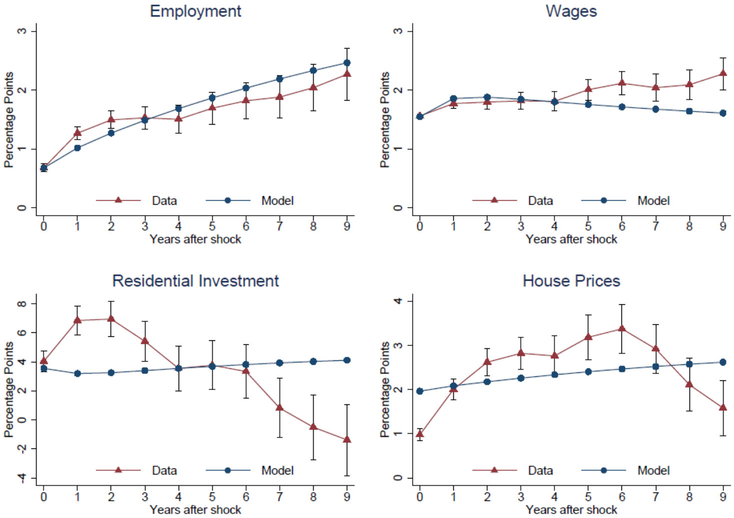
Model Validation: Population



Model Validation: Migration



Model Validation: Labor and Housing



Variable	Standard Deviation*		Correl**		Auto Correl	
	Data	Model	Data	Model	Data	Model
Population	1.33	0.87	-	-	0.81	0.93
Arrival Rate	0.65	0.53	0.59	1.00	0.81	0.93
Leaving Rate	0.58	0.48	-0.42	-1.00	0.80	0.93
Employment	1.58	1.23	0.56	0.93	0.52	0.73
Wages	1.23	1.81	0.16	0.32	0.15	0.20
Construction	19.7	4.27	0.14	0.40	0.12	0.09
House Prices	3.76	2.32	0.29	0.47	0.73	0.07

* standard deviations are relative to population

** correlations are with population

Experiments

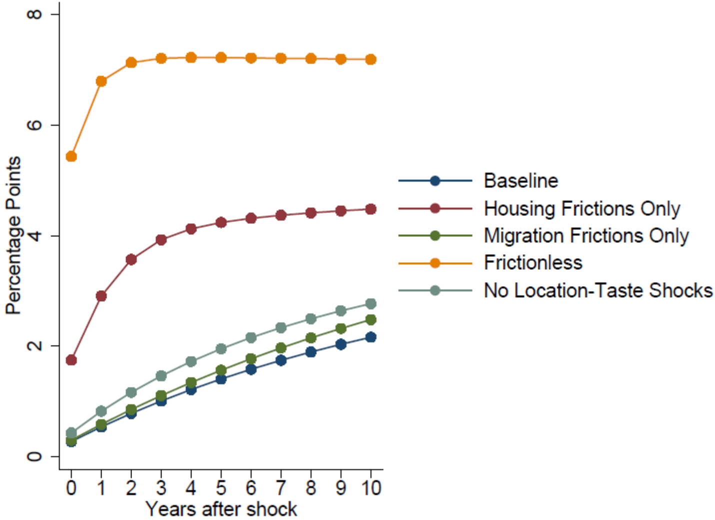
- *Migration Frictions Only*
  Housing is Mobile Across MSAs

- *No Location Taste Shocks*
  Only Migration Friction is Costly Guided Trips, $\psi_1 = \psi_2 = 0$

