Grown-up Business Cycles

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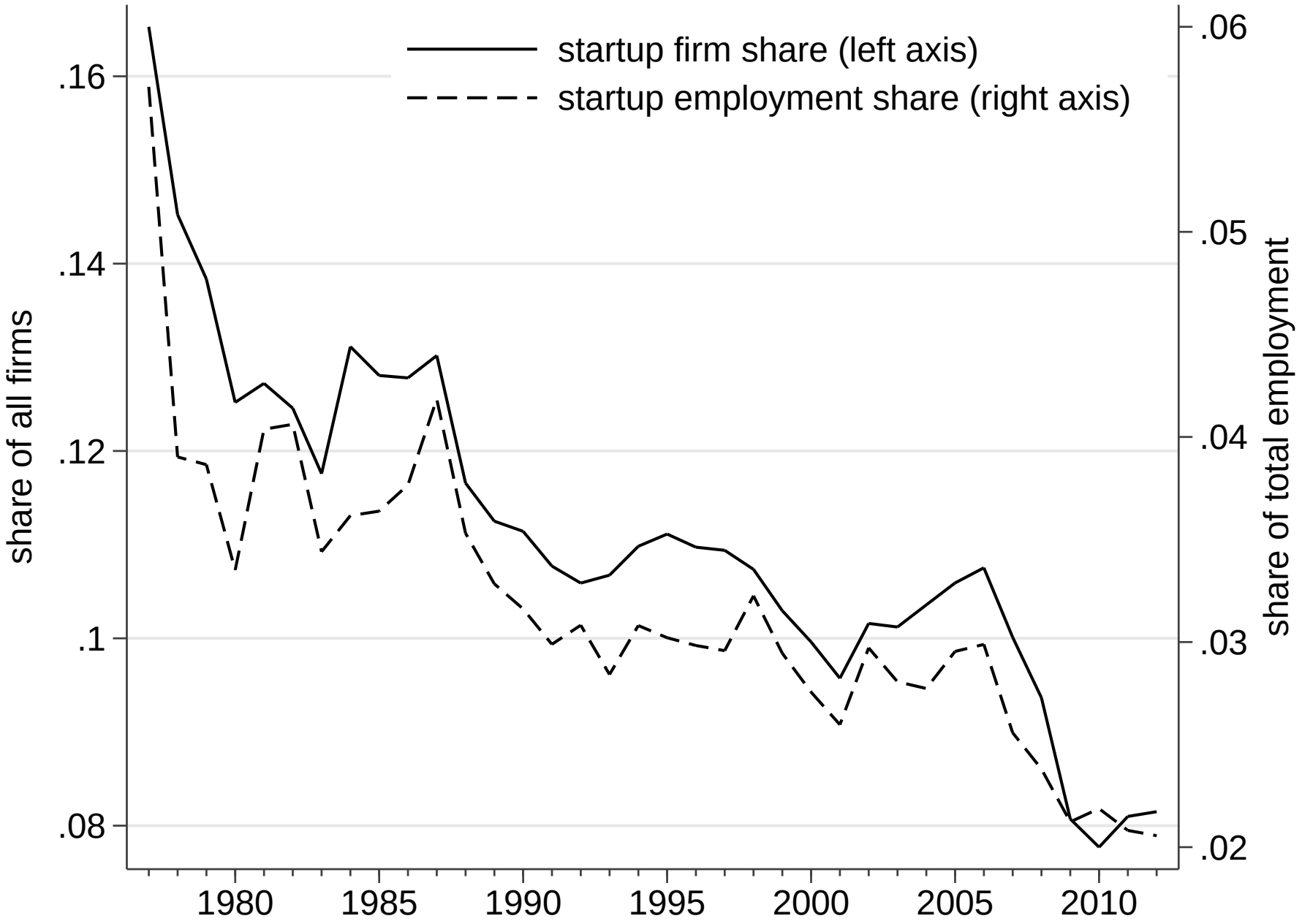
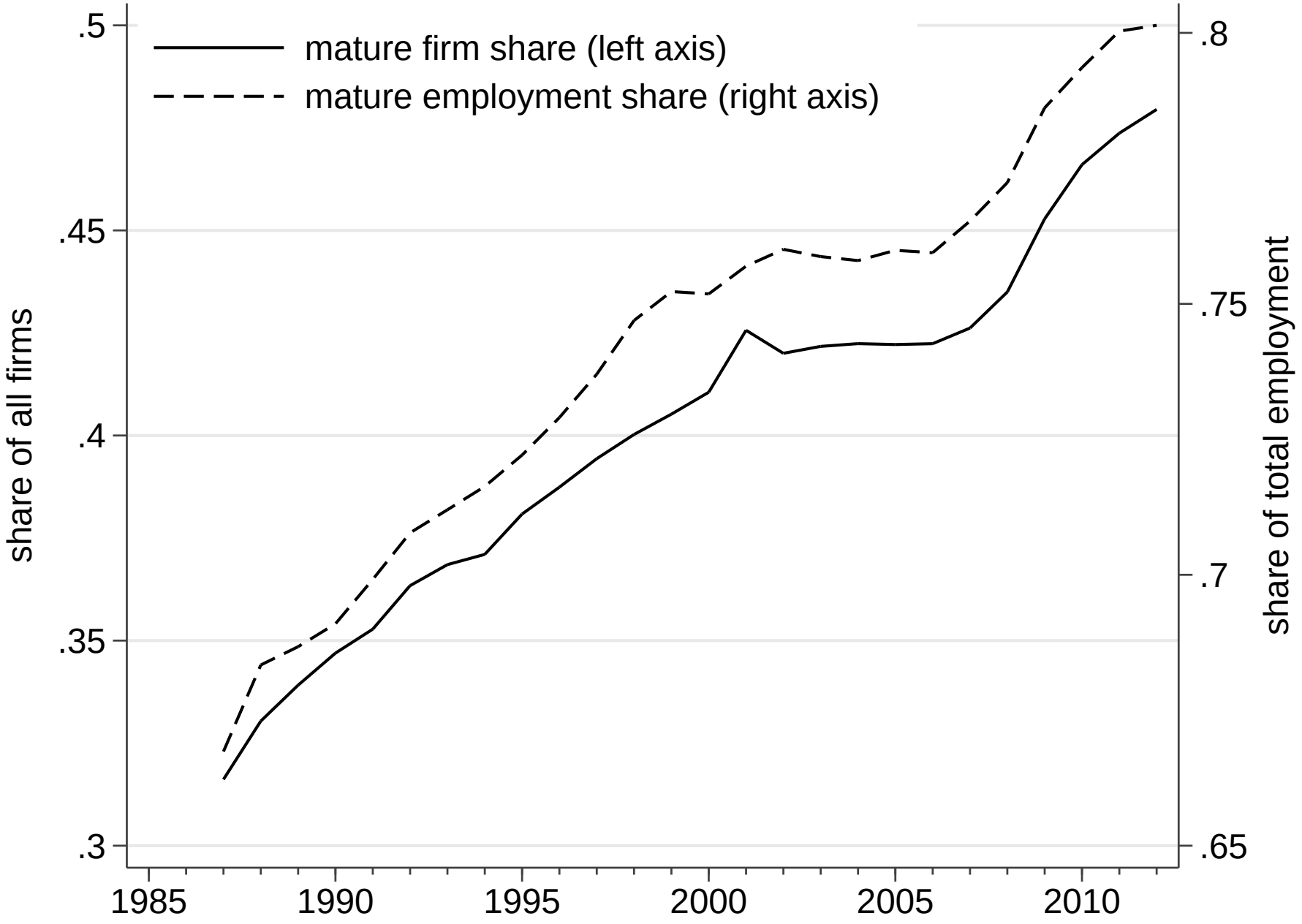
[1]Any opinions and conclusions expressed herein are those of the author(s) and do not necessarily represent the views of the U.S. Census Bureau, Federal Reserve Bank of New York or the Federal Reserve System. All results have been reviewed to ensure that no confidential information is disclosed.

Two changes in U.S. firm demographics: decline in entry



Two changes in U.S. firm demographics: gradual aging



Our paper

Examines the effect of changes in firm demographics on employment dynamics.

