Cyclical Dynamics in Worker and Job Flows and Vacancies

Overview

- Striking asymmetry in cyclical dynamics of creation and destruction in U.S. manufacturing
- Other sectors and countries:
  - Limited time series coverage (annual data for a 5-10 year periods – see, e.g., Foote (1998) and Boeri
  - Destruction is more volatile than creation in manufacturing in other countries
  - New BLS dataset provides quarterly rates back to 1992.
    - Most recent recession looks to be a bit different.
- Variation across employer characteristics (e.g., size, age)
- Unbalanced restructuring in some economies?

Theory: Business Cycle and Reallocation

- Which way does causality go and/or what is nature of interaction?
  - Blanchard and Diamond (1989, 1990)
  - Davis/Haltiwanger (1990)
  - Mortensen/Pissarides (1994, 1999)
  - Caballero/Hammour (1994, 1996)
  - Campbell/Fisher (2001)
  - Foote (1998)
  - Ramey/Watson (1997)
  - Barlevy (2002)

Common Themes

- Common features:
  - Reallocation shocks
  - Frictions:
    - Search/matching
      - Two types of matching:
        - » Allocation of jobs to plants
        - » Allocation of workers to jobs
    - Capital/labor adjustment costs
    - Entry costs
  - Most common: Incentives for reallocation are cyclically sensitive
    - Endogenous timing of reallocation/restructuring
  - Reallocation shocks could generate a recession (Lilien, Davis/Haltiwanger, Blanchard/Diamond)

Efficiency?

- Technological sclerosis and unbalanced restructuring (Caballero and Hammour)
- Sullying effect (Barlevy)
- Sources of inefficiency:
  - Bargaining
  - Hold-up problems
  - Asymmetric information
  - Distortions in credit/product markets
- Growth vs. fluctuations?

Understanding cyclical driving forces

- Aggregate vs. reallocation shocks
- Does timing of reallocation respond in systematic ways to aggregate shocks?
- Is the business cycle caused by reallocation shocks?
- Decomposition of driving forces using a structural VAR
  - Mapping to deep structural parameters?
- Davis and Haltiwanger (AER, 1999) and (JME, 2001)

$$Y_t = [POS_t, NEG_t]$$

$$\epsilon_t = [\epsilon_{at}, \epsilon_{st}]'$$

$$Y_t = A(L)\epsilon_t$$

$$Y_t = D(L)\eta_t, \quad D(0) = I,$$

$$\eta_t = [p_t, n_t]'$$

$$\eta_t = B_0\epsilon_t$$

$$A(L) = D(L)B_0$$

$$p = \epsilon_a + b_{ps}\epsilon_s$$

$$n = b_{na}\epsilon_a + \epsilon_s$$

$$p_t = \epsilon_{at} + b_{ps}\epsilon_{st},$$

$$n_t = b_{na}\epsilon_{at} + \epsilon_{st}.$$

$$\sigma_p^2 = \sigma_a^2 + b_{ps}^2\sigma_s^2,$$

$$\sigma_n^2 = b_{na}^2\sigma_a^2 + \sigma_s^2,$$

$$\sigma_{pn} = b_{na}\sigma_a^2 + b_{ps}\sigma_s^2,$$

$$b_{ps} = \frac{\sigma_{pn} - b_{na}\sigma_p^2}{\sigma_n^2 - b_{na}\sigma_{pn}}.$$

Remarks on Identification:

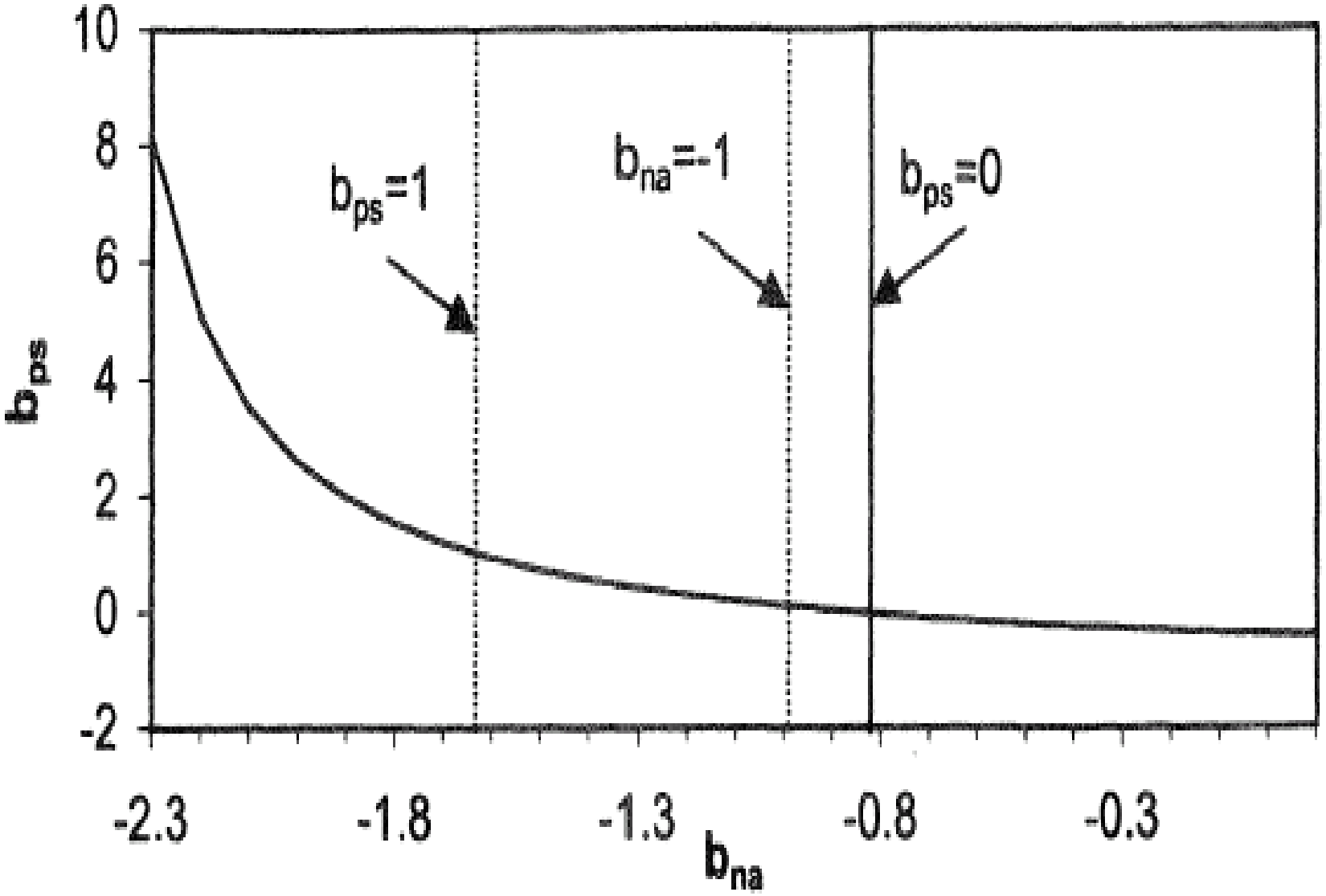
- $b_{na} < 0,\ b_{ps} > 0$ – definitional?
- $b_{na} = -1,\ b_{ps} = 1$ – traditional?
- $b_{na} < -1,\ |b_{ps}| < 1$ – emerging theories?

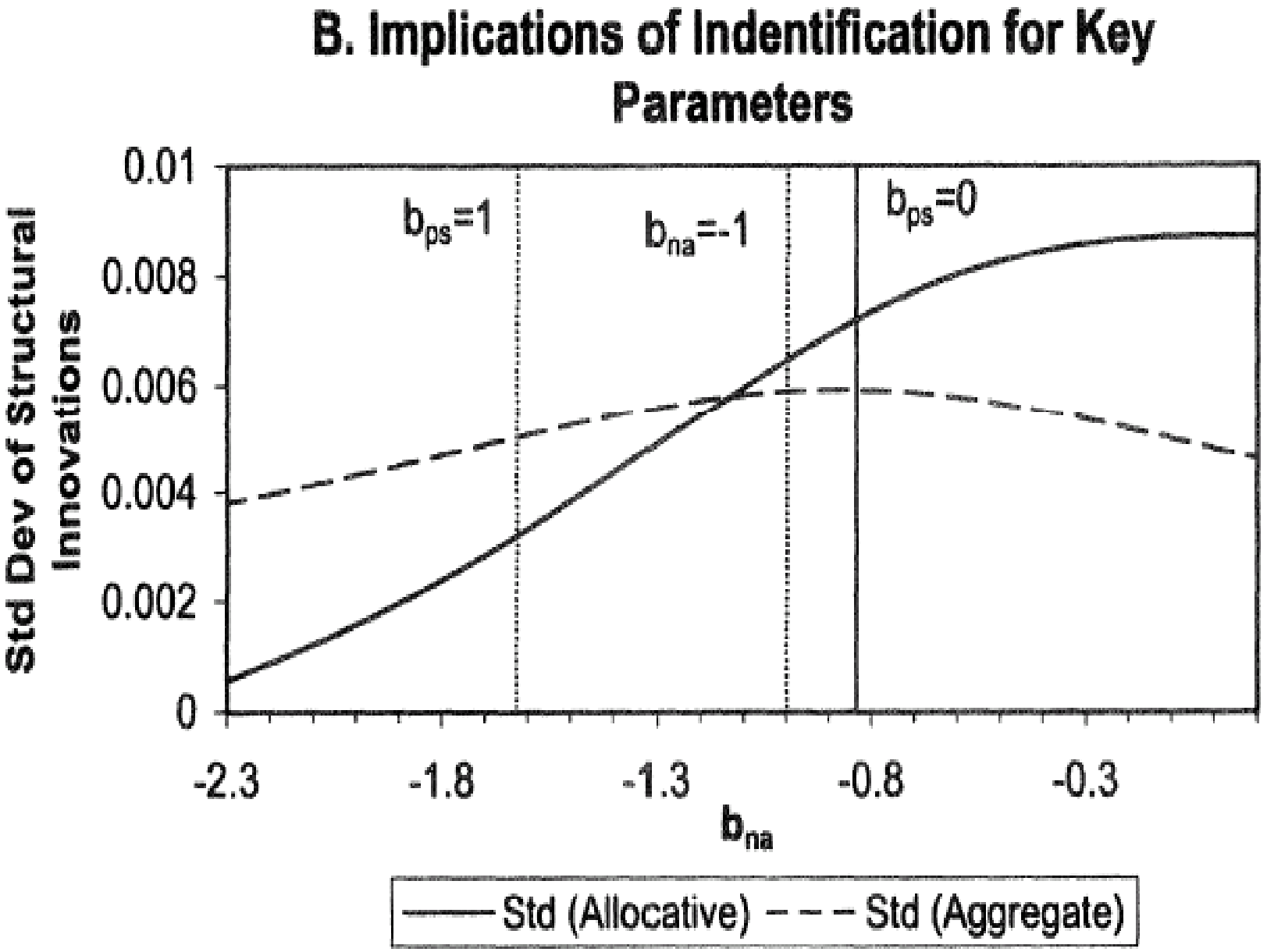
Long run neutrality restrictions

$$\text{(iv)} \quad \sum_{l=0}^{\infty}[A_{11}(l)+A_{21}(l)]=0 \quad \Rightarrow \quad \sum_{l=0}^{\infty}[D_{11}(l)+D_{21}(l)]+b_{na}[D_{12}(l)+D_{22}(l)]=0$$

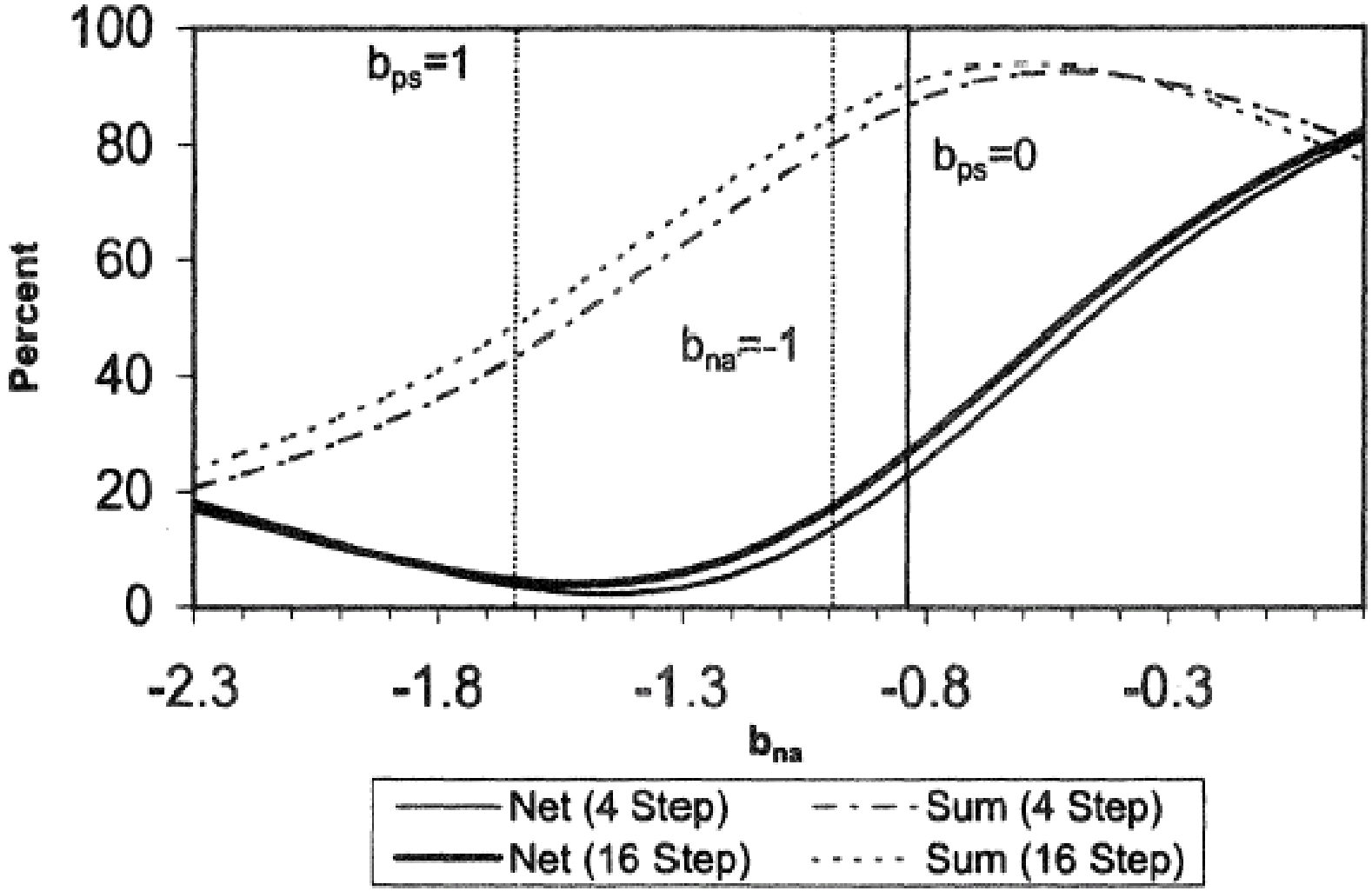
$$\text{(v)} \quad \sum_{l=0}^{\infty}[A_{12}(l)-A_{22}(l)]=0 \quad \Rightarrow \quad \sum_{l=0}^{\infty}b_{ps}[D_{11}(l)-D_{21}(l)]+[D_{12}(l)-D_{22}(l)]=0$$

A. Implications of Identification for Key Parameters




B. Implications of Indentification for Key Parameters
Std Dev of Structural Innovations
0.01
0.008
0.006
0.004
0.002
0
b_{ps}=1
b_{na}=-1
b_{ps}=0
-2.3
-1.8
-1.3
-0.8
-0.3
b_{na}
Std (Allocative)
Std (Aggregate)

C. Percent of Net Growth and Job Reallocation Due to Allocative Shocks



7-Variable system with observable shocks

$$o = \varepsilon_o + b_{om}\varepsilon_m$$

$$m = b_{mo}\varepsilon_o + \varepsilon_m$$

$$a = b_{ao}\varepsilon_o + b_{am}\varepsilon_m + \varepsilon_a + b_{ar}\varepsilon_r$$