- *Housing Frictions Only*
  Free Guided Trips, $A = 0$

- *Frictionless*
  Full Flexibility

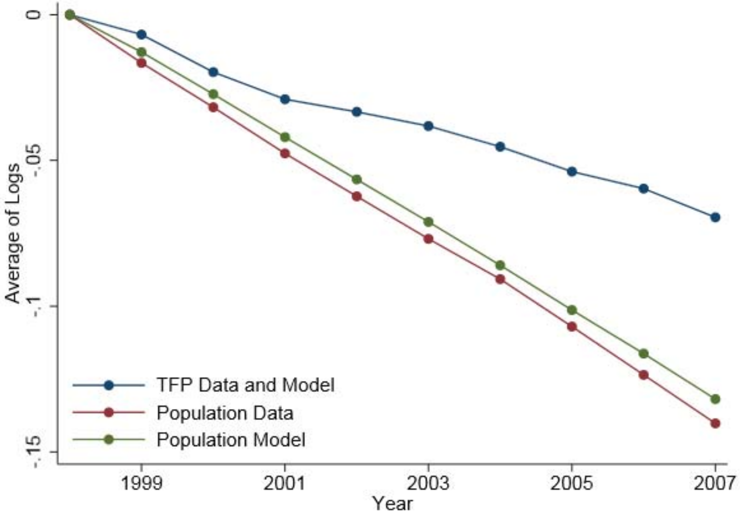
Why is Population Slow to Adjust to Shocks?



Urban Decline

- Study bottom 15 MSAs in our sample
- Feed in TFP paths from the data, 1985-2007
- Plot average population dynamics, 1998-2007

Model Predicts Persistent Urban Decline



Conclusion

- Empirically founded model of gross migration and urban population dynamics
- Costs of moving to desirable cities is the key source of slow population adjustments
- Housing has a very limited impact

Extra slides

Why People Move: CPS 1999-2007

Reason	Total	In County	Out of County	Out of State
Percentages		61.0	38.0	18.0
Family	25.7	26.3	24.9	24.1
Work	12.9	3.7	27.4	36.7
Housing	53.6	65.8	34.9	23.8
Other	7.5	4.1	12.8	15.3

Aside: Housing and Migration in Roback

- Consider a Rosen-Roback model w/o consumption insurance

$$(1-\psi)\ln c + \psi \ln (h/p) \quad = \quad U$$

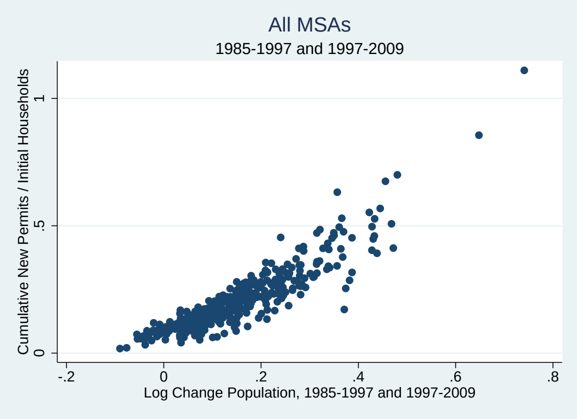
- After a negative productivity shock of $g = 0.1$ (10%),

$$\ln\left(\frac{p_1}{p_0}\right) \quad \approx \quad -\delta - \left(\frac{1-\psi}{\psi}\right) g \;\; = \;\; -0.56$$

with $\delta = 0.064$ and $\psi = 0.167$

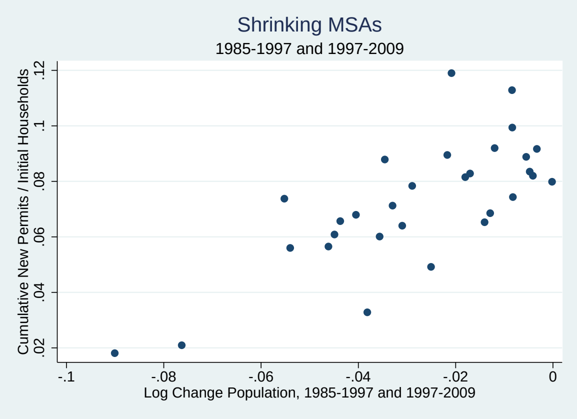
- This implies $p_1 = 0.57 p_0$
  - If consumption falls, housing/person must rise.
  - But housing is a small share of expenditures.
  - ... so p must fall a lot.

Permits vs Population



cum permits / stock = 0.065 (0.007) + 0.949 (0.059) * chg log pop
402 obs

Permits vs Population



cum permits / stock = 0.094 (0.004) + 0.781 (0.102) * chg log pop
30 obs

Gross versus Net Worker Flows