- Document the *heterogeneity* and the *stability* of exit and growth margins by firm age
  - Long-run behavior
  - Business cycle behavior
- Conditional on entry, little change in trend or cyclical components of firm dynamics by firm age since 1980s
  - *Decline* in firm entry is the main driver of aging $\longrightarrow$ *startup deficit*
- *Startup deficit* continues to reshape aggregate employment dynamics
  - Decoupling of employment and output growth during recoveries but not during recessions
  - When adjusted for the effects of startup deficit recovery dynamics look less *jobless*

Related literature

- Secular decline in young firms and dynamism
  Reedy and Litan (2011); Hyatt and Spletzer (2013); Decker, Haltiwanger, Jarmin and Miranda (2014); Foster, Grim, and Haltiwanger (2014); Hathaway and Litan (2014); Davis and Haltiwanger (2014);
- Differential impact of business cycles on firm types
  Gertler and Gilchrist (1994); Chari, Christiano, and Kehoe (2013); Moscarini and Postel-Vinay (2012); Fort, Haltiwanger, Jarmin and Miranda (2013)
- Age distribution of workers and business cycle volatility
  Gomme et. al. (2005); Jaimovic and Siu (2009); Lugauer (2012)
- Changing employment dynamics and jobless recoveries
  Groshen and Potter (2003); Koenders and Rogerson (2005); Bachmann (2011); Shimer(2012); Jaimovic and Siu (2012); Berger (2012)

Why not size? 1987 2007 1987-2007

Measurement

Measuring firm startup and survival

- US Census Bureau Business Dynamics Statistics (BDS) 1977 to 2012
  - Nearly universal coverage of nonfarm private sector
  - Longitudinally linked at the firm level to compute: entry, exit and employment growth
- Firm age
  - Initial firm age is the age of the firm's oldest establishment
  - Left-censored in 1977: identifying 11+ limits us to 1987-2012
- New firms or "startups" have only age 0 establishments
  - Robust to changes in ownership, periods of inactivity

Framework

Decomposing shifts in the age distribution

Abstracting from within-age group heterogeneity and only consider:

- New firms or "startups" s (age 0)
- Young y (ages 1-10)
- Mature m (ages 11+)

For each age group a

- F_t^a is the number of group a firms
- N_t^a is the average (employment) size of group a firms

Age group employment is $E_t^a = F_t^a N_t^a$

Distinguish startup employment $S_t = F_t^s N_t^s$

Aggregate employment is

$$E_t = S_t + E_t^y + E_t^m$$

Decomposing shifts in the age distribution

Define a growth rate for startup employment, *startup growth*, as

$$g_t^s \equiv \frac{S_t - S_{t-1}}{S_{t-1}}$$

For incumbents, define the *unconditional growth rate* for the current age group cohort a as

$$g_t^a \equiv \frac{E_t^a - E_{t-1}^{a-1}}{E_{t-1}^{a-1}}$$

- x_t^a is the *survival rate* from $t-1$ for the current (year t) age group a cohort

$$x_t^a \equiv \frac{F_t^a}{F_{t-1}^{a-1}}$$

- n_t^a is the *conditional growth rate* of average firm size from $t-1$ to t for the current age group a cohort

$$1 + n_t^a \equiv \frac{N_t^a}{N_{t-1}^{a-1}}$$

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$$\boxed{g_t^a \equiv \frac{E_t^a - E_{t-1}^{a-1}}{E_{t-1}^{a-1}} = x_t^a (1 + n_t^a) - 1}$$

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Decomposing shifts in the age distribution

Law of motion for firms and employment

$$
\begin{aligned}
E_t^s &= S_t \\
E_t^y &= \left(q_{t-1} E_{t-1}^y + S_{t-1}\right) x_t^y \left(1 + n_t^y\right) \\
E_t^m &= \left(E_{t-1}^m + \left(1 - q_{t-1}\right) E_{t-1}^y\right) x_t^m \left(1 + n_t^m\right)
\end{aligned}
$$

q_{t-1} is share of young employment from previous year $t-1$ that will remain young in year t; with transition matrix P_t, then employment distribution $\vec{E}_t$

$$
\vec{E}_t = P_t \vec{E}_{t-1} + (1,0,0)' S_t
$$

Consider behavior of:

1. Entrant dynamics S_t
2. Incumbent lifecycle dynamics P_t:
   - Survival rate, x_t
   - Conditional growth rate, n_t

Employment shares

Decomposing shifts in the age distribution

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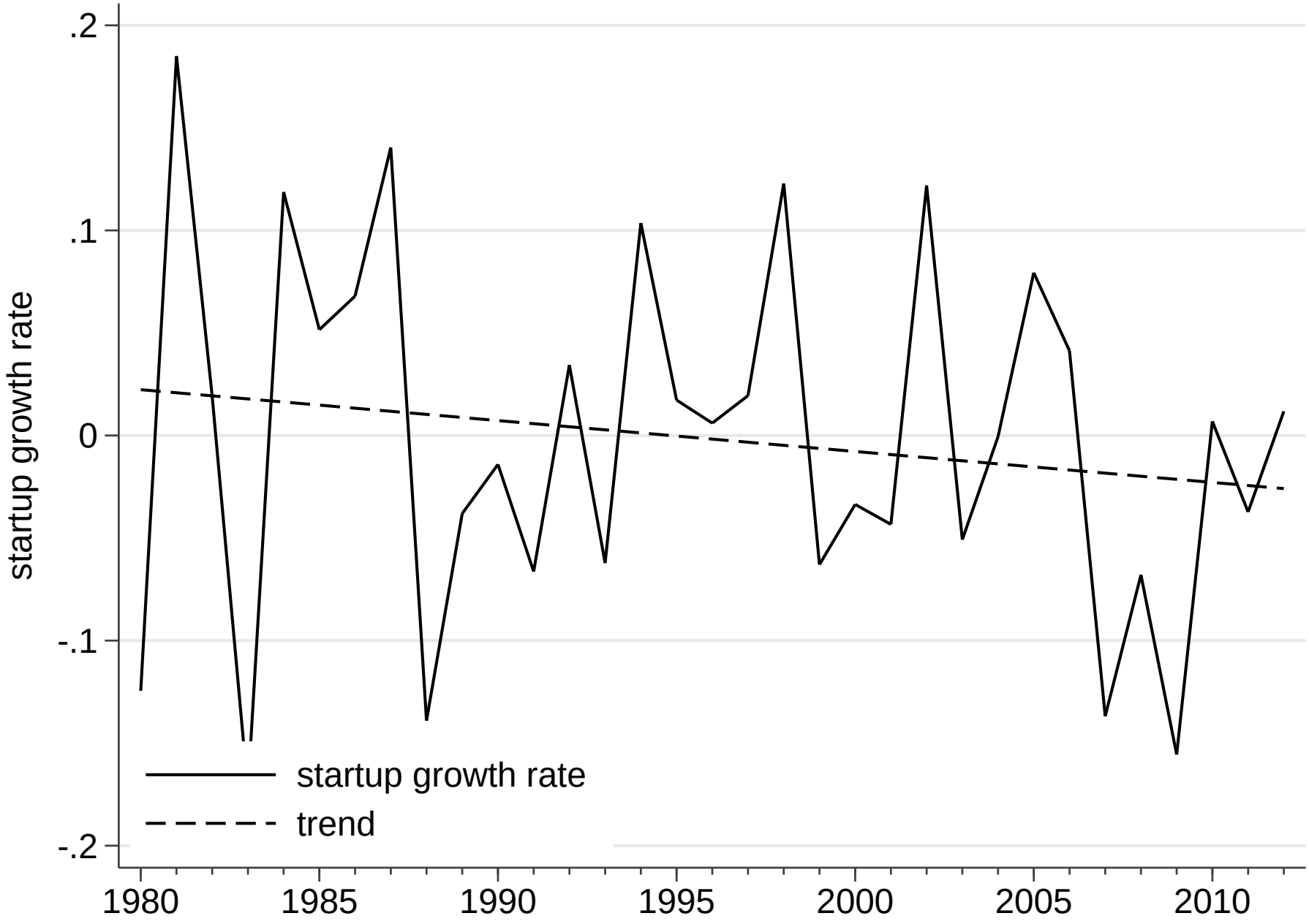
Employment shares