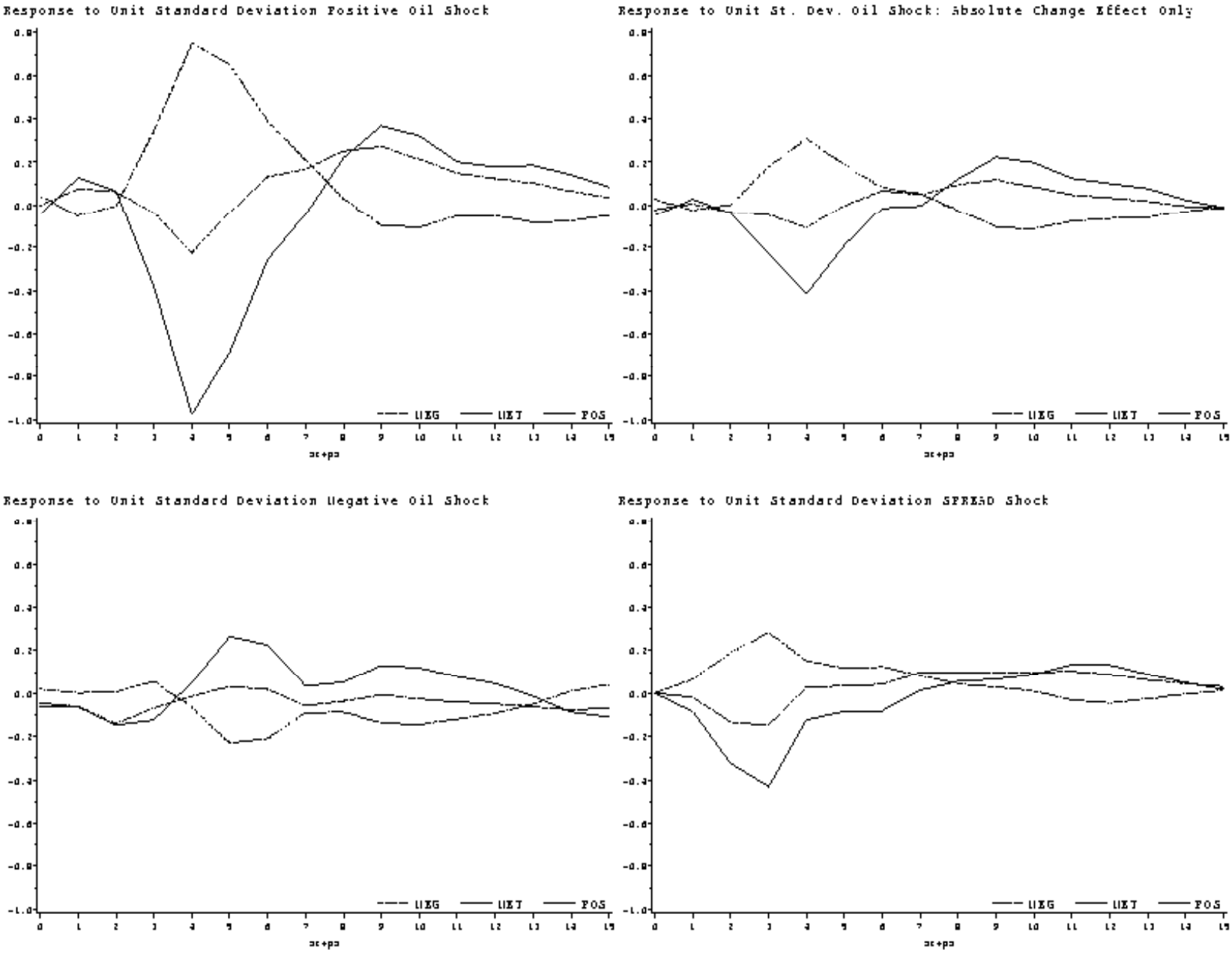
$$r = b_{ro}\varepsilon_o + b_{rm}\varepsilon_m + b_{ra}\varepsilon_a + \varepsilon_r$$

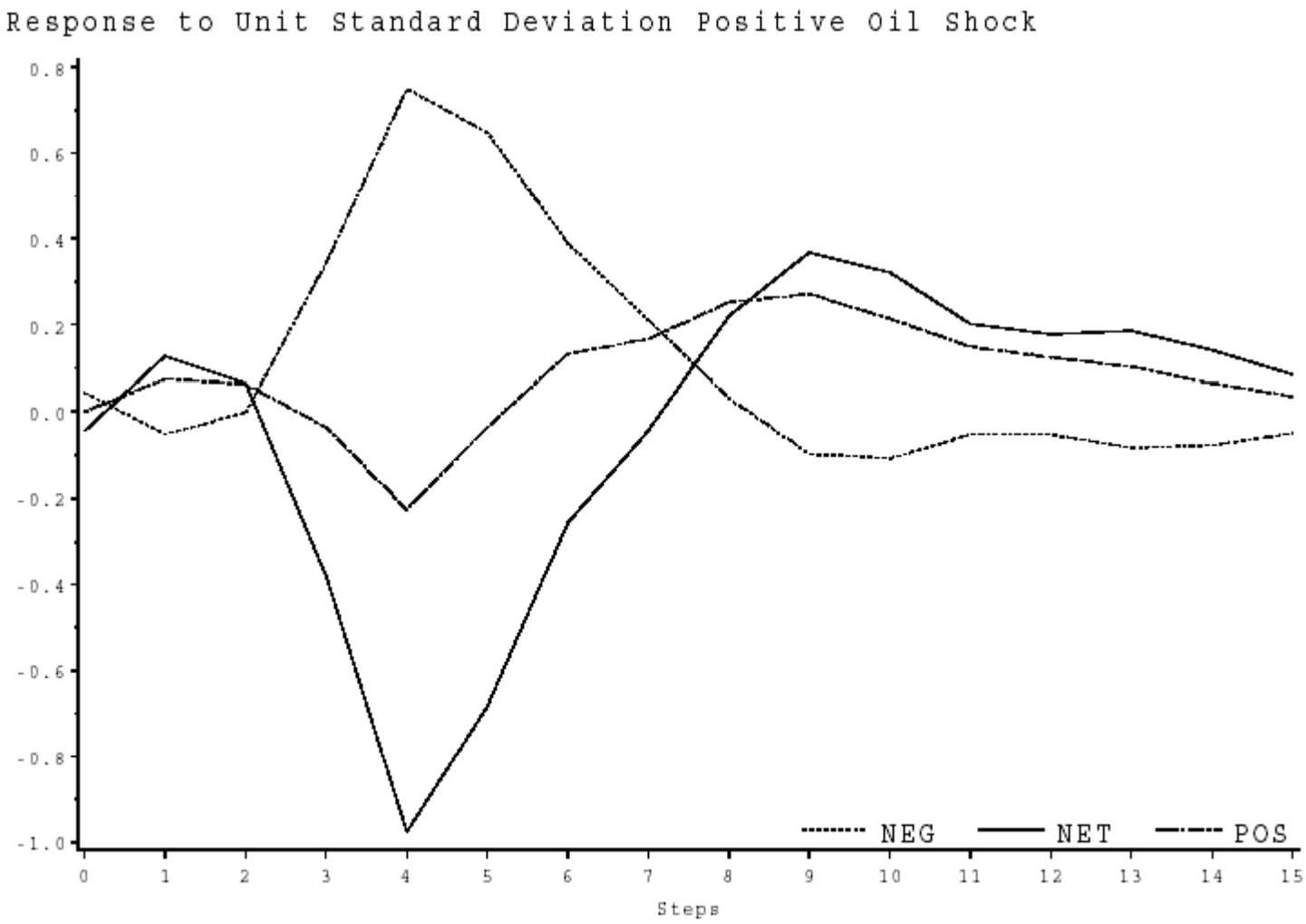
$$c = b_{co}\varepsilon_o + b_{cm}\varepsilon_m + b_{ca}\varepsilon_a + b_{cr}\varepsilon_r + \varepsilon_c$$

$$p = b_{po}\varepsilon_o + b_{pm}\varepsilon_m + b_{pa}\varepsilon_a + b_{pr}\varepsilon_r + b_{pc}\varepsilon_c + \varepsilon_p + b_{pn}\varepsilon_n$$

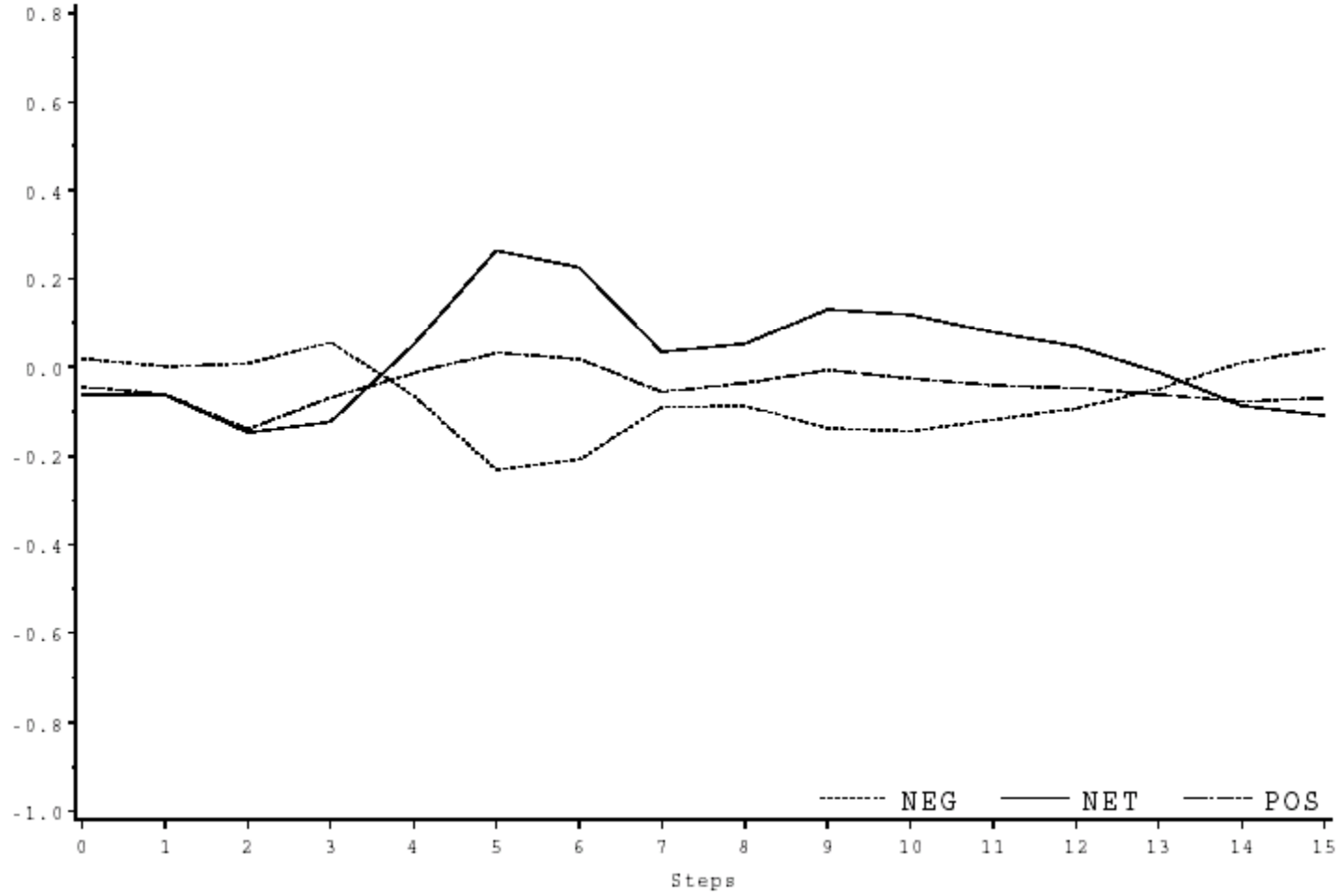
$$n = b_{no}\varepsilon_o + b_{nm}\varepsilon_m + b_{na}\varepsilon_a + b_{nr}\varepsilon_r + b_{nc}\varepsilon_c + b_{np}\varepsilon_p + \varepsilon_n.$$

Figure 3: Impulse Response Functions for Total Manufacturing, Five–Variable VAR Subsystem




Response to Unit Standard Deviation Positive Oil Shock
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Steps
NEG
NET
POS

Response to Unit Standard Deviation Negative Oil Shock



Net vs. Reallocation Responses to Oil and other Shocks

- Net employment response to 73 oil price shock is -8 percent at 8 quarters but only -2 percent at 16 quarters.
- Reallocation response is 11 percent at 16 quarters.
- Net response to 79 money shock is -3 percent at 8 quarters, -1.3 percent at 16 quarters -- and reallocation response is 2.7 percent at 16 quarters.

Reallocation Responses to Shocks

- Oil Shocks:
  - positive price shocks cause downturn but negative shocks cause upturns;
  - reallocation dynamics can explain why;
- Credit/Money Shocks:
  - Look more like “traditional” aggregate shock
  - Still asymmetric response of destruction relative to creation -- recessions as reorganizations?

Taking stock…

- Theory and evidence link reallocation (permanent) and cycle
- Evidence for non-manufacturing still unclear
- Theory and evidence has not fully exploited differences by plant characteristics (e.g., size, age)
- Causality difficult

Search/matching literature and vacancies

Overview

- Models of search & matching now standard for understanding of labor market interactions
- One critical component is the process of:

  demand for labor → vacancy posting → worker-job match
- Until recently, good data for studying process in US did not exist
  - To date, relevant micro analyses almost non-existent
- This lecture exploits newly available **JOLTS** data (both macro *and* micro) to explore role of vacancies in job and worker flows

Background – Standard Model

- Mortensen-Pissarides (1994):
  - Vacancies – (costly) tool used by firms to signal an open job
  - Free entry $\Rightarrow$ firms post vacancies until E(returns) = cost
  - Search frictions cause hiring/job creation to be costly & time-consuming process
  - Once matched, worker & job stay together so long as E(returns) of match remain ≥ 0;
    - If a shock drives E(returns) < 0, match separates/job is destroyed

- Interesting complications:
  - On-the-job search and quits
  - Hires with no posted vacancy and multiple hires per vacancy
  - New hires vs job creation and separations vs job destruction

Resulting Empirical Questions

- What is the role of vacancies in hiring?
  - Do they truly capture all unmet labor demand?
  - Are they essential inputs to hiring?
- What does the hiring-vacancy relationship look like?
  - Is it the same at aggregate and establishment levels?
- When a firm changes employment, how does it alter its mix of hires, separations, & vacancies?
  - Put differently, where do vacancies fit into the relationships between job creation & hires, and job destruction & separations?

More Deep-Rooted Questions

- Is the standard matching function consistent with the micro data evidence on vacancies, hires and number of job searchers?
  - Does $h = m(v,u)$ hold at the firm level?

- What modifications of the standard matching model are necessary to accommodate the patterns at the micro level?
  - Are there other variables that may factor in to the matching process?