Startup employment growth rate, g_t^s



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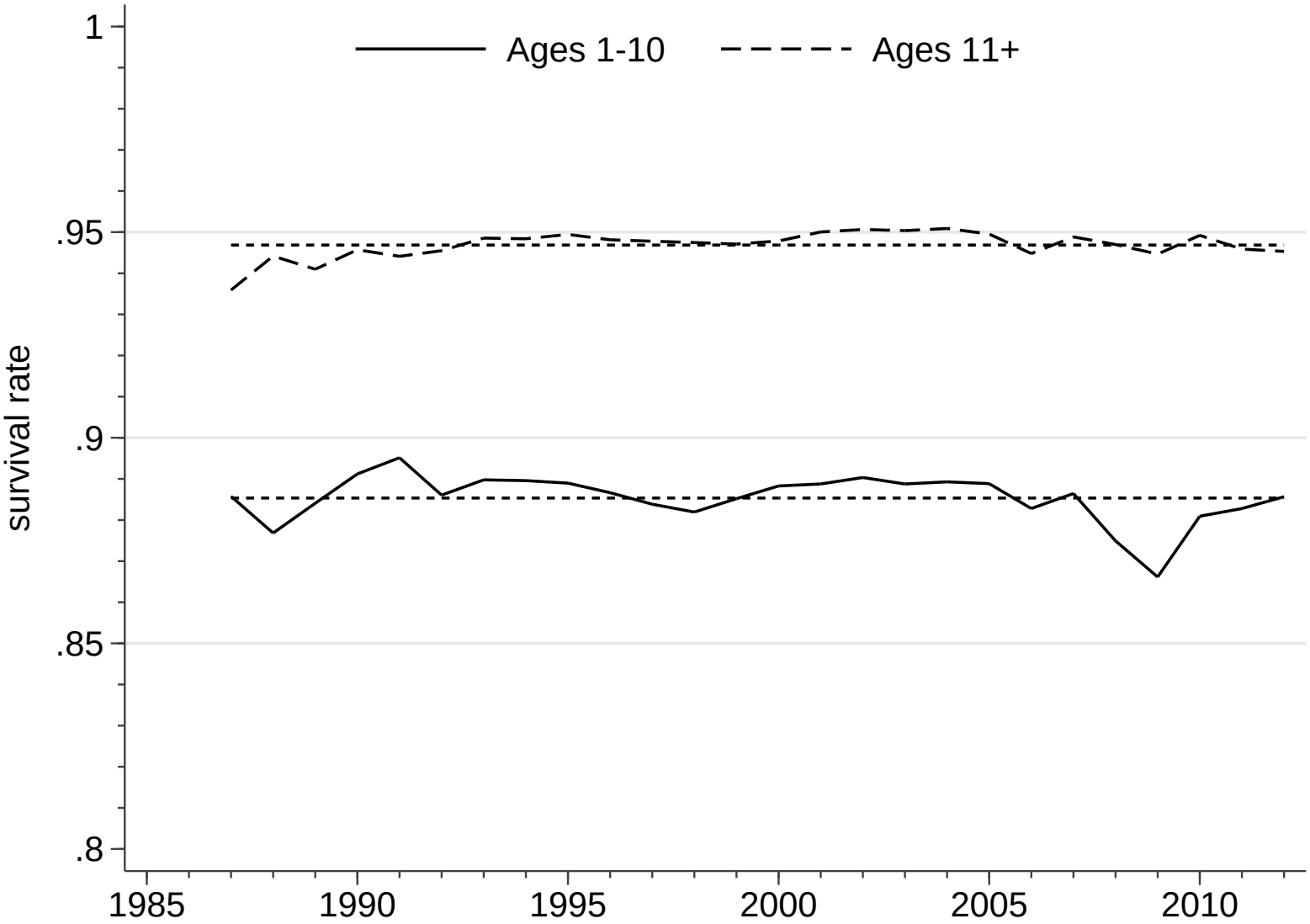
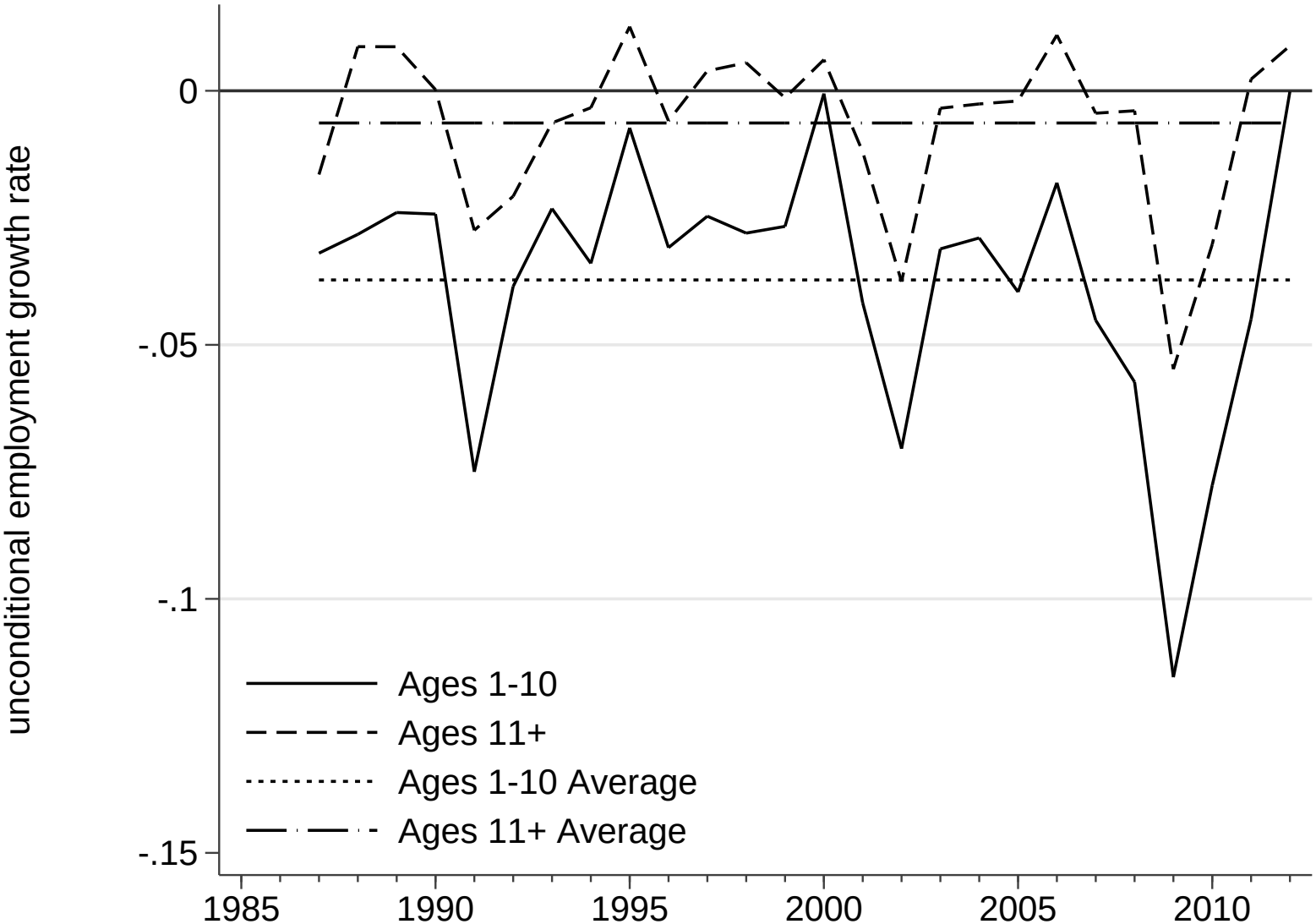
Employment shares

Survival probabilities by age group x_t



Conditional growth rate by age group n_t

Unconditional age group growth rates, $g_t^a = x_t^a(1+n_t^a)-1$



Aging is the cumulative effect of the startup deficit

Evidence suggests that P_t fluctuates around a stable long run average $\bar{P}$

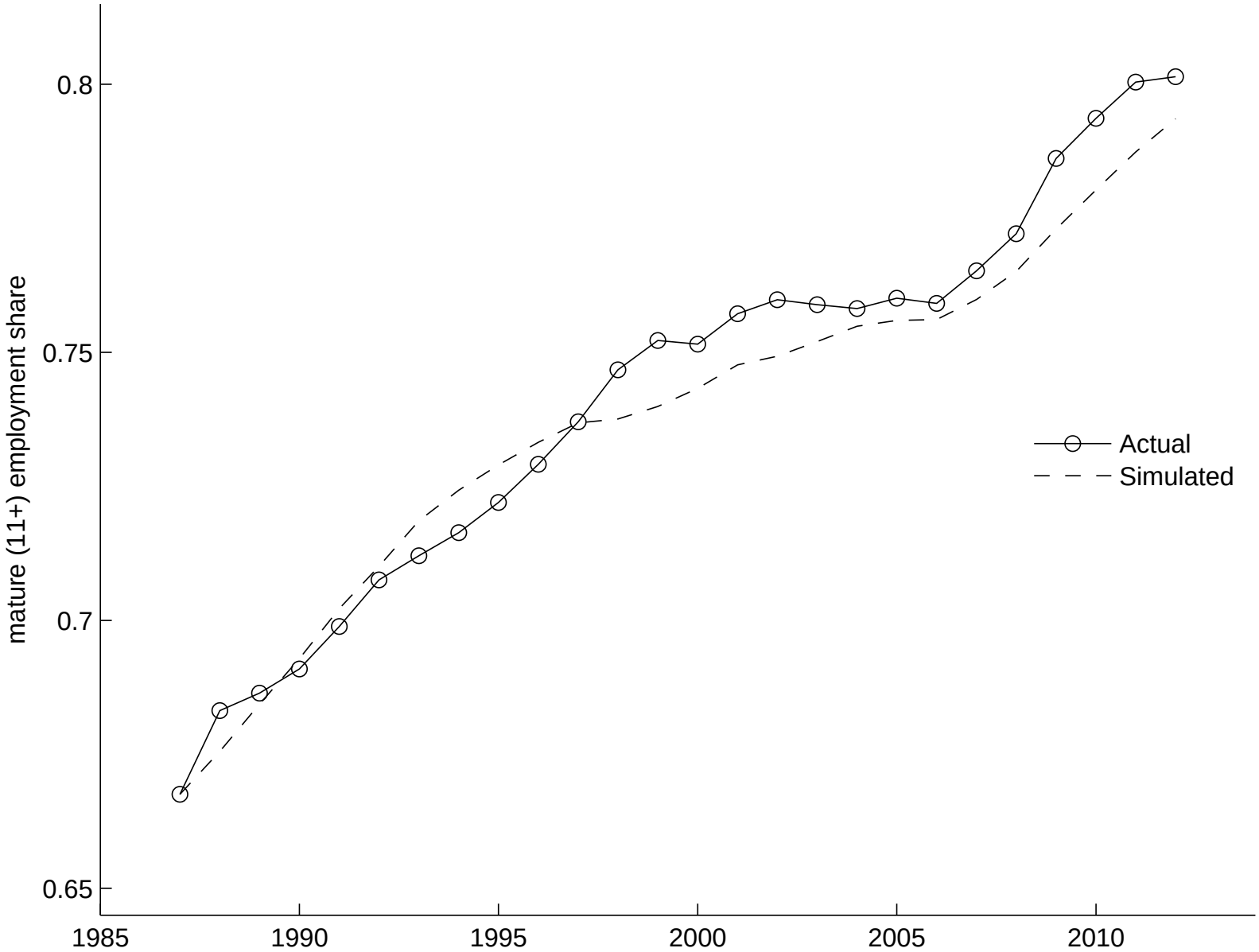
We drop the t and consider the predicted age distribution with all fluctuations removed replacing

$$P_t = \bar{P}$$

and using S_t:

$$\vec{E}_t = \bar{P}\vec{E}_{t-1} + S_t \implies \vec{E}_t = \sum_{k=0}^{\infty} \bar{P}^k (1,0,0)' S_{t-k}$$