JOLTS Concepts & Definitions (1)

- Job Openings and Labor Turnover Survey (JOLTS)
  - Monthly survey of roughly 16,000 establishments starting in December 2000
  - Core questions on:
    - Employment level
    - # hires during month
    - # separations during month (with quit/layoff breakdown)
    - # posted vacancies at end of month

JOLTS Concepts & Definitions (2)

- Stock of employment at mid month (pay period including the 12th); all employees on payroll at the time
- Hires, separations (incl. quits, layoffs & other separations) are flows measured over the course of the calendar month
  - Definitions allow workers to move off (on) payroll without necessarily being separated (hired)
- Posted, unfilled vacancies at the end of calendar month
  - A vacancy must be part of an active recruitment, and must be for a job that can start within 30 days
  - Definition may not capture long-term postings or vacancies posted and filled within the calendar month

JOLTS Data & Measurement

- Data used for study
  - Pooled microdata from Dec 2000 to Jan 2005
  - Use only estabs with observations over two consecutive months
    - Allows tabulation of net employment change & use of lagged vacancy rate
  - Restrict to estabs with positive employment in consecutive months -- very few entering/exiting estabs anyway
  - All estimates sample-weighted
- Measurement Issues
  - Given definitions, timing differences, and potential measurement error, $H - S = \Delta E$ need not hold (and often does not) in JOLTS micro data
  - Worker flows and job flows computed from JOLTS are smaller than those from other sources

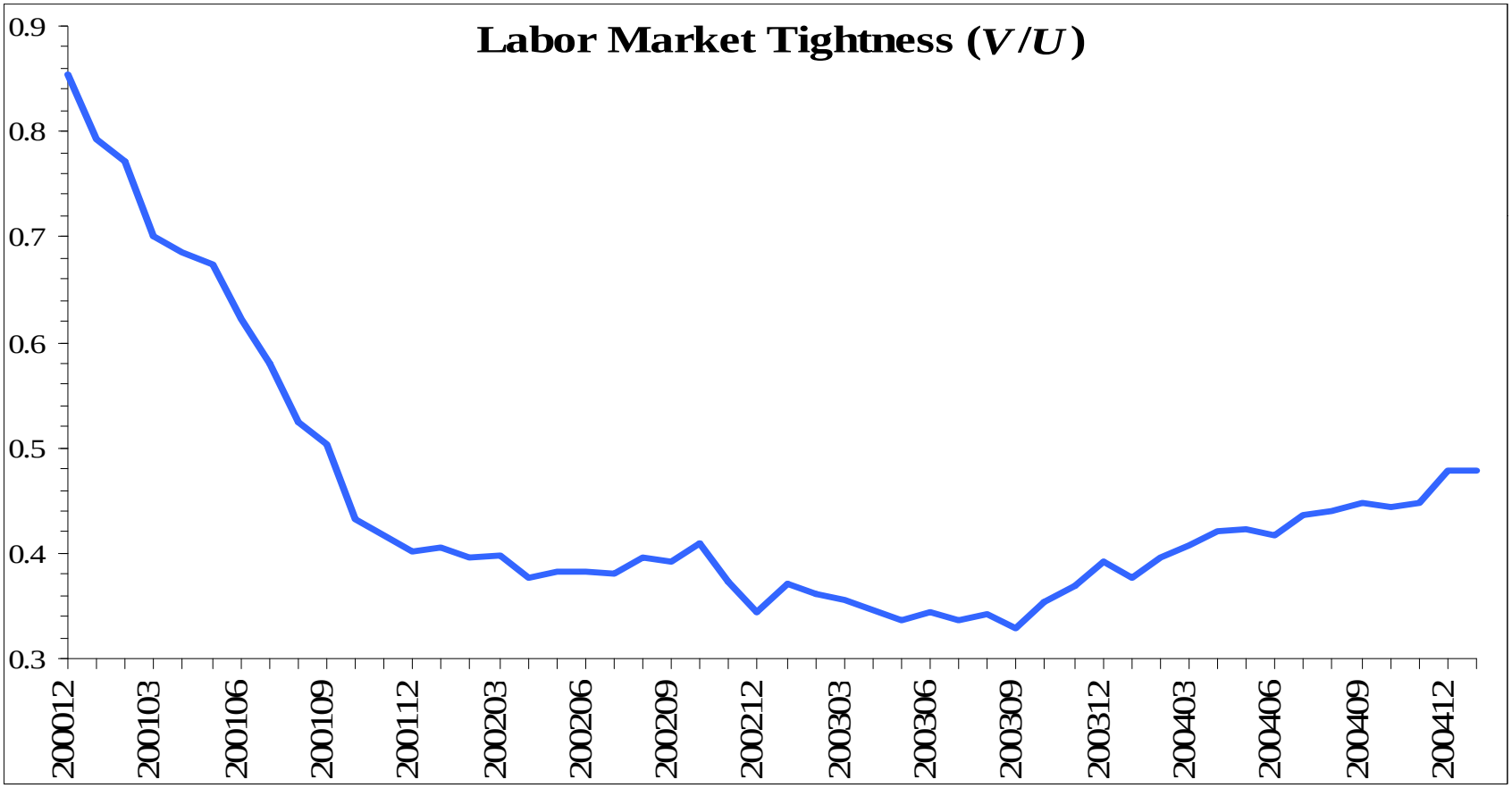
JOLTS Data & Measurement (cont'd)

- We impose identity that $H - S = \Delta E$
  - $H(t)$, $S(t)$, and $E(t)$ data taken at face value for month t
  - $E(t–1)$ redefined as $E(t) - H(t) + S(t)$ so identity holds

- We relate vacancies posted at end of $t - 1$ to hires and separations during t and employment growth from *t-1* to t

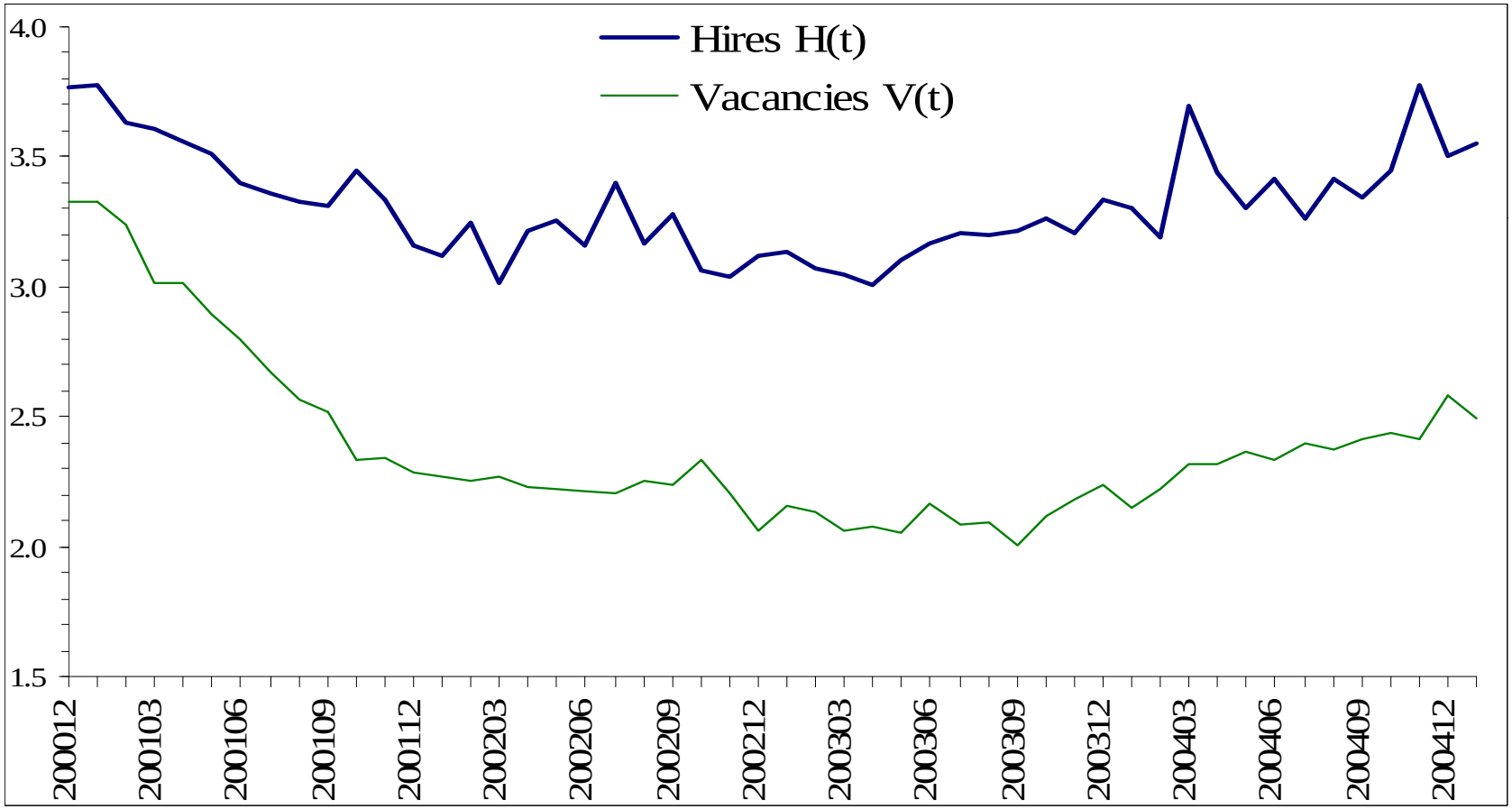
- Measures turned into rates using DHS average employment denominator, $\frac{1}{2}[E(t) + E(t–1)]$
  - Vacancy Rate denominator = V + DHS Emp.

Aggregate Evidence – Labor Market Tightness



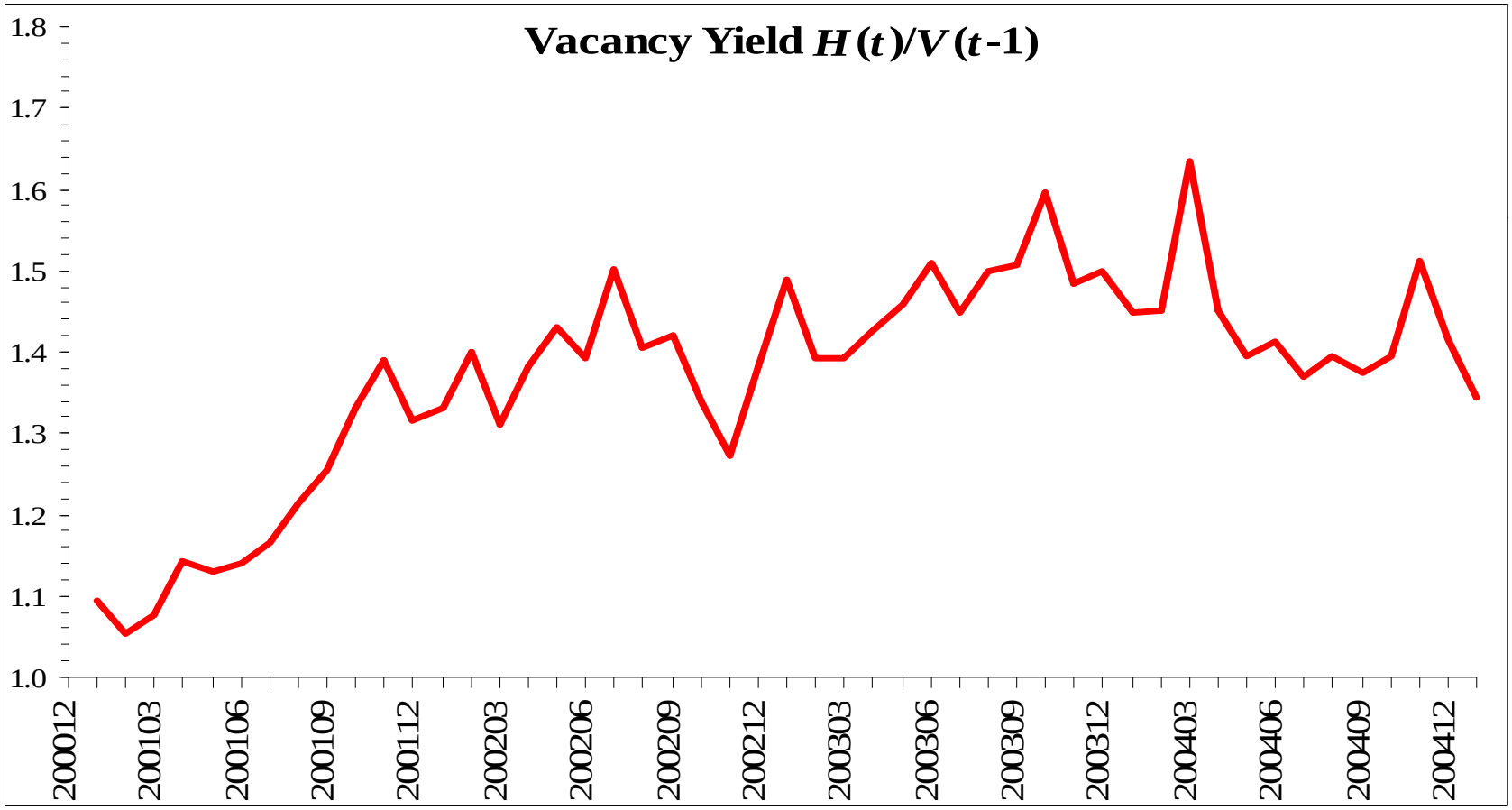
- There were large movements in *V*/*U* during the period

Aggregate Evidence – Hires and Vacancies



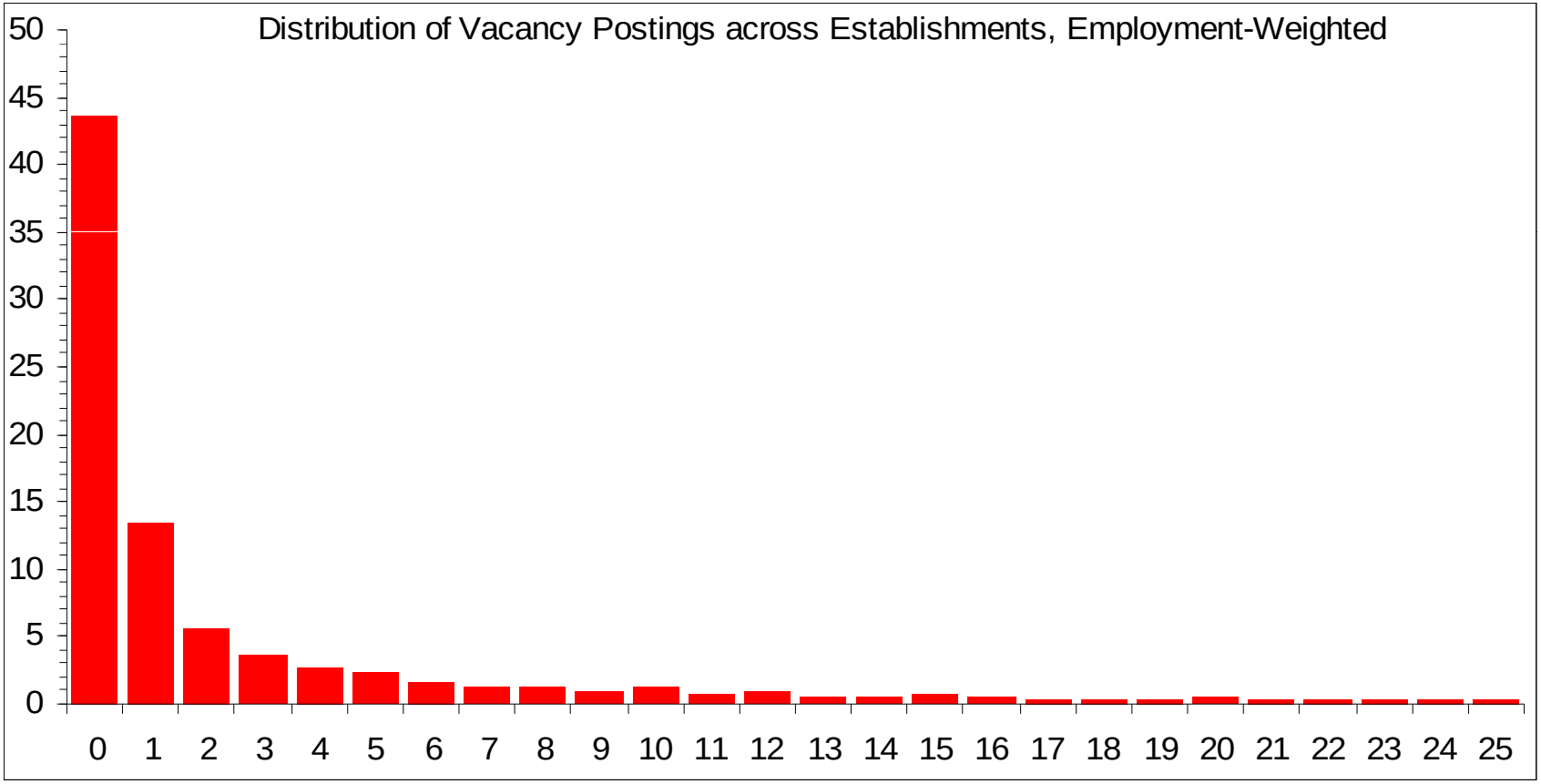
- Hires and vacancies also had considerable volatility

Aggregate Evidence – The Vacancy Yield



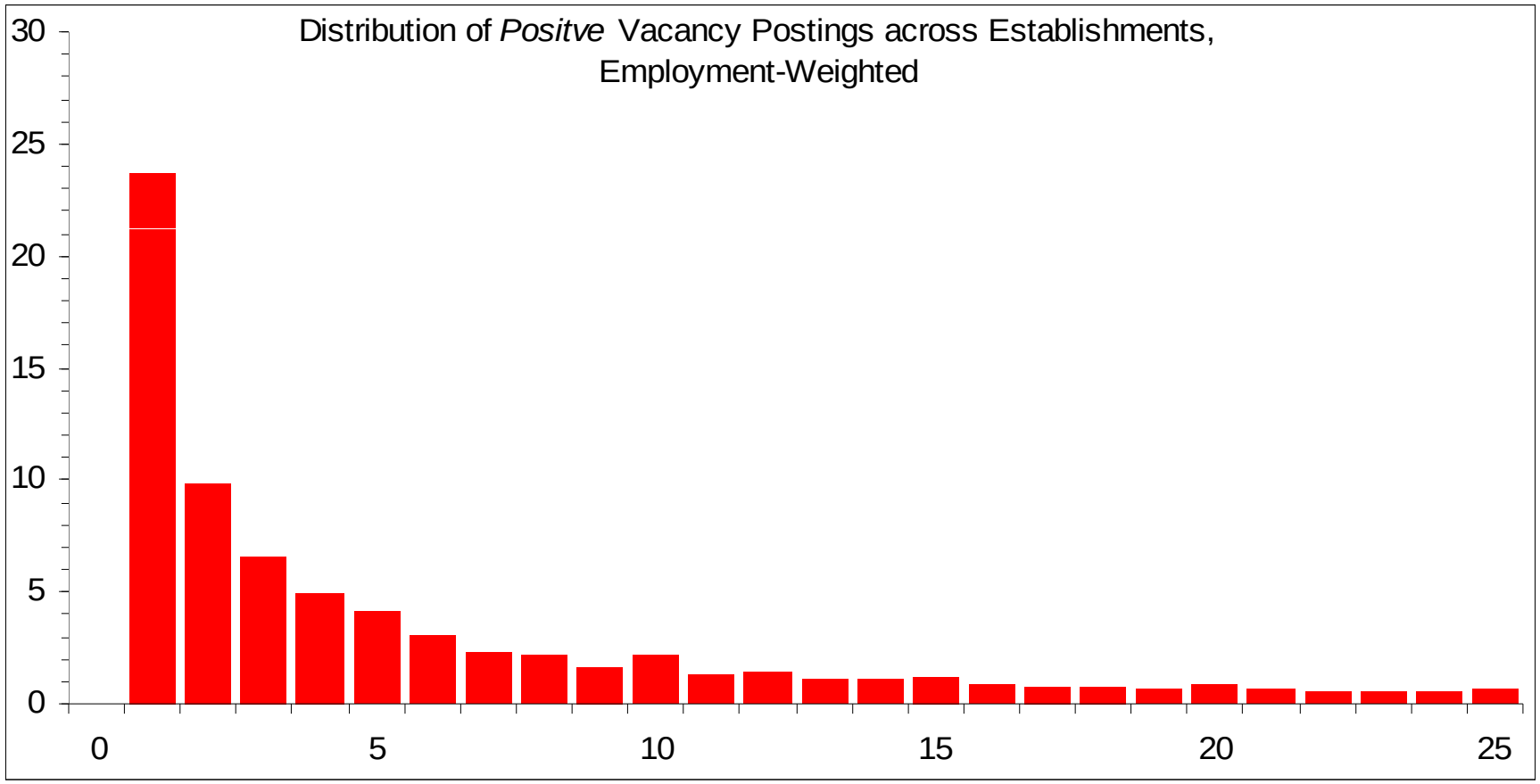
- The yield, however, has been acyclical, if not somewhat counter-cyclical

Basic Micro Evidence – How are Vacancies Distributed?



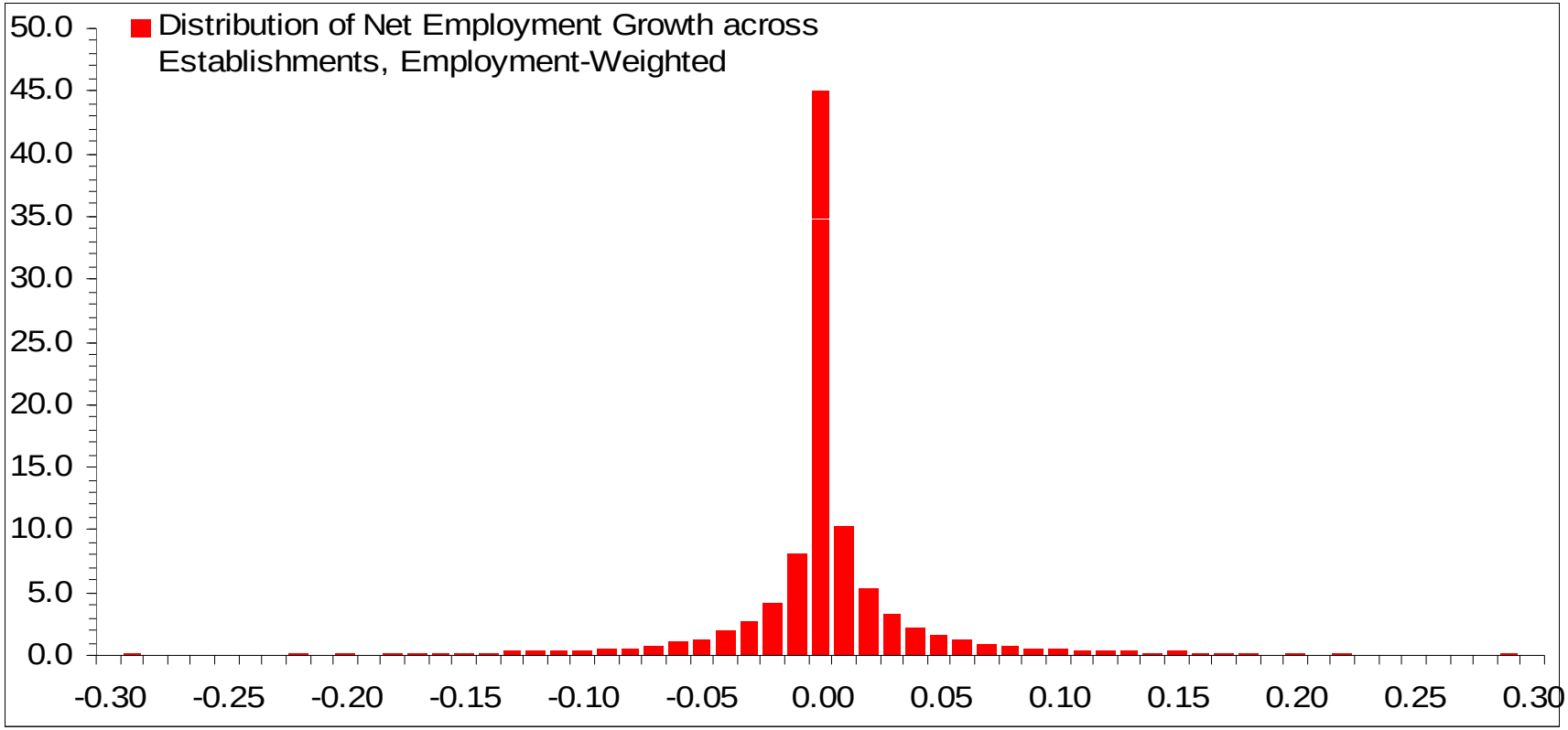
- Employment-weighted, 46 percent of estabs post no vacancies; unweighted it's even greater (88 percent!)

Basic Micro Evidence – How are Vacancies Distributed?



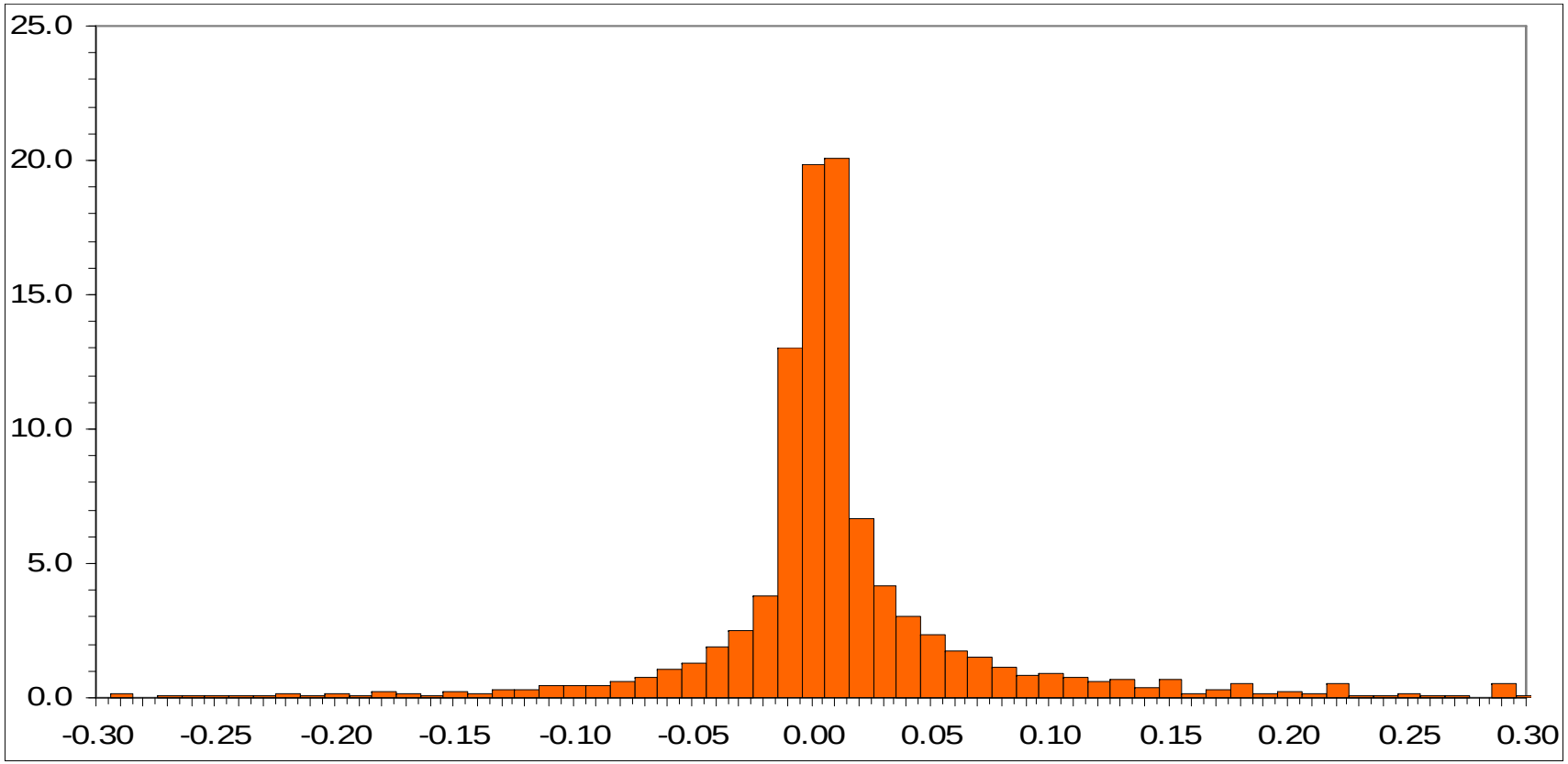
- ...and conditional on posting a vacancy, 24 percent of estabs only post <u>one</u> (unweighted, 66 percent!)

Basic Micro Evidence – Why so few vacancies?



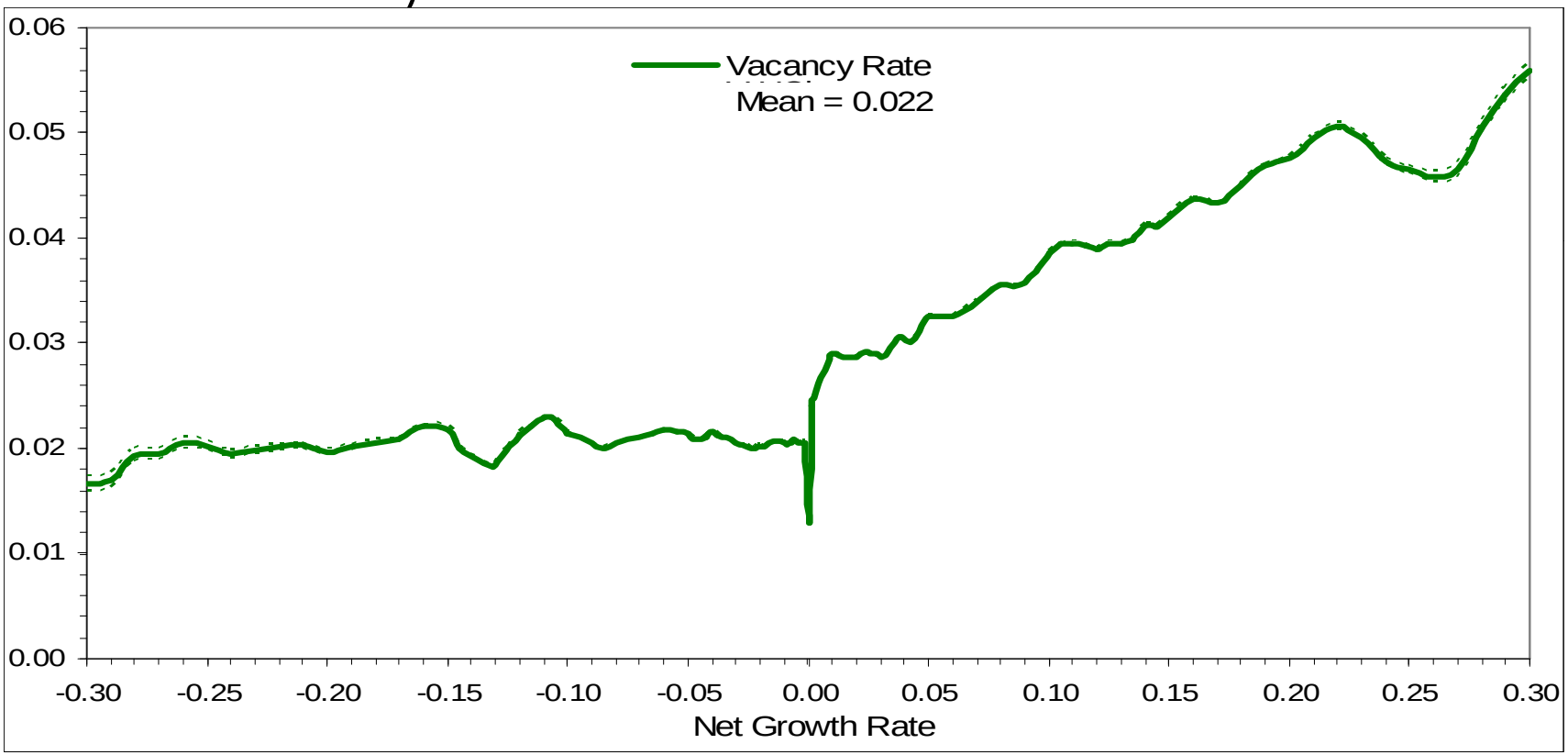
- Because there are few monthly employment changes!
  - 78 pct of estabs, representing 45 pct of employment have no net change in a month