Predicted mature share



Long run stability of incumbent margins of adjustment

1. Significant heterogeneity in dynamics by firm age
2. Conditional on age, (average) margins of firm dynamics appear stationary
   - Despite a significant shift in the age distribution, lifecycle dynamics of firms have changed little over this period
3. Corollary: trend decline in startup rate, the *startup deficit*, drives the reallocation of employment towards older firms

Within sectors | Within states | State x 4-digit NAICS table | State x 4-digit NAICS density

Business Cycle Fluctuations

Incorporating business cycle fluctuations in P_t and S_t

Introduce business cycle variation with mean zero business cycle shock Z_t

Estimate age group *business cycle sensitivity* β^a by projecting the growth rate g_t^a on a constant and a business cycle shock proxy Z_t

$$g_t^a = \bar{g}^a + \beta^a Z_t + \varepsilon_t$$

Young firms are *more cyclically sensitive* than mature firms when

$$|\beta^y| > |\beta^m|$$

Since g_t^s may have a time-varying trend component, project g_t^s on Z_t while allowing its mean to drift

$$g_t^s = \mu_t^s + \beta^s Z_t + \varepsilon_t^s$$

Startup deficit is long run shortage of startup growth captured by $\{\mu_t^s\}$

Even if μ_t is constant, if it doesn't keep pace with employment growth, the startup employment share, S_t/E_t, will decline

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Estimating β by age group

We use two sources of variation in business cycle shocks

Aggregate time-series variation

$$g_t^a = \bar{g}^a + \beta^a Z_t + \varepsilon_t^a$$

Within-year t cross-state s variation

$$g_{st}^a = \bar{g}^a + \psi_s^a + \lambda_t^a + \beta^a Z_{st} + \varepsilon_{st}^a$$

Coefficient β compares the expected change in the state-level age group growth rate for states with Z_{st} better than the national average versus states with Z_{st} worse than the national average

Measuring Z_t

Estimated cyclical sensitivity of g_t^a and g_t^s

	Incumbents		
	Young	Mature	Startups
	A. National		
$\hat{\beta}$	0.984^{***}	0.546^{**}	0.41
	(0.340)	(0.220)	(1.54)
p-value of $\beta^y = \beta^m$	0.014		
	B. State		
$\hat{\beta}$	0.717^{***}	0.438^{***}	1.71^{***}
	(0.0716)	(0.0388)	(0.57)
p-value of $\beta^y = \beta^m$	0.000		
Years	1987-2012	1987-2012	1980-2007
Year FE	Yes	Yes	Yes
Detrending	-	-	Linear

Startup Alternate Detrend | Incumbent Alternate Measures | Stability

Cyclical sensitivity by age group

1. Young firms are more cyclical than mature firms
2. Startup employment contribution is strongly procyclical
3. Robust to alternative proxies for business cycle shocks, choice of age groups and time periods and use of within industry variation
4. Despite a significant shift in employment shares, no apparent trends in cyclicality measures β_t^a

Grown-Up Employment Dynamics

Isolating the effect of the startup deficit

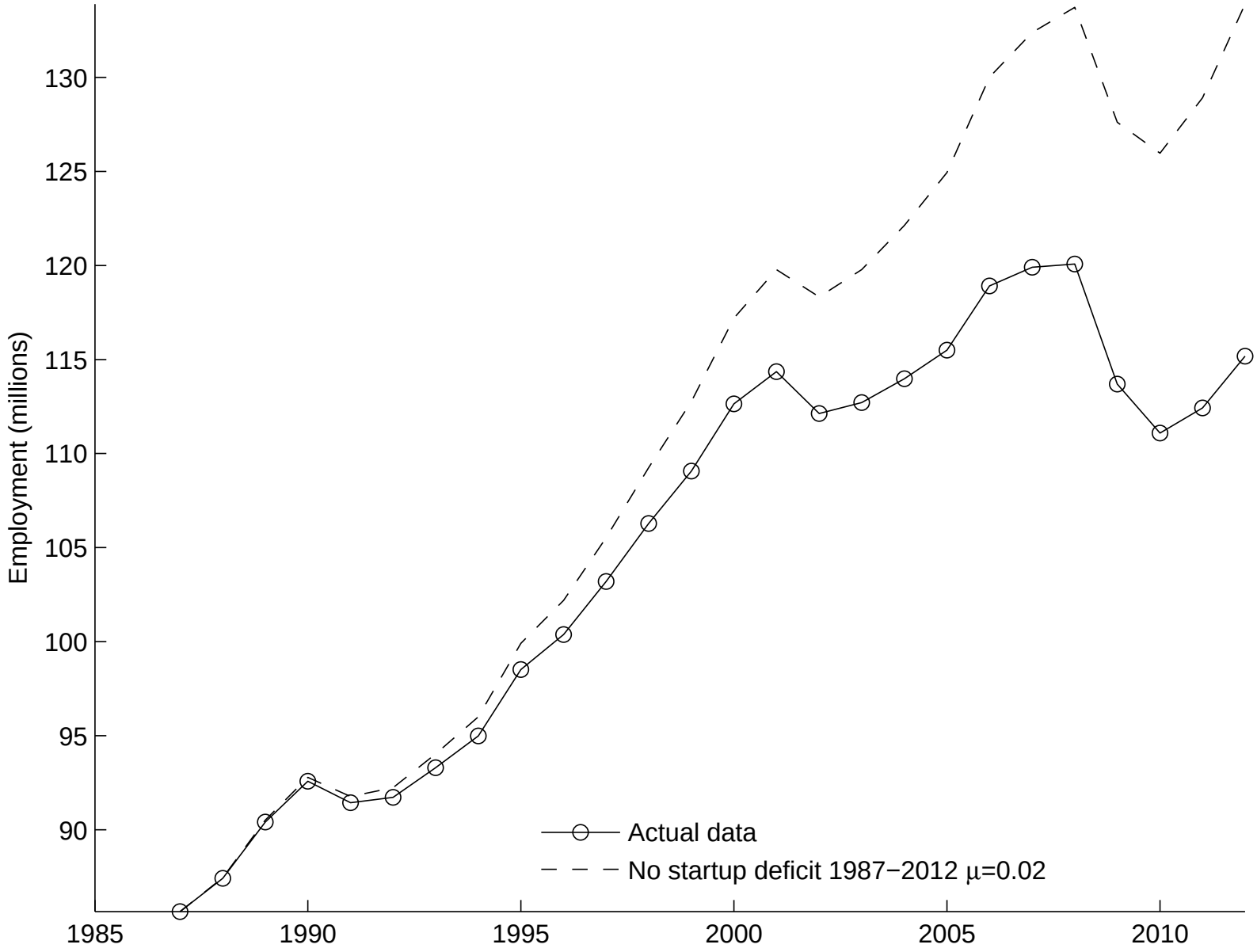
Use the decomposition framework to isolate the effects of the startup deficit on trend and cyclical employment behavior

$$\vec{E}_t = P_t \vec{E}_{t-1} + (1,0,0)' S_t$$

Apply the same shocks with and without a startup deficit

- Solve forward with actual P_t and S_t
- Solve forward with actual P_t but S_t^c where $\mu_t^s = \bar{\mu}_{1980s}^s = 0.02$

Startup deficit weakens trend employment growth



... and it reshapes business cycle employment dynamics

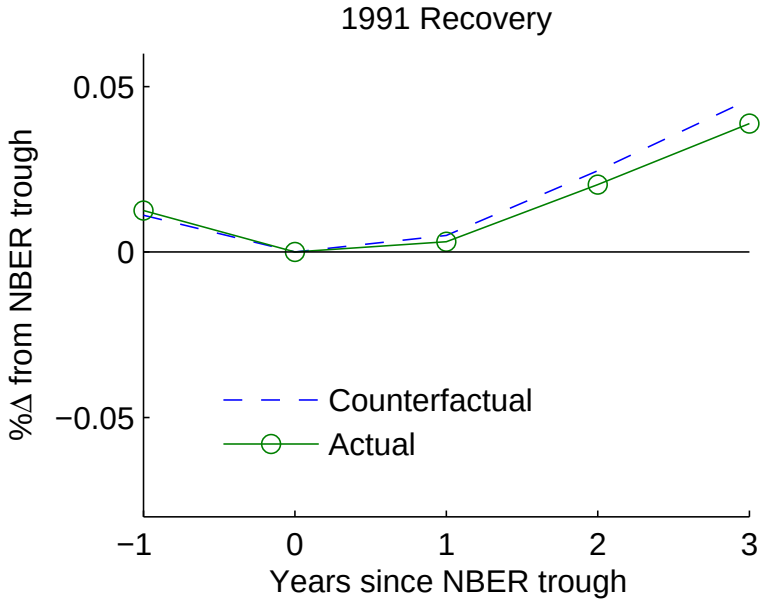
Compare recession and recovery employment dynamics with and without a startup deficit

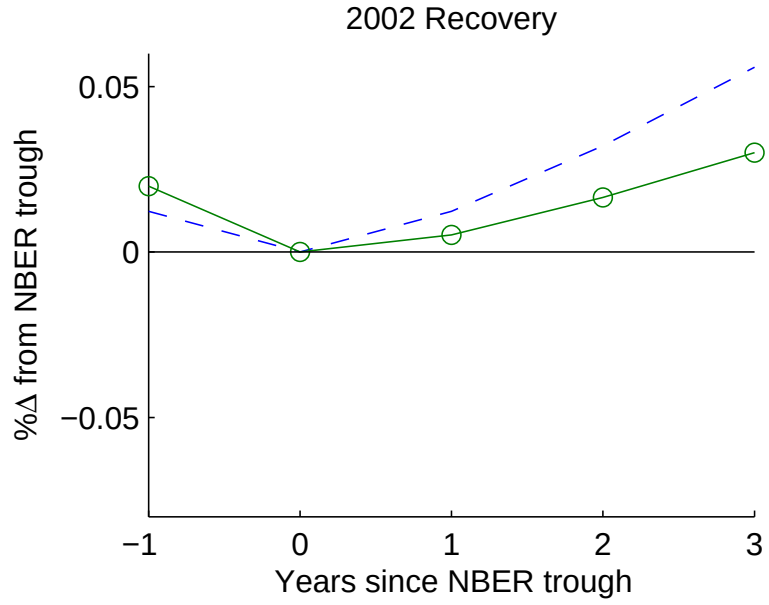
- Normalize employment to NBER troughs
- Measure employment response during contraction and recovery for each business cycle

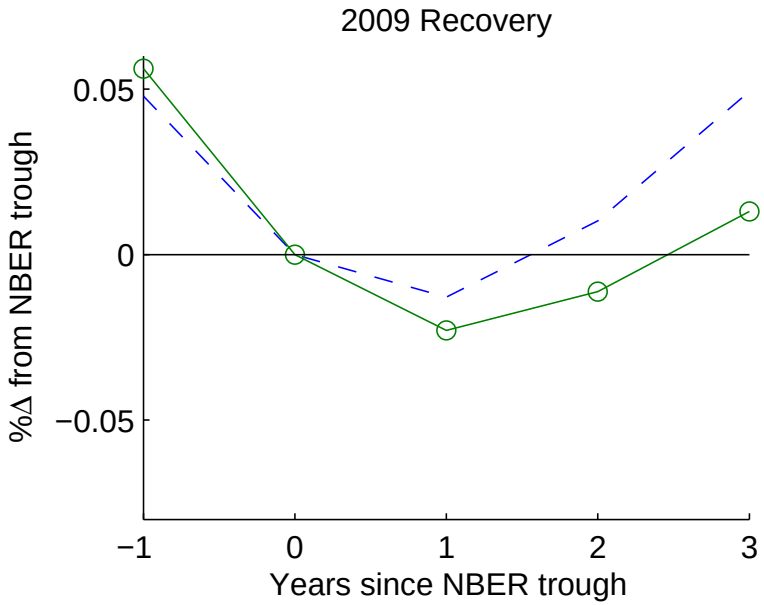
Startup deficit exaggerates the contraction and slows the employment recovery

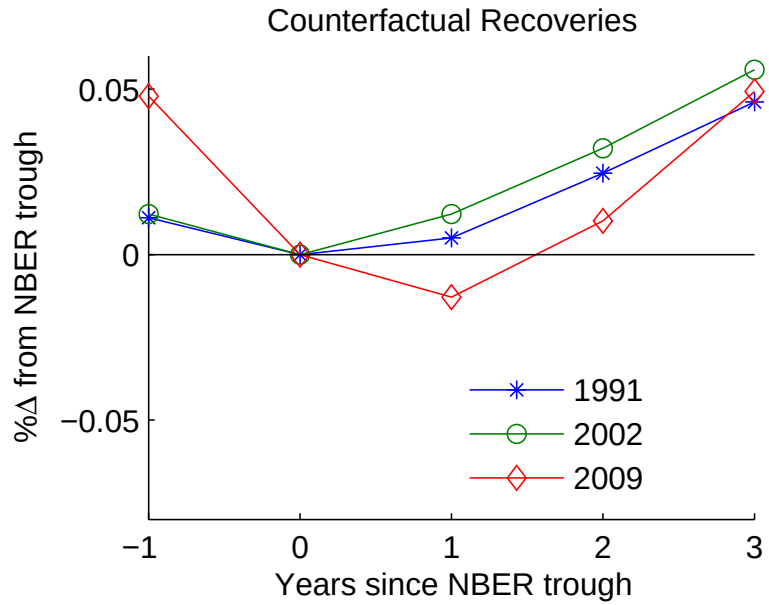
Startup deficit adjusted recoveries are similar