Vacancy & Net Growth Relations – Distribution of Vacancies across Net



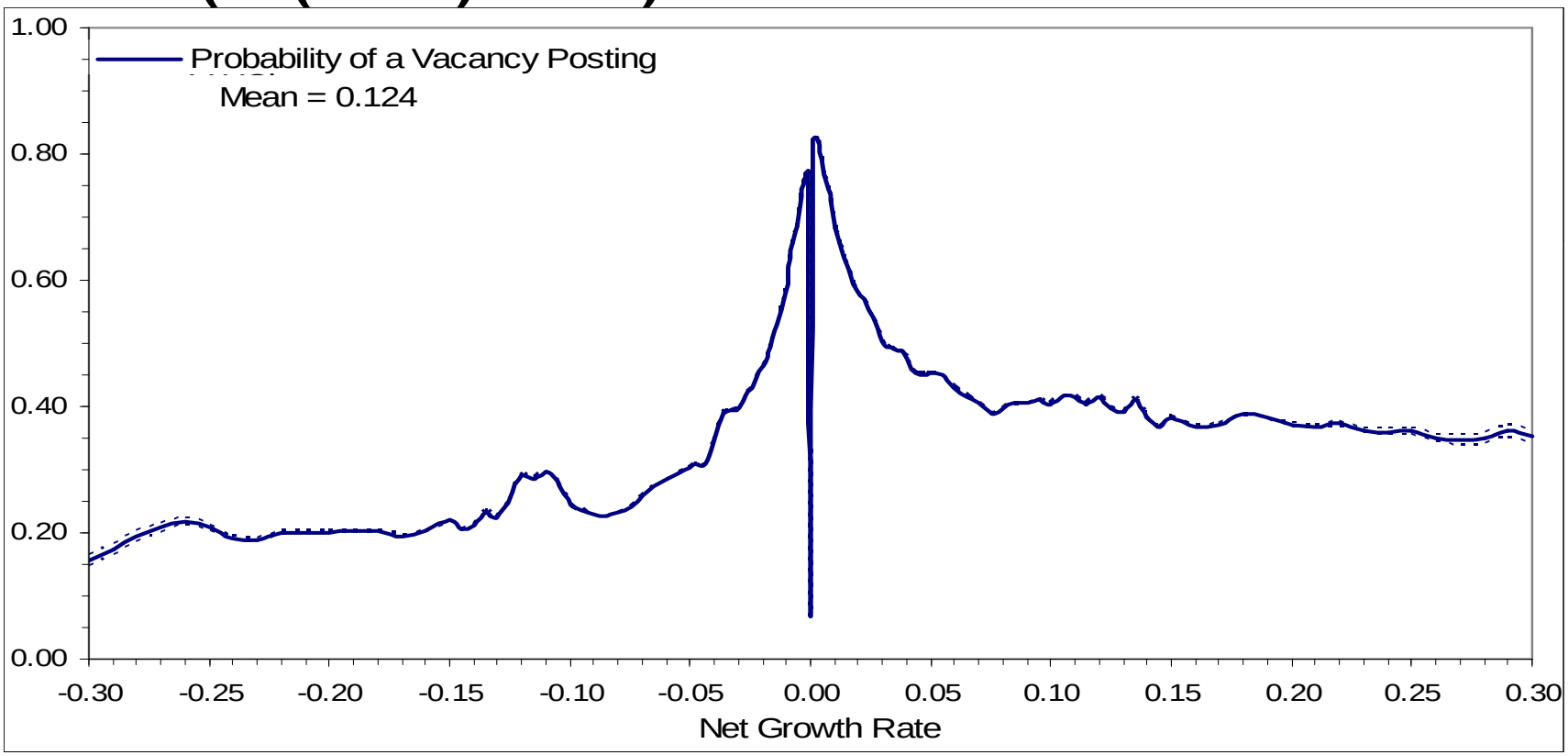
- Most vacancies occur at estabs with little to no net growth
  - Distribution highly skewed to the right
  - Contracting estabs still post 26 pct of all vacancies

Vacancy & Net Growth Relations – Vacancy Rates as a function of Net



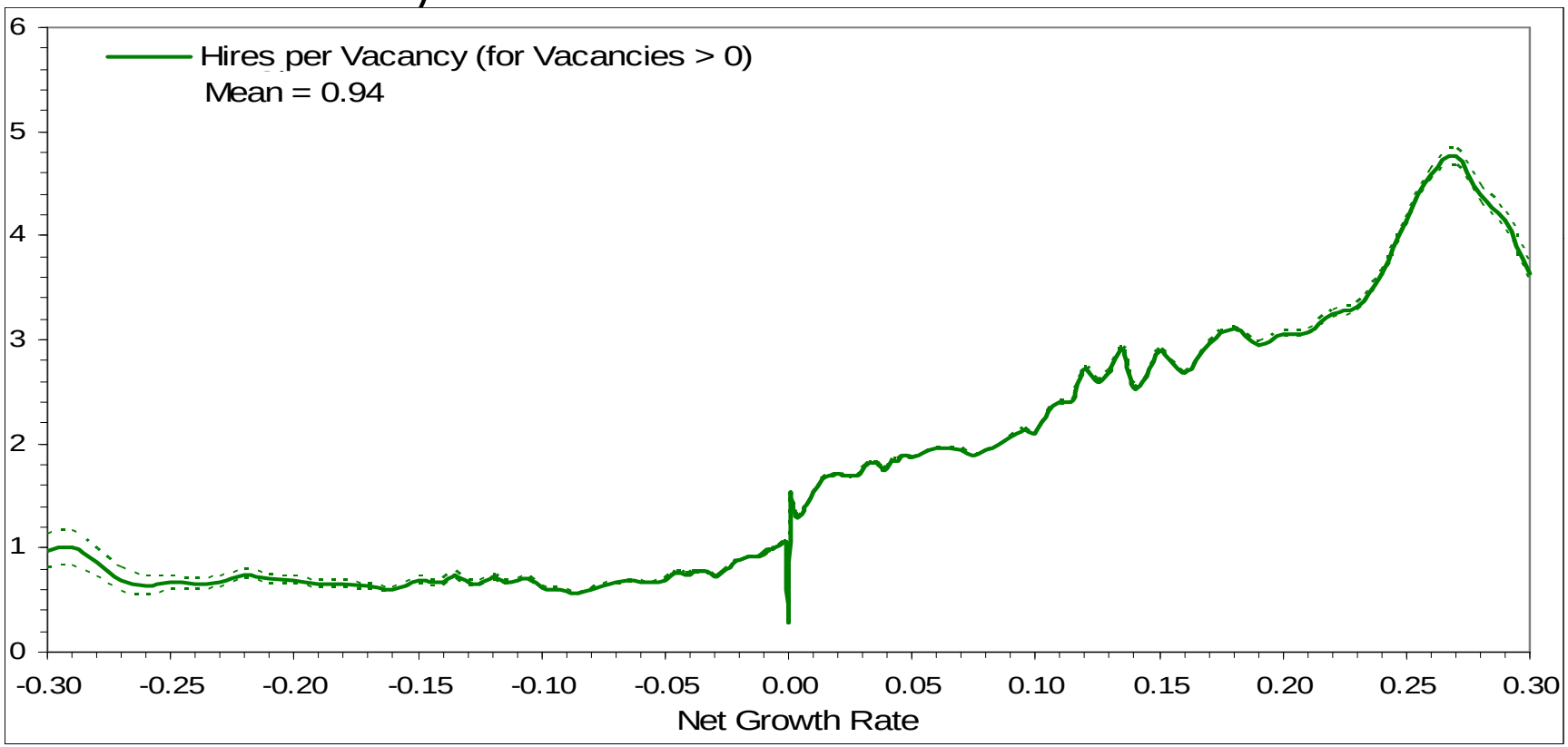
- Vacancy Rates increase nonlinearly with net growth
  - Contracting estabs have essentially constant rates (~ 2 pct)
  - Zero-growth estabs have lowest rates (1.4 pct)

Vacancy & Net Growth Relations – Pr($V(t-1) > 0$) as a function of Net



- Probability of a vacancy posting increasing in Net, but…
  - Estabs with small changes are most likely to post vacancies
  - Zero-growth estabs have very low vacancy posting probability

Vacancy & Net Growth Relations – Vacancy Yield as a function of Net



- Vacancy yield also nonlinearly increasing in net
  - Expansions have yield >> 1, contractions have yield ≤ 1
  - Similar pattern when all hires included (but with mean yield > 1)
  - Pattern differs considerably from aggregate patterns

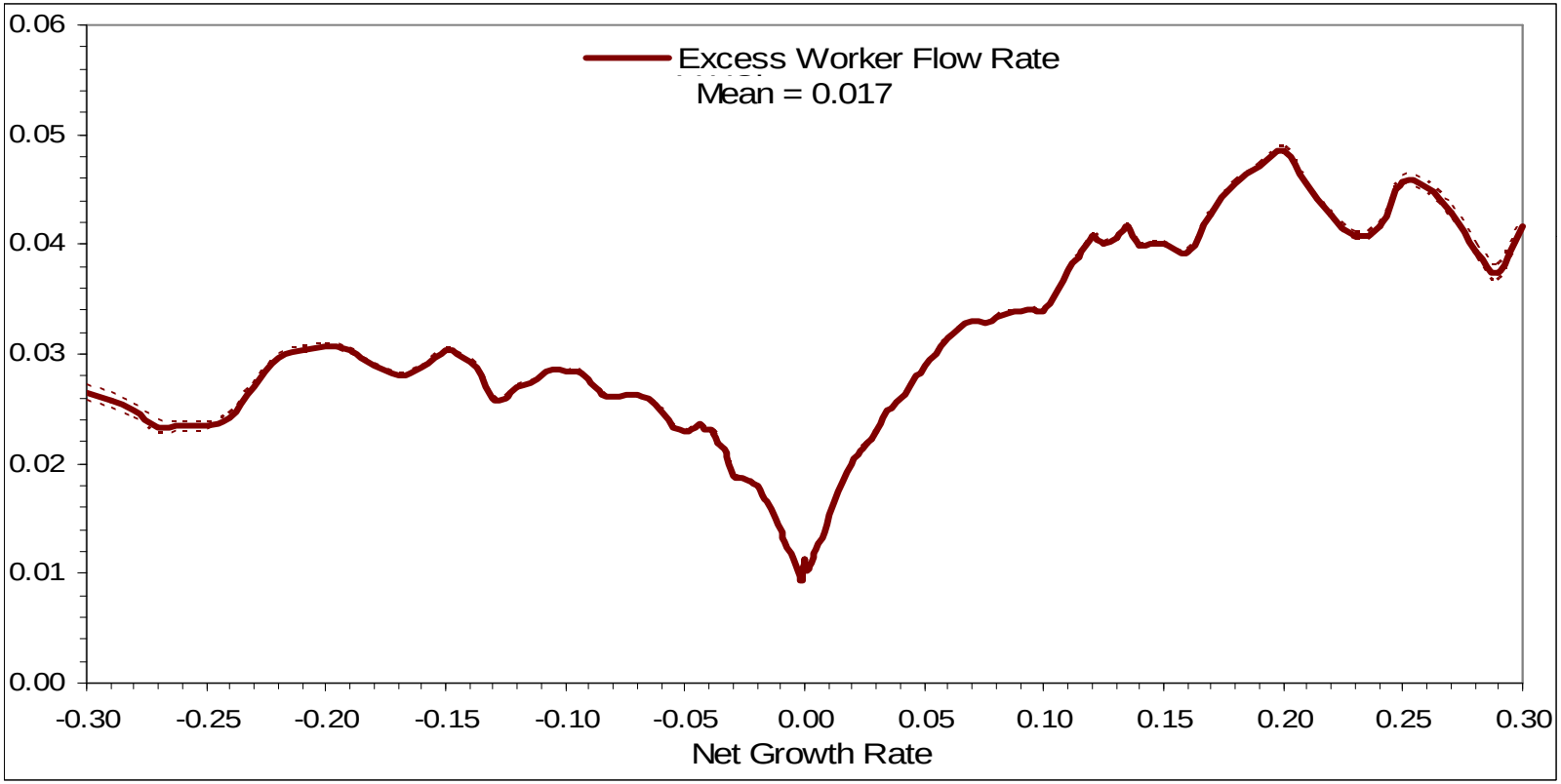
Summary of Vacancy Findings

- Most estabs have no vacancies, net growth; rich dynamics come about from small share that do
- Vacancy posting and yield behavior clearly varies with estab growth
  - Most relations are nonlinear
  - Zero-growth estabs appear fundamentally different in their vacancy patterns (less likely to need active search)
  - Yield evidence suggests factors correlated with growth may affect matching process
- Next, take a step back to worker-job flow relations
  - Remember that…
    - Estab Net Growth > 0 ≡ Job Creation
    - Estab Net Growth < 0 ≡ Job Destruction
  - Useful to see how vacancy behavior is related

Worker & Job Flow Relations – Hires and Separations vs Net Growth

- Strong nonlinear relations of *H* and *S* to net growth
  - *H* rates rise sharply to right of 0, *S* rates rise sharply to left of 0
  - Considerable hires at contracting, separations at expanding estabs

Worker & Job Flow Relations – Excess Worker Flows vs Net Growth

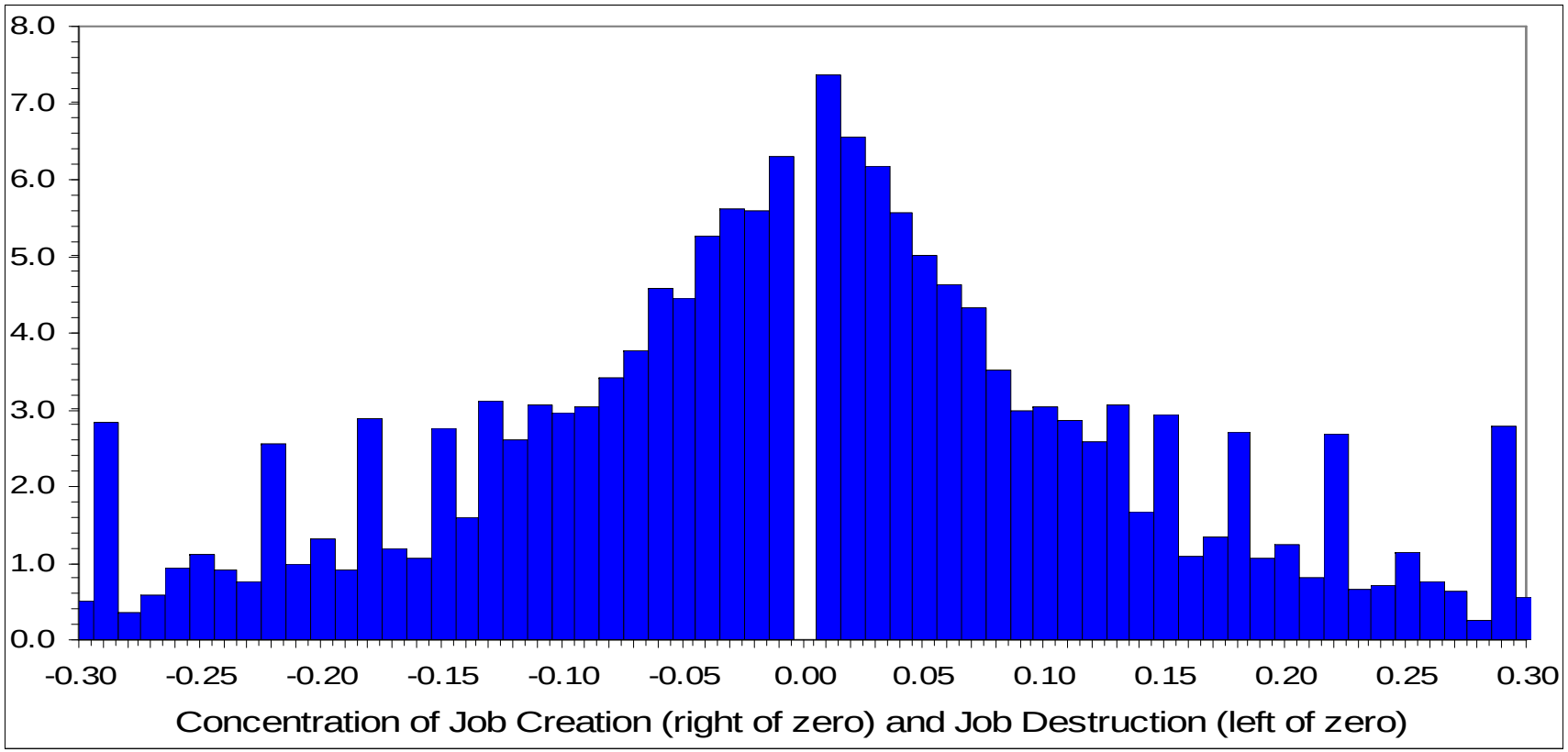


- Excess Flow ≡ $H - JC = S - JD$, highlights churning from last figure
  - Excess flows increase with the magnitude of net growth
  - Greater excess churning for expanding estabs (~ 4-5 pct vs 2-3 pct)