Business cycle dynamics



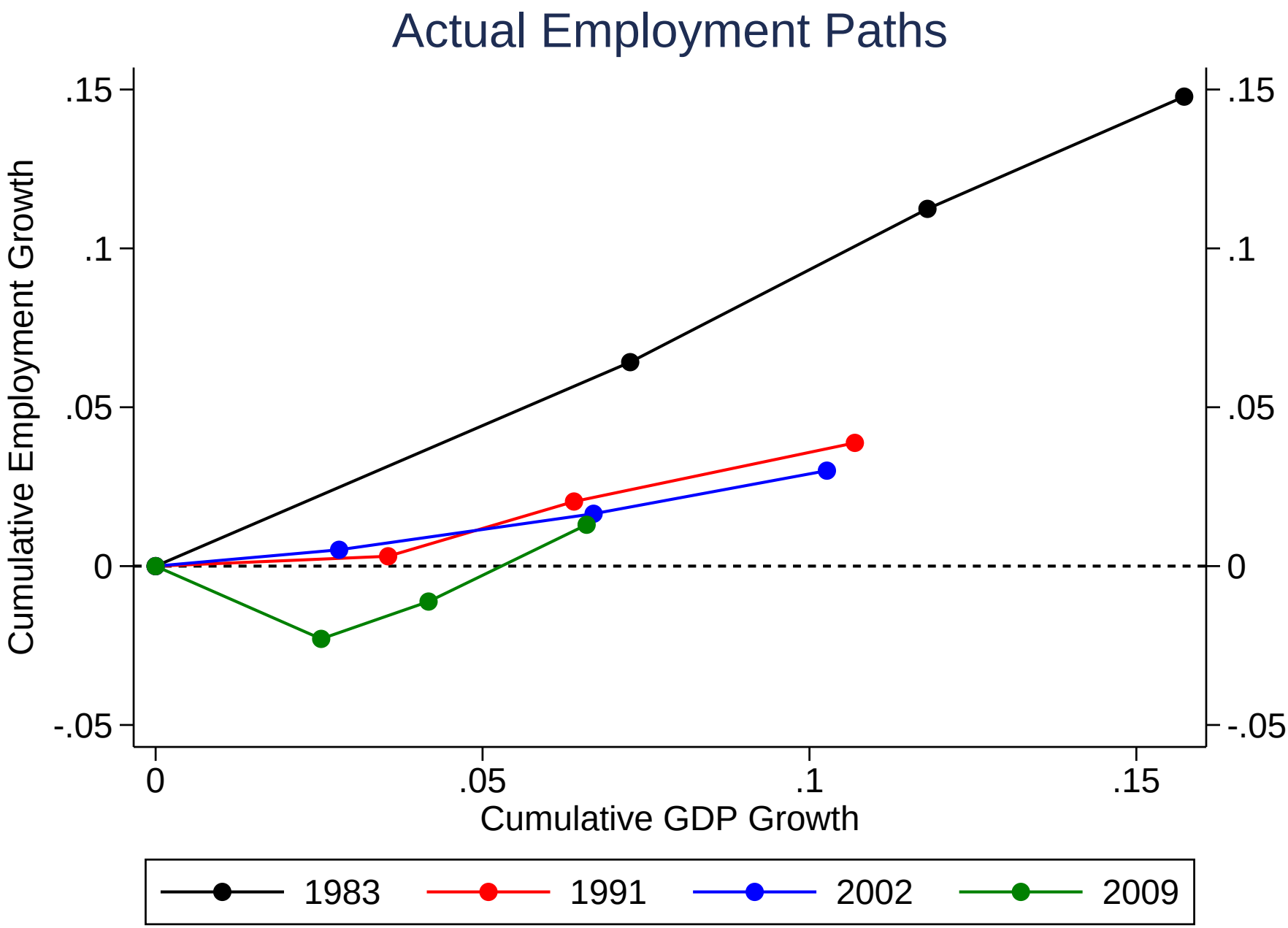






Differences Variance Decomposition

Joblessness of recoveries



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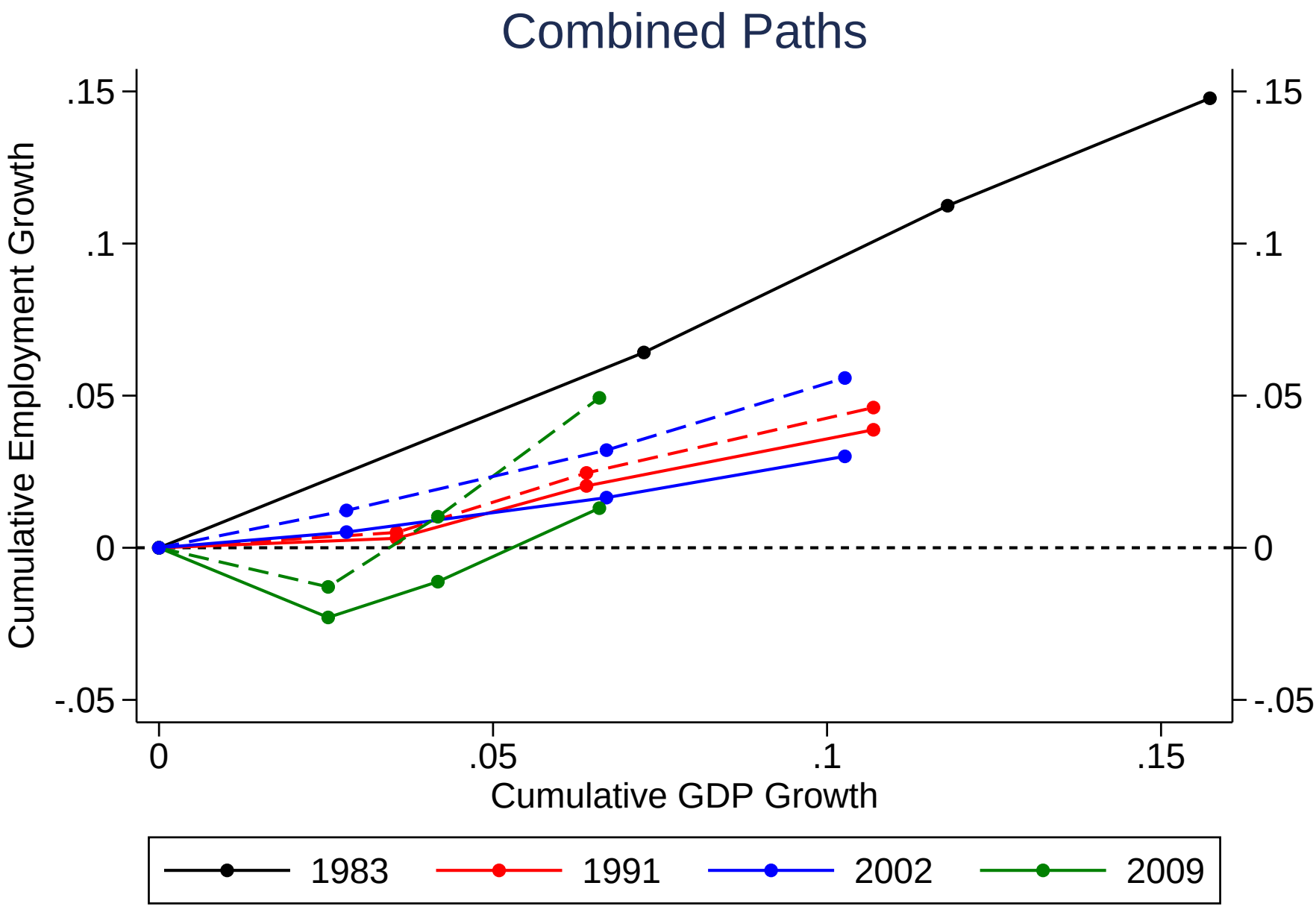


Dashed line represents counterfactual employment outcome.

Decomposing aggregate employment growth

Aggregate employment is

$$E_t = S_t + E_t^y + E_t^m$$

Aggregate growth rate of E_t is the sum of growth contributions from startups, young, and mature firms

$$g_t = \underbrace{s_{t-1}(1+g_t^s)}_{\text{Startup contribution}} + \underbrace{(1-\omega_{t-1})\,g_t^y + \omega_{t-1} g_t^m}_{\text{Incumbent contribution}}.$$

Startup employment share

$$s_{t-1} \equiv S_{t-1}/E_{t-1}$$

Incumbent mature share

$$\omega_{t-1} \equiv \frac{E_{t-1}^m + (1-q_{t-1})\,E_{t-1}^y}{E_{t-1}}$$

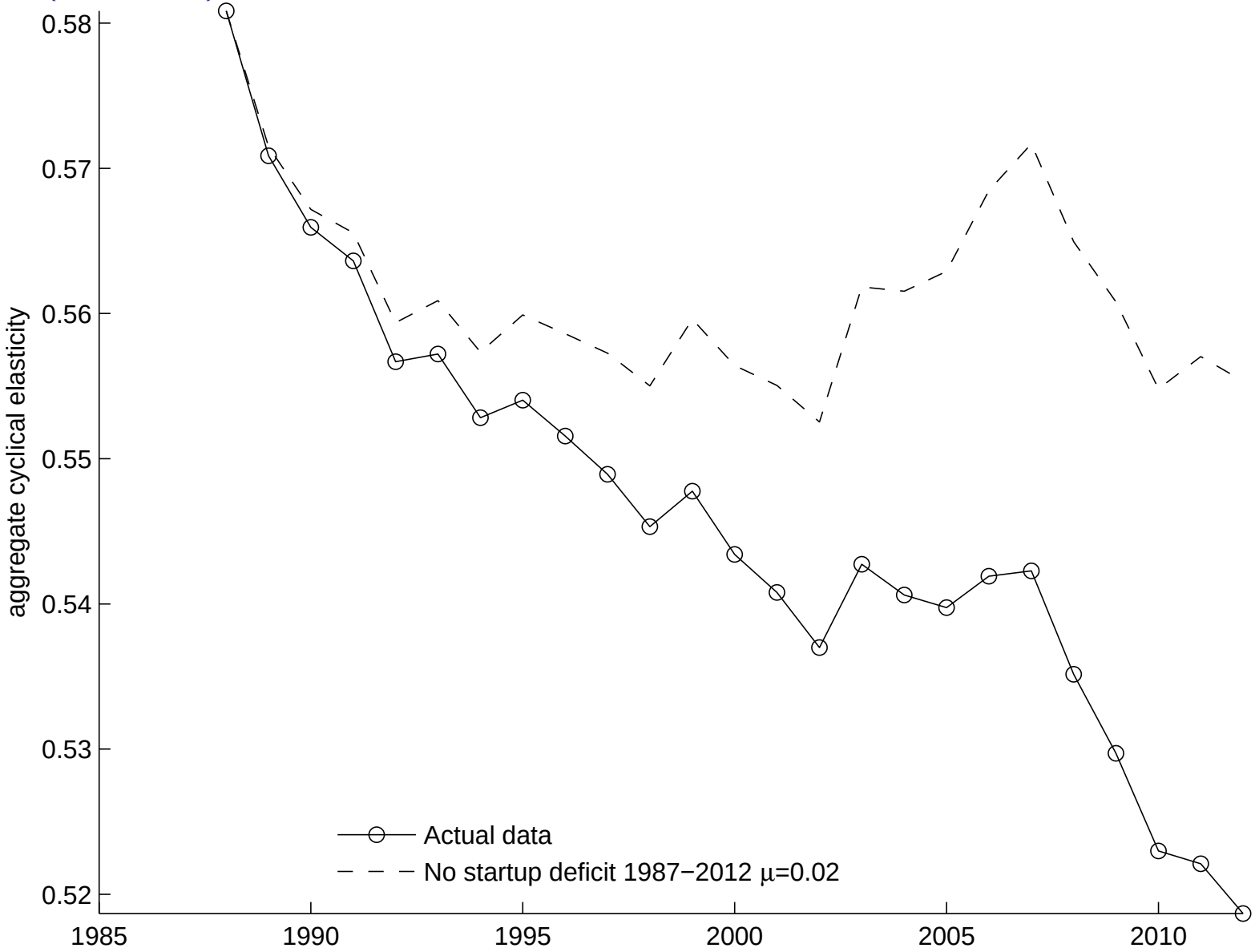
Employment over time

Aggregate employment grows at rate:

$$
\begin{aligned}
g_t \quad = \quad & \underbrace{\left(s_{t-1}\beta^s + (1-\omega_{t-1})\,\beta^y + \omega_{t-1}\beta^m\right) Z_t}_{\text{Cyclical component}} \\
& + \underbrace{s_{t-1}(1+\mu_t^s) + (1-\omega_{t-1})\,\bar{g}^y + \omega_{t-1}\bar{g}^m}_{\text{Trend component}} \\
& + s_{t-1}\varepsilon_t^s + (1-\omega_{t-1})\,\varepsilon_t^y + \omega_{t-1}\varepsilon_t^m \ .
\end{aligned}
$$

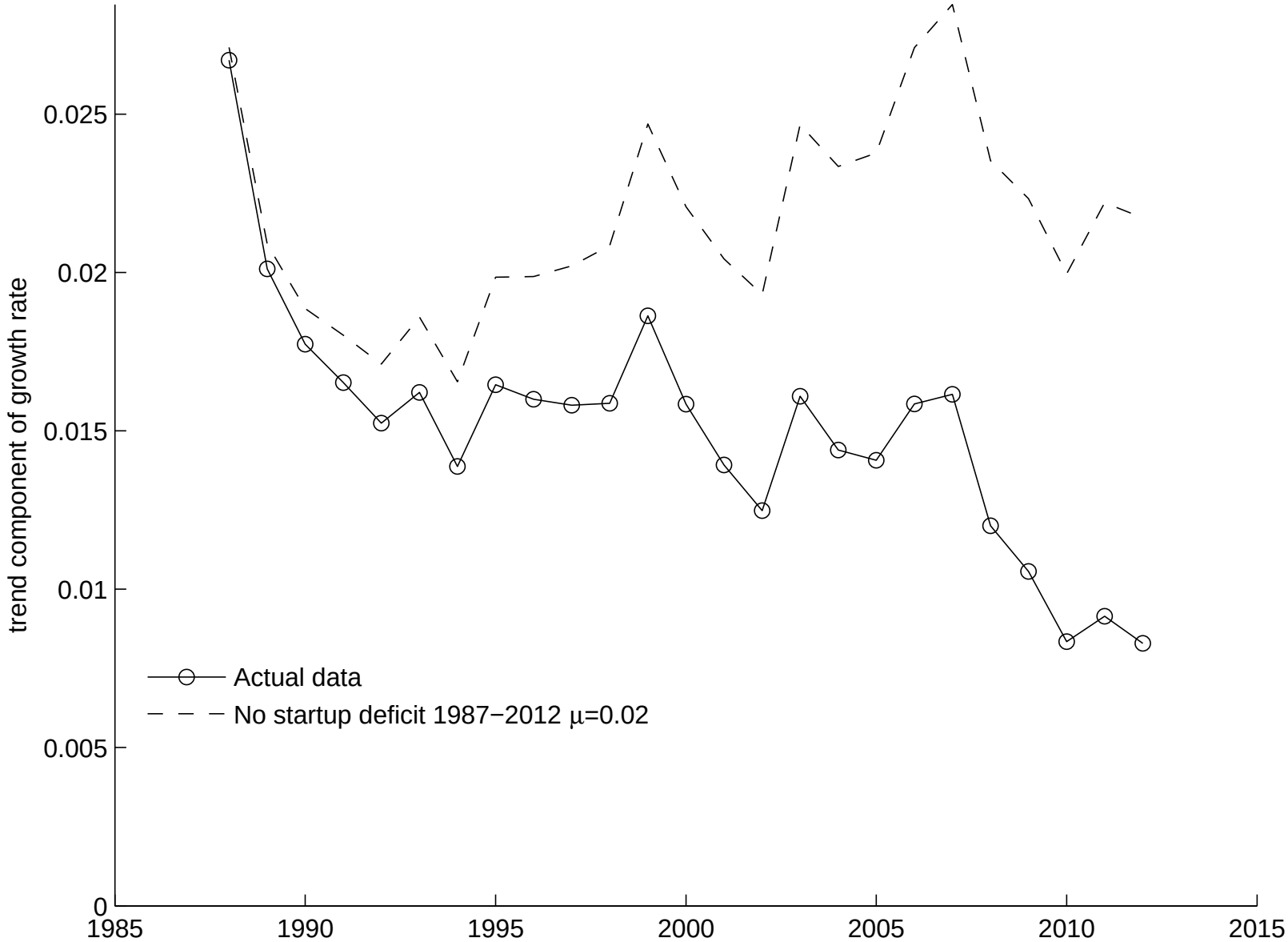
Aggregate cyclical elasticity β

$s_{t-1}\beta^s + (1-\omega_{t-1})\beta^y + \omega_{t-1}\beta^m$



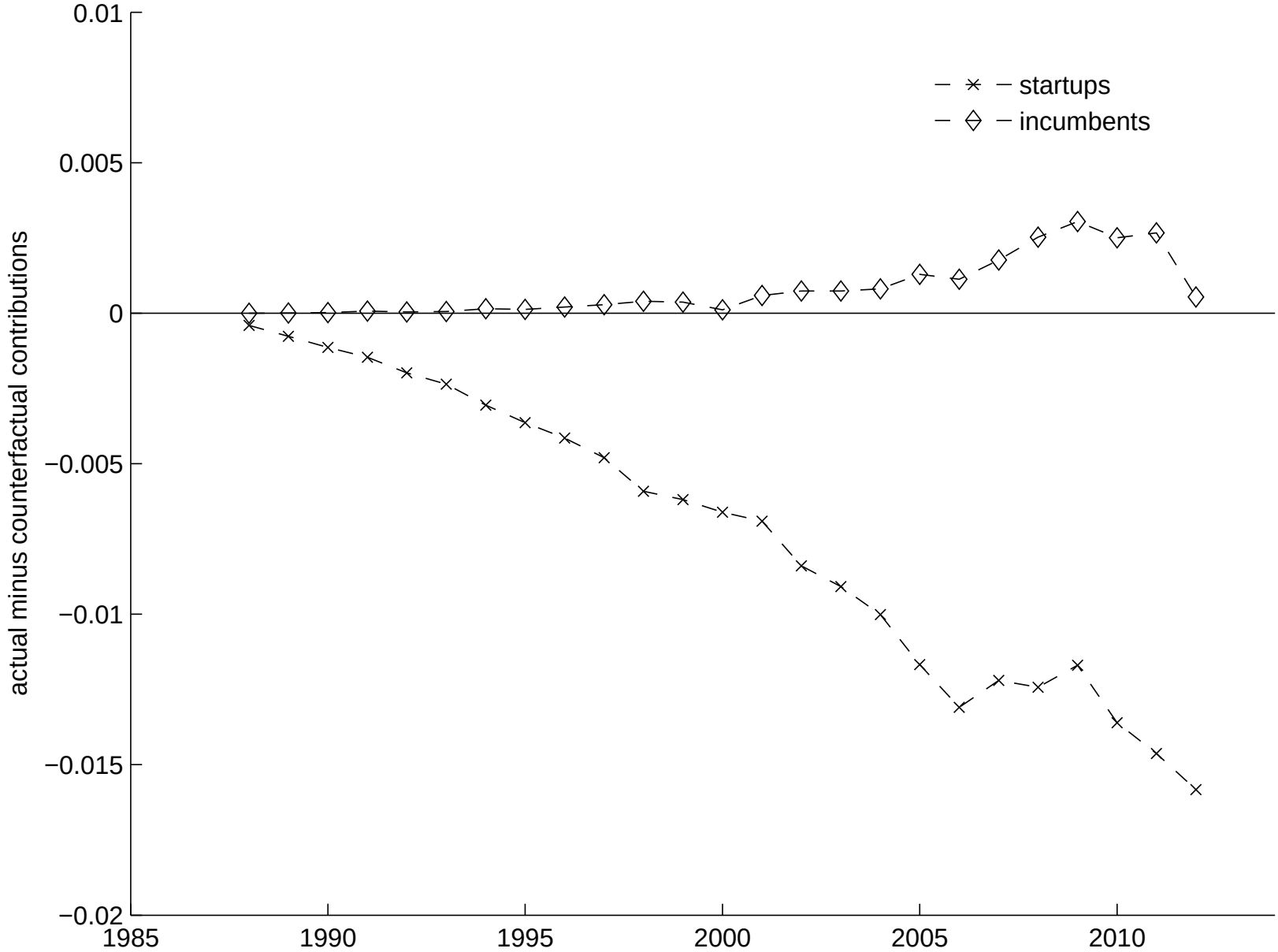
Aggregate trend component

$s_{t-1}(1+\mu_t^s)+(1-\omega_{t-1})\bar{g}^y+\omega_{t-1}\bar{g}^m$



Opposing effects of startup deficit

Actual minus counterfactual startup and incumbent growth contributions



Conclusions

- Document a notable decline in the startup rate and increase in the employment and firm share of mature businesses since the 1980s
- Despite these dramatic changes
  - Little to no change in firm life cycle dynamics conditional on entry
  - Little to no change in cyclicality
- Important effects on aggregate employment dynamics due to
  - Outsized employment growth contribution from entering firms
  - Lower unconditional growth rate of employment at young firms
  - More pronounced cyclicality of employment growth at young firms
- Asymmetric effect of firm aging on employment dynamics over the business cycle
- Consistent with the emergence of *jobless* recoveries

Preview of Work on Explaining the Startup Deficit
Karahan, Pugsley, and Şahin (2015)

Potential explanations for the decline in firm entry

- Not due to sectoral and/or geographic shifts in economic activity
- Generate the decline in entry but also account for the stability of the growth and survival margins.