Worker & Job Flow Relations – Some Notes on Worker Flows

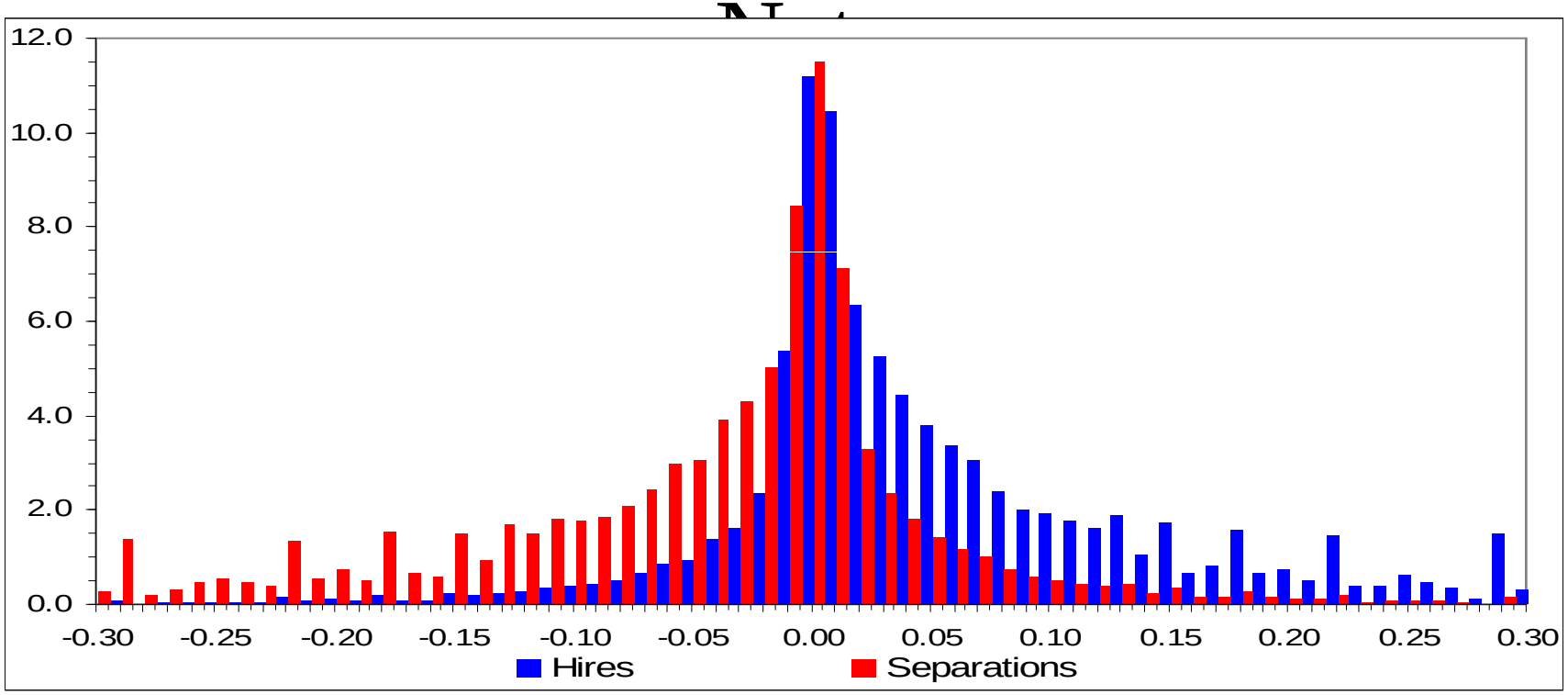
- Worker-job flow relations are robust to a variety of circumstances
  - Patterns persist across sectors, size class, relaxation of identity restriction
  - Patterns persist in other data, at lower frequency
    - LEHD – quarterly, administrative (universe) data
  - Patterns persist in high and low-growth periods
    - Curves show little to no movement over business cycle
    - Instead, aggregate flow rates change mainly via shifts in the net growth distribution

Worker & Job Flow Relations – Concentration of Job Flows



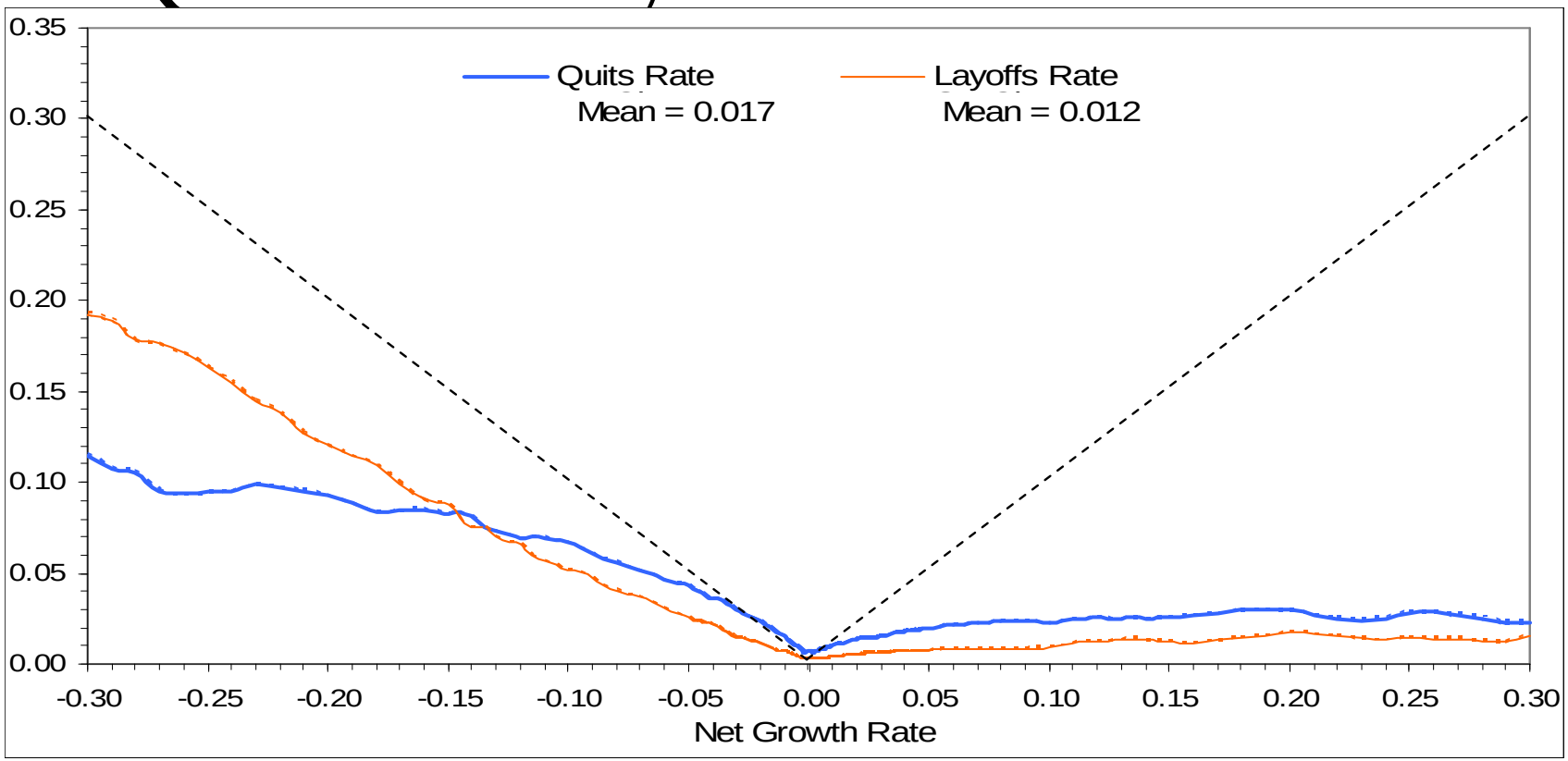
- Job flows spread over wide range of net growth rates
  - Larger job flow shares at smaller growth rates
  - Similar to pattern in DHS (1996), except missing births and deaths.

Worker & Job Flow Relations – Distribution of Worker Flows along Net



- Worker flows concentrated among small Net changes
  - *H* distribution skewed to right, *S* distribution skewed to left
  - Yet, 17 pct of *H* occur at contractions, 24 pct of *S* occur at expansions
  - Small net changes have low churning rates, but represent most total churning

Worker & Job Flow Relations – Quits and Layoffs vs Net Growth

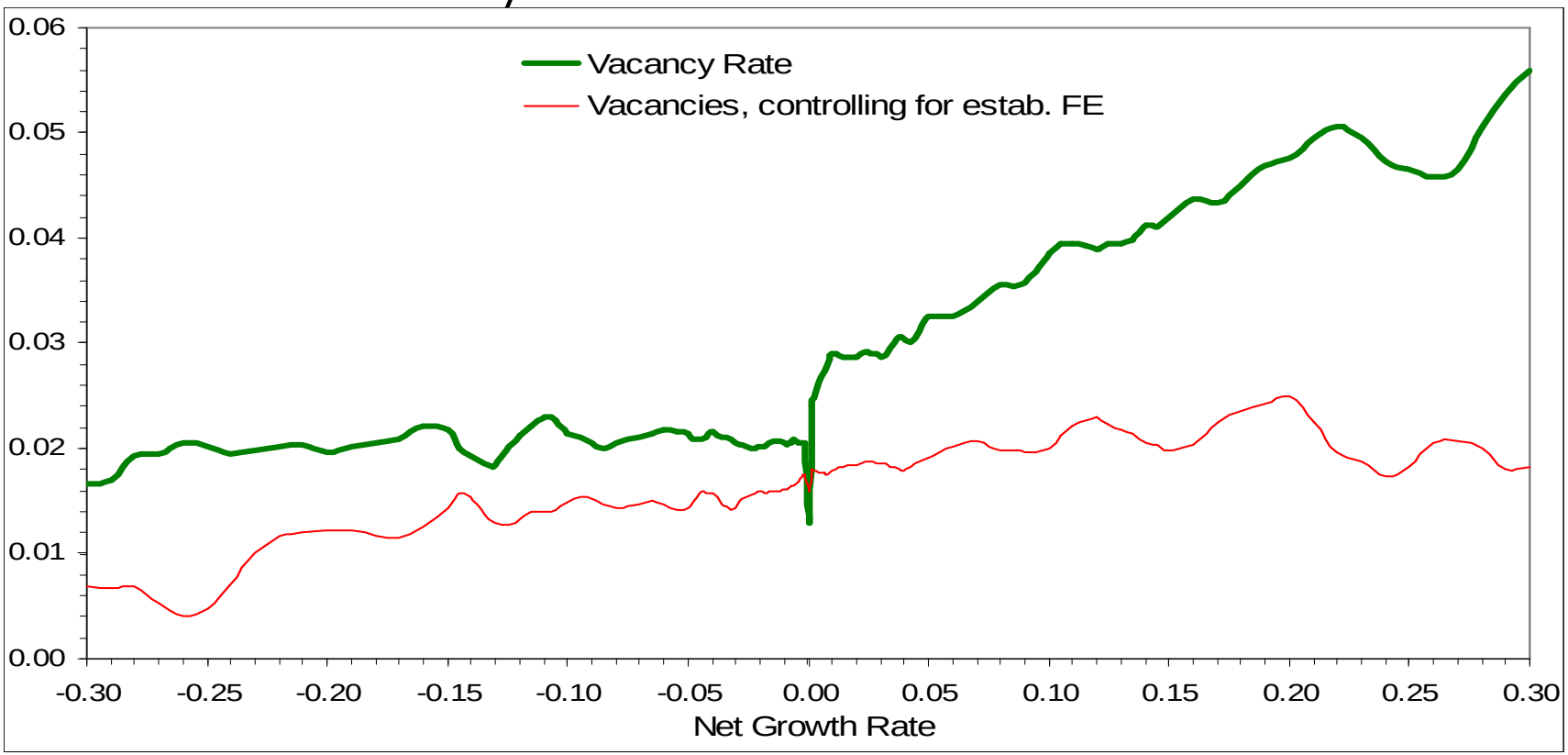


- Quits, Layoffs also exhibit strong nonlinear patterns
  - Quits dominate separations at expansions
  - Quits also account for many separations at contractions
  - Layoff/quit ratio rises as net growth rate becomes more negative

The Role of Structural Heterogeneity

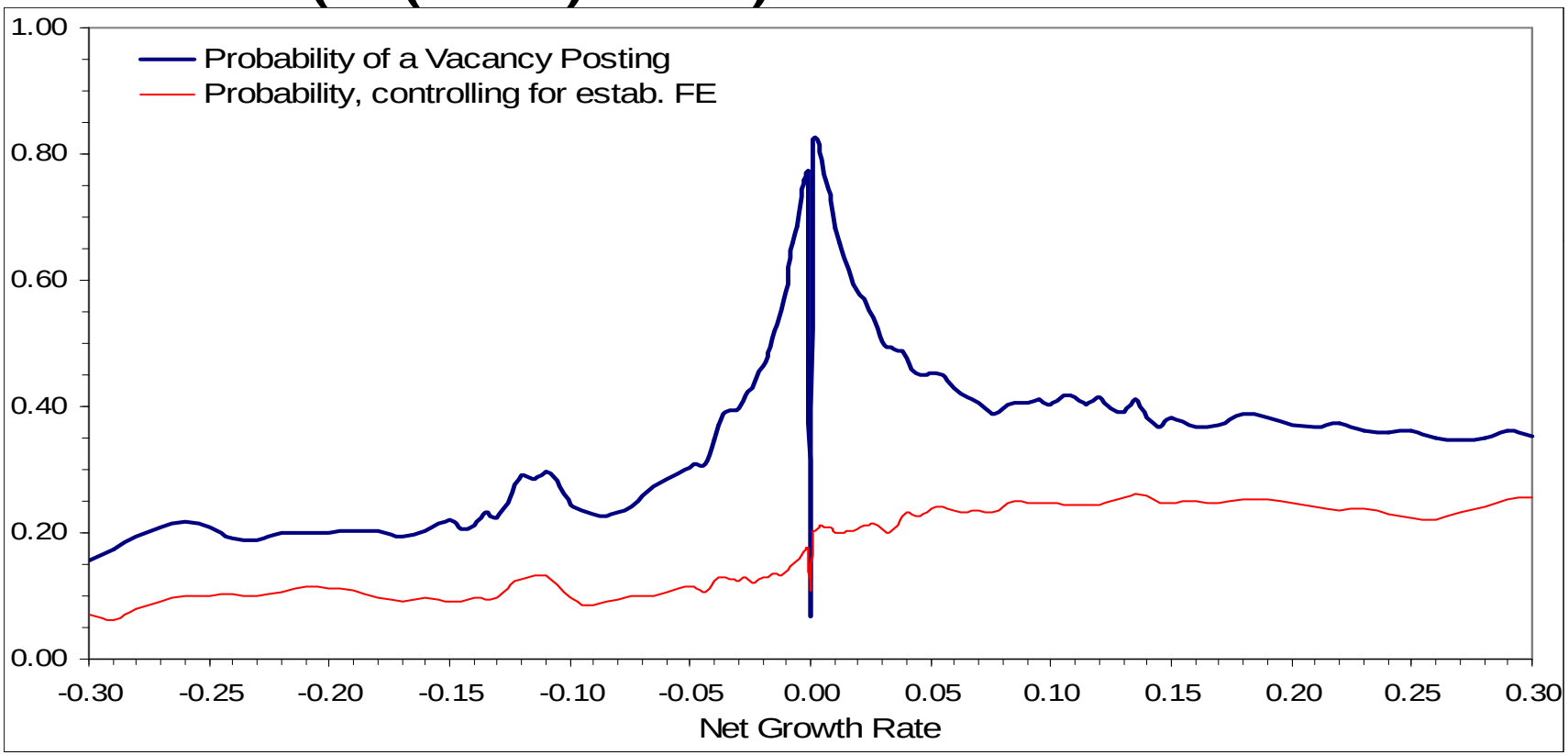
- Evidence thus far says little about differences across establishments
- Variations by estab size (see handout)
  - Small estabs: least likely to post a *V*, yet have highest churning
  - Conditional on $V > 0$, vacancy yield increases in size; unconditionally, it decreases
- Variations by sector (see handout)
  - Much variation in *H*, *S*, *V* Rates and likelihood of posting a vacancy
  - High churn industries (retail, construction) tend to have low likelihoods of *V postings*
- For more comprehensive check on role of heterogeneity, we replicate previous results controlling for establishment fixed effects

Controlling for Establishment FE – Vacancy Rates vs Net Growth



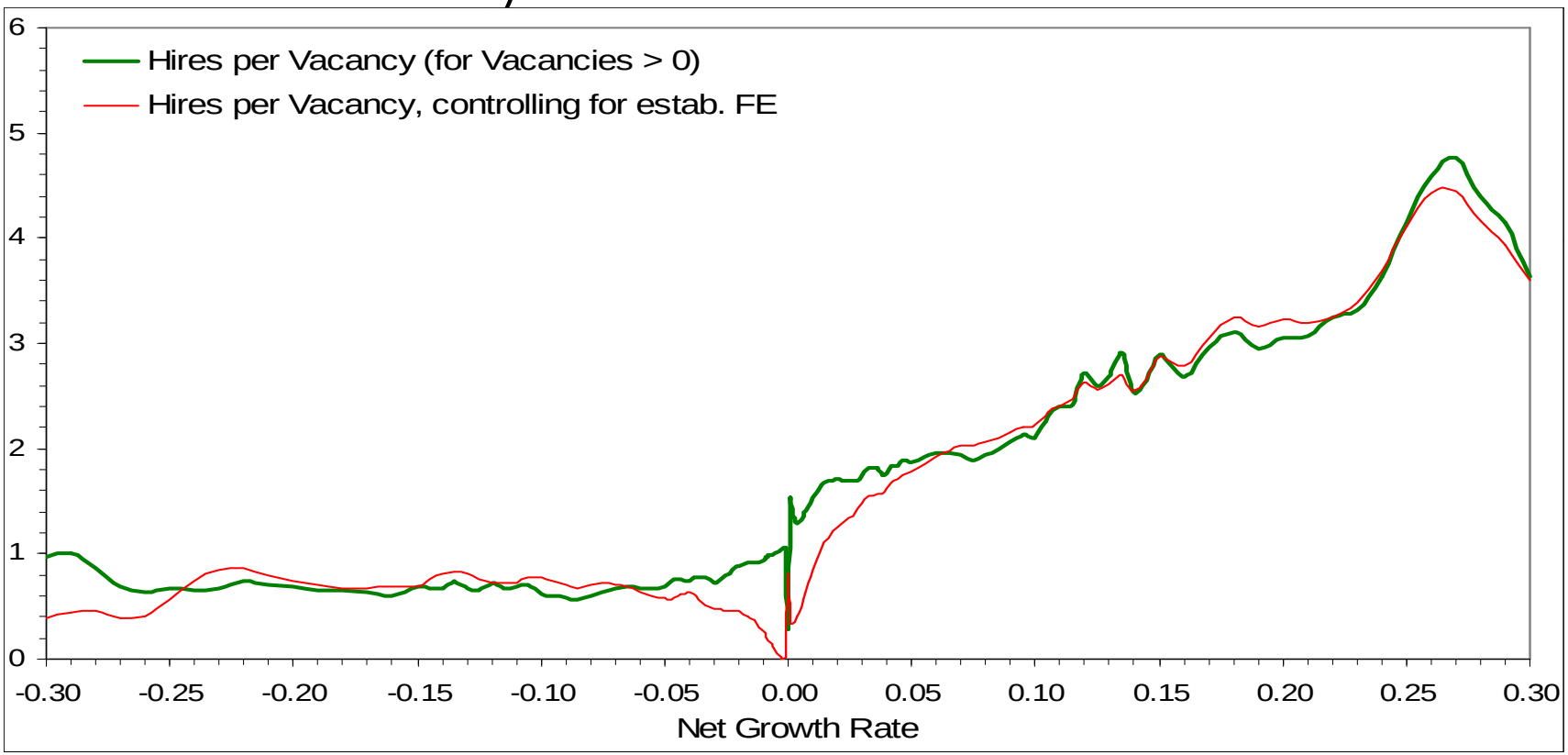
- Vacancy rates still increase with net growth, but estab effects account for some of the key nonlinearities

Controlling for Establishment FE – Pr($V(t-1) > 0$) vs Net Growth



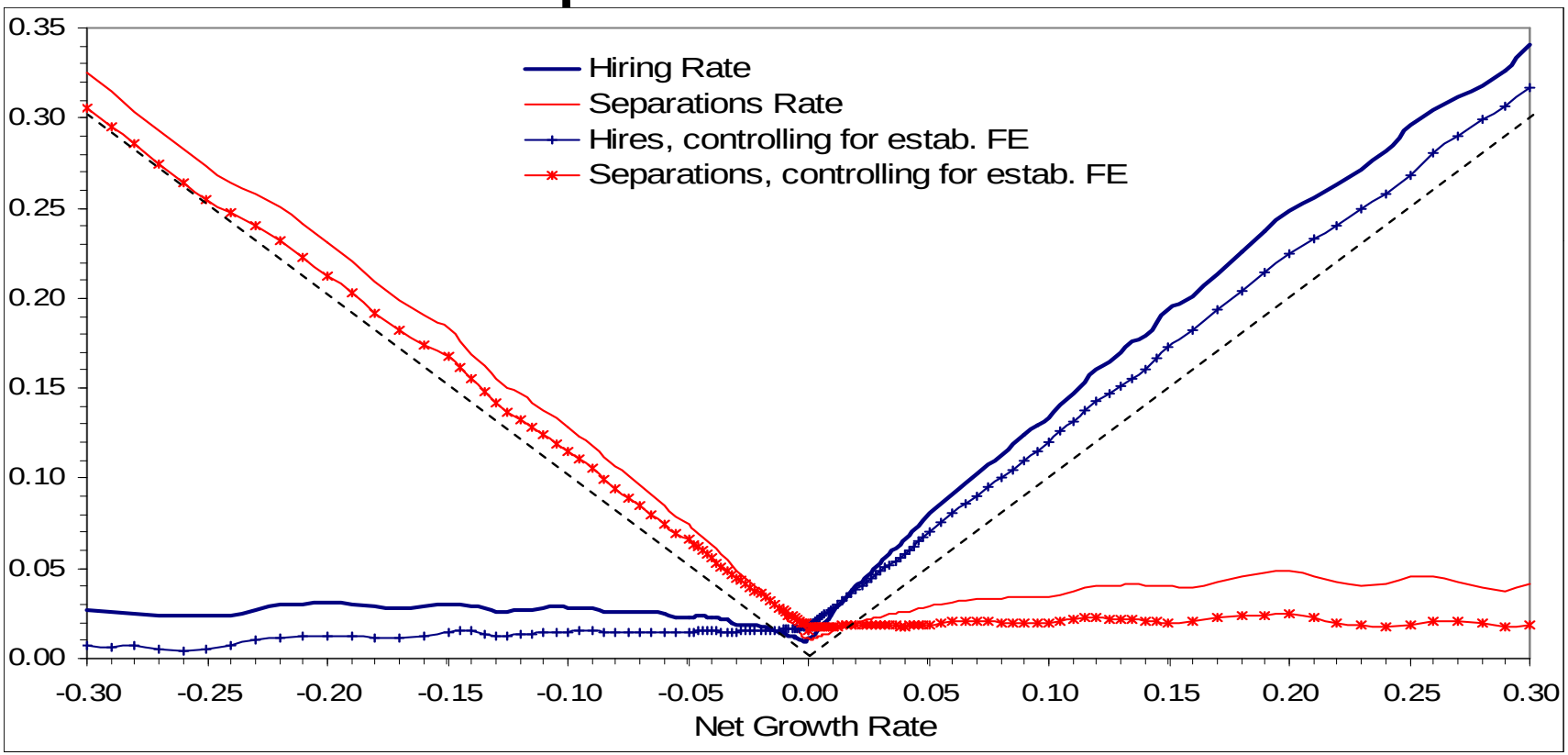
- The same is true for the probability of posting a vacancy; estab effects account for high likelihood of postings among small net changes

Controlling for Establishment FE – Vacancy Yield vs Net Growth



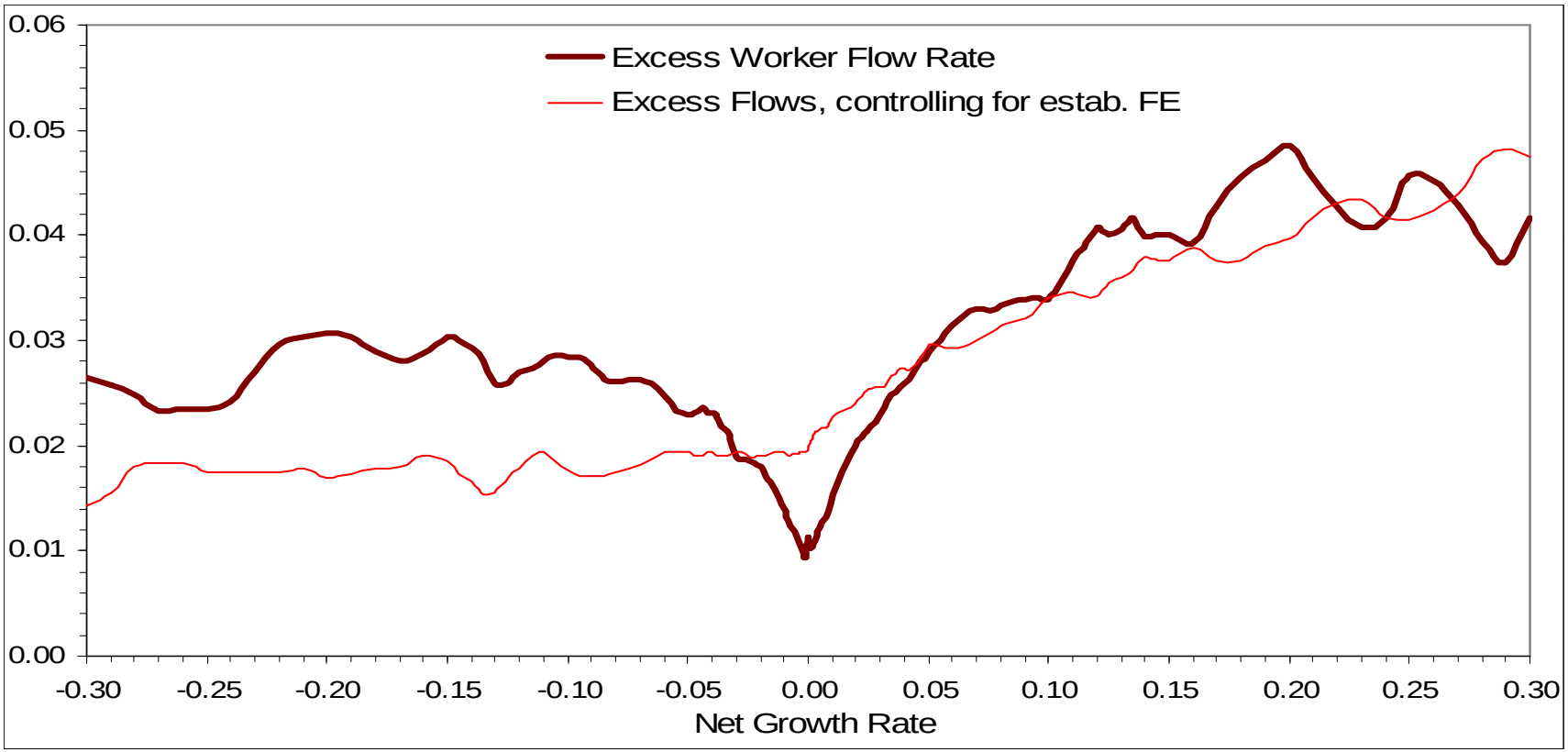
- Estab effects do not, however, account for the nonlinear patters of the vacancy yield, and even exacerbates them among small net changes

Controlling for Establishment FE – Hires and Separations vs Net Growth



- Estab effects have almost no effect on the patterns of hires or separations

Controlling for Establishment FE – Excess Worker Flows vs Net Growth



- …But estab effects remove some of the nonlinearities of excess churning; churning is now flat among contractions and increasing among expansions

Key Points

- Vacancy and worker flow patterns exhibit robust nonlinear relations to establishment growth
- At monthly frequencies, patterns stem from dynamics of a small share of establishments
- Expansions, contractions, and stable estabs have fundamentally different vacancy and worker flow behavior
  - For expanders, churning rates and vacancy yields rise with net growth rate
  - Contractions have generally constant rates of each
  - Stable estabs are exactly that: low-churn, low-search, low-yield, etc.

Implications for Models of Labor Market Search & Matching

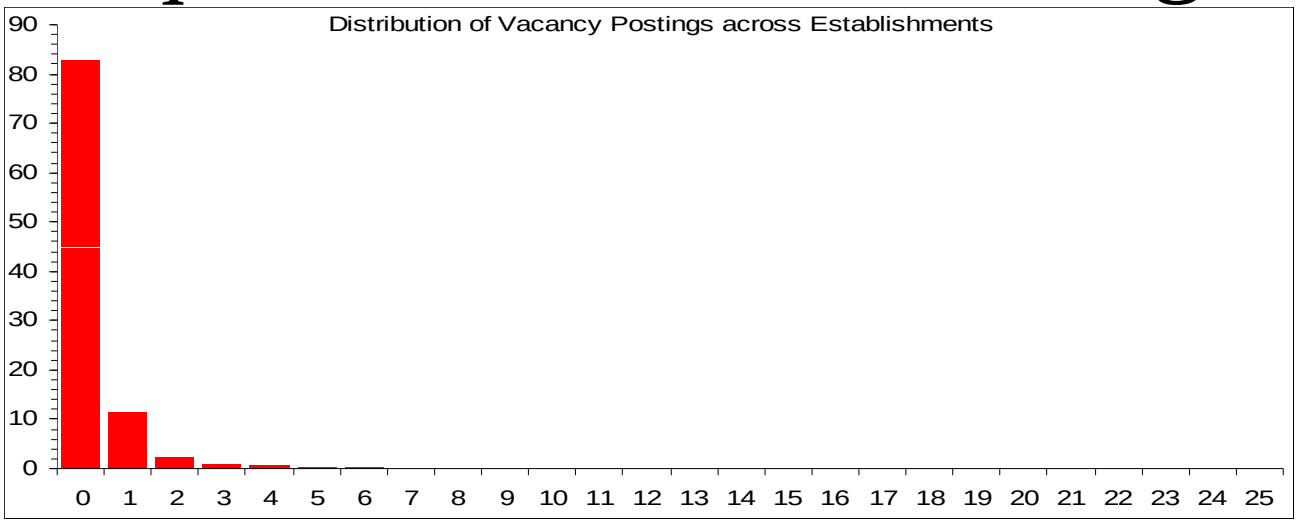
- The standard matching process cannot account for the observed micro-level vacancy and worker flow patterns
  - Excess churning (and thus match efficiency) varies systematically with firm growth
  - The vacancy yield also varies systematically with growth
  - Asymmetries exist in the patterns of vacancies and worker flows between expanding and contracting firms

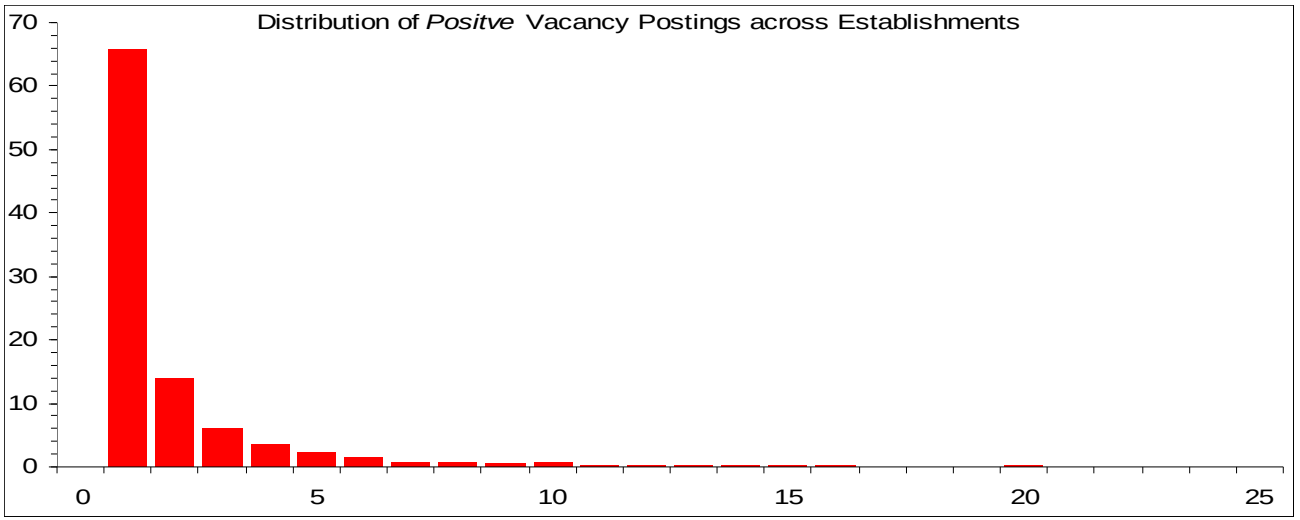
- Evidence suggests factors correlated with firm growth may affect the search process
  - Growth may act as a signal of success, job security to searching workers
  - Long-term successful firms may attract workers via a “reputation effect”
  - Firms more successful/efficient in production may also be more efficient in labor market search

Topics for Further Thought & Research

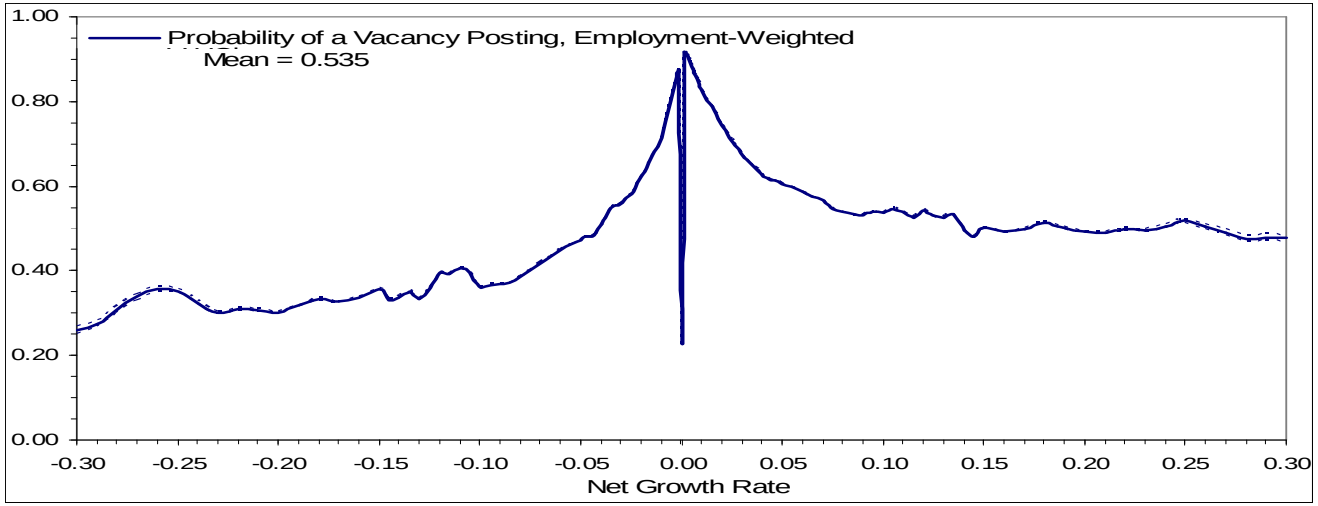
- Estimate local and micro matching functions
  - Can we “rescue” standard matching specification by formally modeling unmeasured vacancies?
- Explore vacancy and worker flow behavior in response to longer-term growth paths
- Robust nonlinear micro relationships + cross-sectional heterogeneity imply new way of thinking about the cyclical behavior of aggregate worker flows
  - See Davis, Faberman, & Haltiwanger (2005), Caballero-Engel (1992)
- Quit/layoff, hire/vacancy patterns raise questions about different types of labor search behavior
  - Expansion hiring vs. Quit replacement hiring

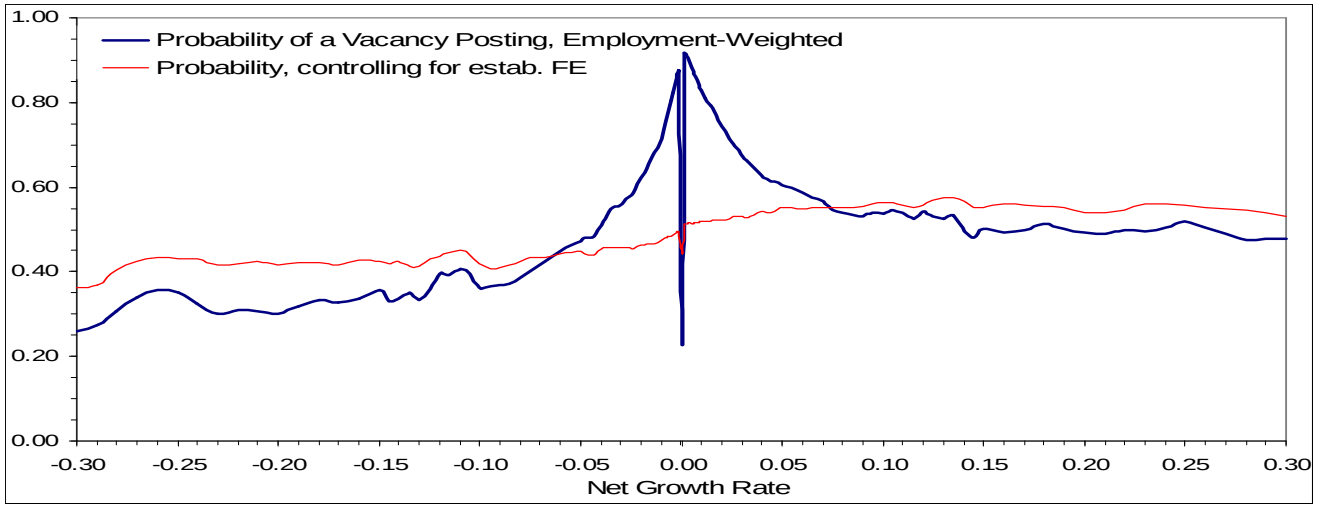
Distributions of Vacancy Postings, Equal Establishment Weights



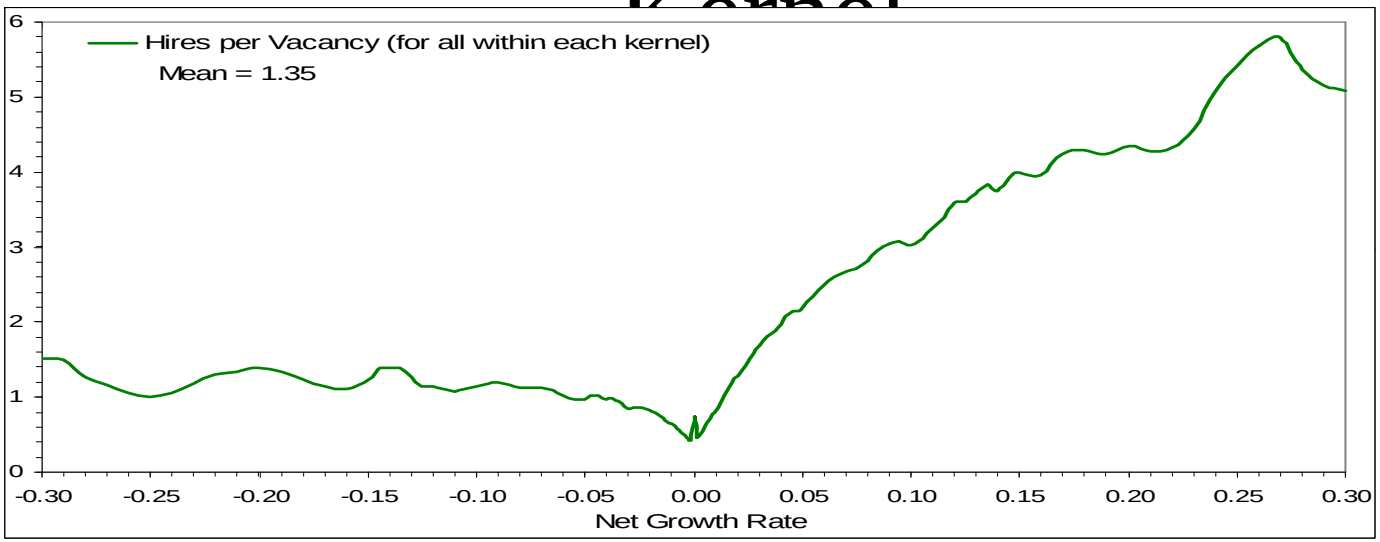


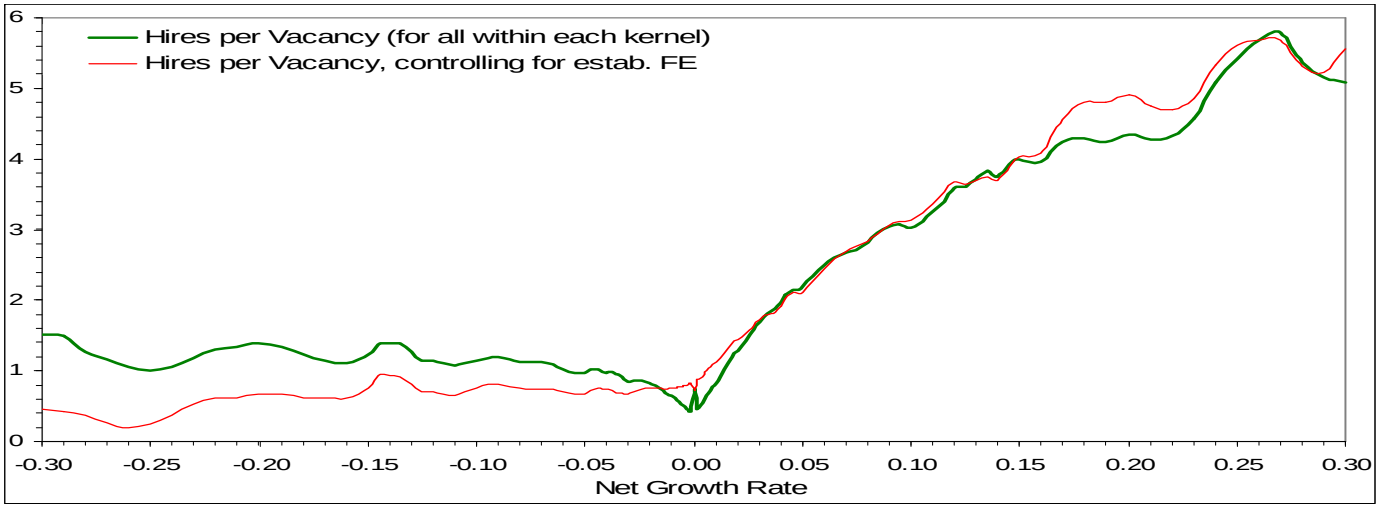
Pr($V(t-1) > 0$) vs Net Growth, Employment-Weighted



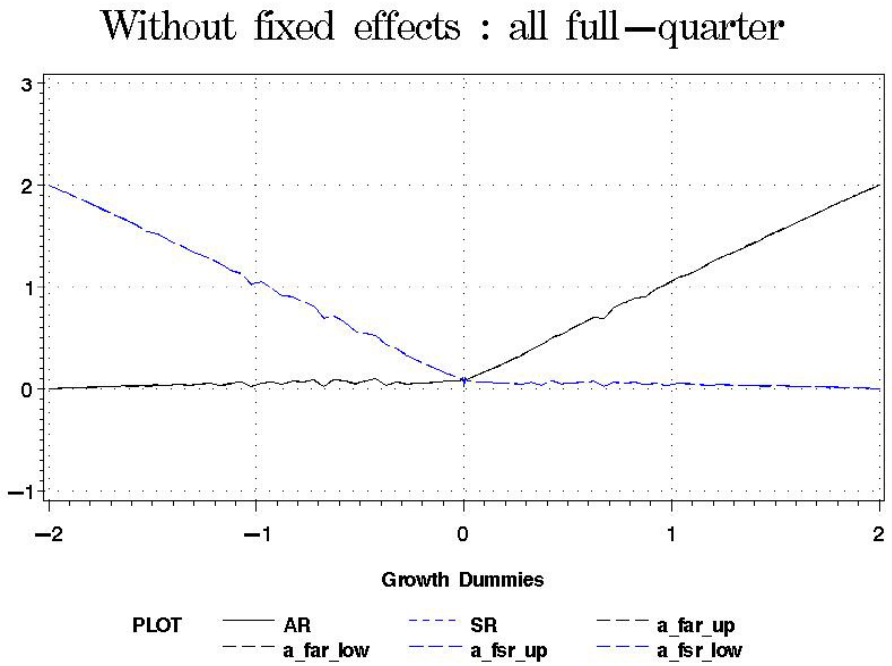


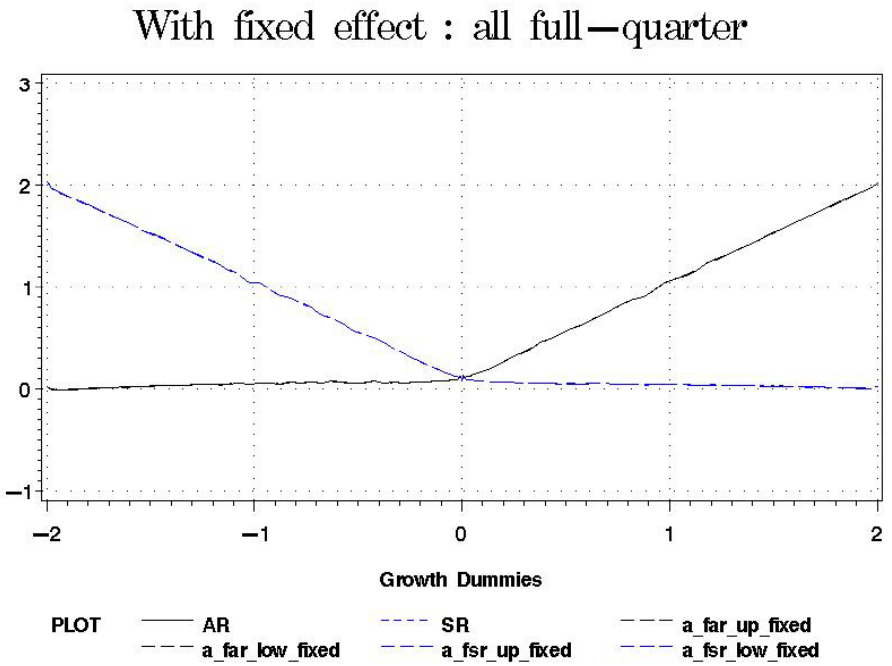
Vacancy Yield vs Net Growth, Including all Hires in a Growth Kernel





Hires and Separations vs Net, Quarterly LEHD Data for 10 States





Differences in Patterns by Establishment Size

Employees	*H*	*S*	*Q*	*L*	*XWF*	*V*	Pr(*V*)	*H*/*V* (*V*>0)	Pr(V) (emp)	*H*/*V*
0 to 9	3.4	3.1	1.7	1.2	1.1	1.5	0.05	0.4	0.08	1.7
10 to 49	4.0	3.9	2.2	1.4	1.9	1.9	0.21	0.8	0.25	1.8
50 to 249	3.9	3.6	2.0	1.4	2.1	2.3	0.50	1.5	0.54	1.5
250 to 999	3.0	2.7	1.5	1.1	1.7	2.5	0.78	2.2	0.80	1.1
1,000 to 4,999	2.0	1.9	1.0	0.6	1.3	2.7	0.90	2.4	0.92	0.7
5000 +	1.5	1.3	0.7	0.5	0.9	2.3	0.93	2.8	0.93	0.6

Differences in Patterns by Industry

Industry	***H***	***S***	***Q***	***L***	***XWF***	***V***	**Pr(*V*)**	***H/V*** **(*V*>0)**	**Pr(V) (emp)**	***H/V***
Resources	3.2	3.3	1.3	1.4	1.5	1.1	0.09	1.1	0.34	2.6
Construction	5.5	5.4	2.1	3.1	2.4	1.4	0.08	1.0	0.25	3.4
Manufacturing	2.3	2.6	1.2	1.2	1.2	1.4	0.16	1.2	0.54	1.5
Transp., Utils., Wholesale,	2.6	2.6	1.3	1.1	1.3	1.6	0.10	0.8	0.46	1.5
Retail Trade	4.4	4.2	2.6	1.3	2.4	1.9	0.12	1.1	0.39	2.0
Information	2.1	2.3	1.3	0.8	1.1	2.0	0.17	0.8	0.62	1.0
FIRE	2.3	2.2	1.3	0.6	1.1	2.1	0.09	0.7	0.50	1.0
Personal Serv.	4.3	3.8	2.0	1.6	2.2	3.0	0.11	1.0	0.57	1.3
Health & Ed.	2.7	2.3	1.5	0.7	1.5	3.3	0.16	0.8	0.68	0.7
Leisure & Hosp.	6.2	5.9	3.9	1.8	3.4	2.9	0.18	1.2	0.45	1.9
Other Services	3.3	3.1	1.9	1.0	1.5	1.9	0.10	0.6	0.29	1.4
Government	1.5	1.2	0.6	0.4	0.7	1.8	0.24	1.0	0.74	0.8

Quits and Layoffs vs Net, Controlling for Establishment FE