Two main sources of change:

- Changes in laws and regulations, market concentration, education and licensing requirements, and shifts in economies of scale
  - Barriers to entry
  - Overhead costs of operating
- Slowdown in labor supply growth and aging of the workforce
  - Smaller set of "potential innovators"
  - Smaller set of "unattached workers"

Effects of within state changes in labor supply growth

2SLS: Instrumented by lagged fertility rates

	(1)	(2)	(3)	(4)
	Startup Rate (%)			
WAP GR (20+, %)	0.925***	1.434***		
	(0.292)	(0.302)		
CLF GR (%)			0.786***	1.141***
			(0.255)	(0.259)
Constant	8.545***	10.07***	8.983***	10.58***
	(0.277)	(0.584)	(0.166)	(0.503)
Observations	1,316	1,316	1,316	1,316
R^2	0.880	0.854	0.800	0.681
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
State trends	-	Yes	-	Yes
Years	1980-2007	1980-2007	1980-2007	1980-2007
1st stage F-stat	23.53	25.30	23.70	17.83

Reference Slides

Employment shares

Define $e_t^a \equiv E_t^a / \vec{E}_t$ then

$$\vec{e}_t = \frac{P_t}{1+g_t}\vec{e}_{t-1} + (1,0,0)\, e_t^s \ ,$$

where g_t is the growth rate in aggregate employment. Note that

$$e_t^s = \frac{S_t}{E_t} = \frac{F_t^s}{F_t}\frac{N_t^s}{N_t} \ .$$

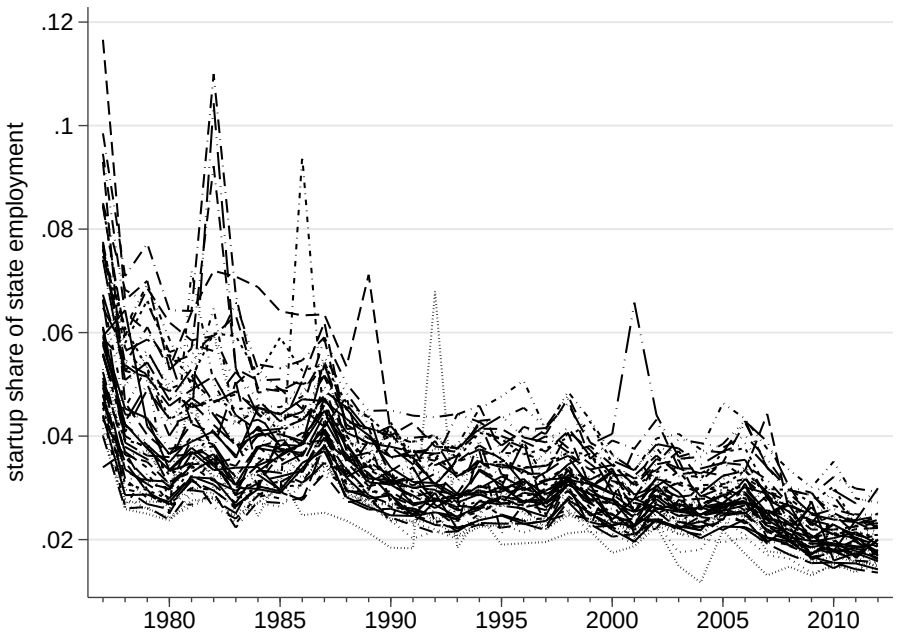
Measuring business cycle shocks

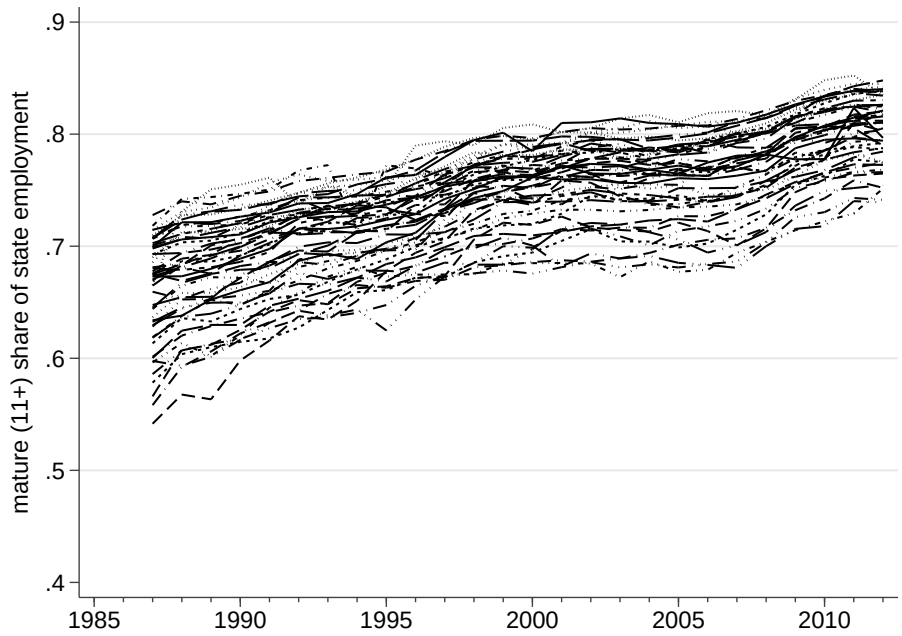
What is a good proxy for Z_t? We consider several alternatives:

1. Log difference in annual GDP/GSP
2. Log difference in annual personal income
3. Change in annual average unemployment rate
4. Cyclical deviation from HP filtered unemployment

Note that Fort, Haltiwanger, Jarmin and Miranda (2013) focus on 1-3 while Moscarini and Postel-Vinay (2012) use 4.

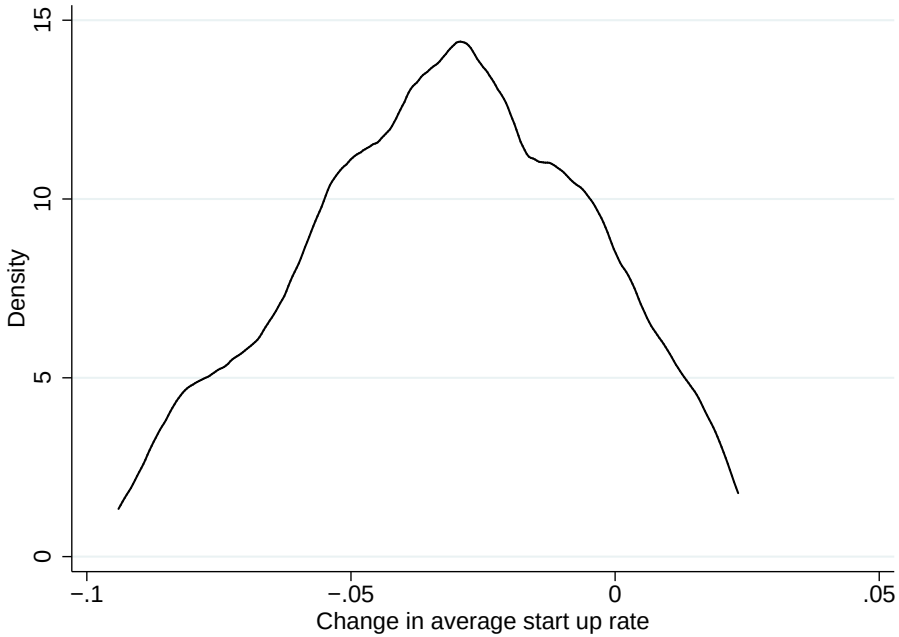
Within state



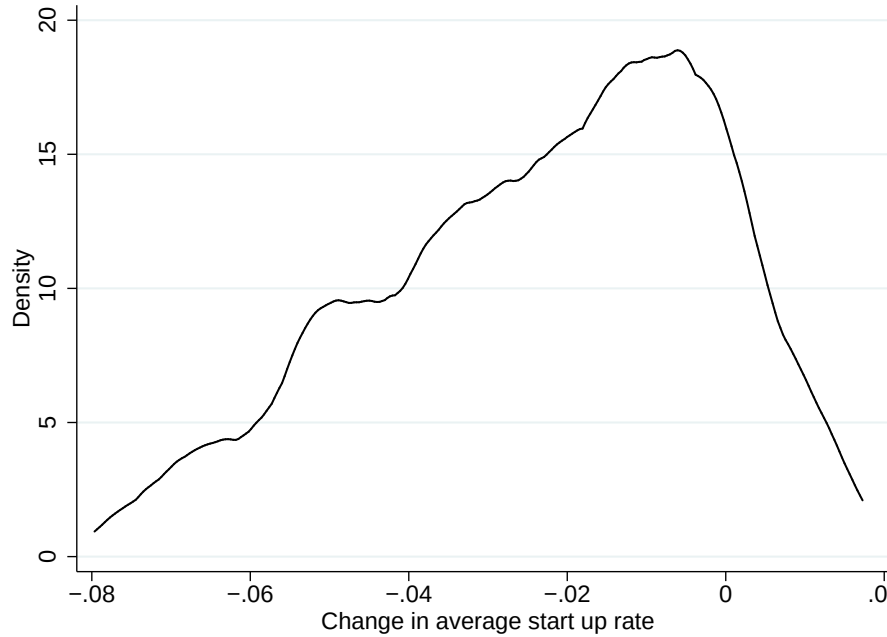


Startup rates Mature firm share

Long run changes within state x 4-digit NAICS

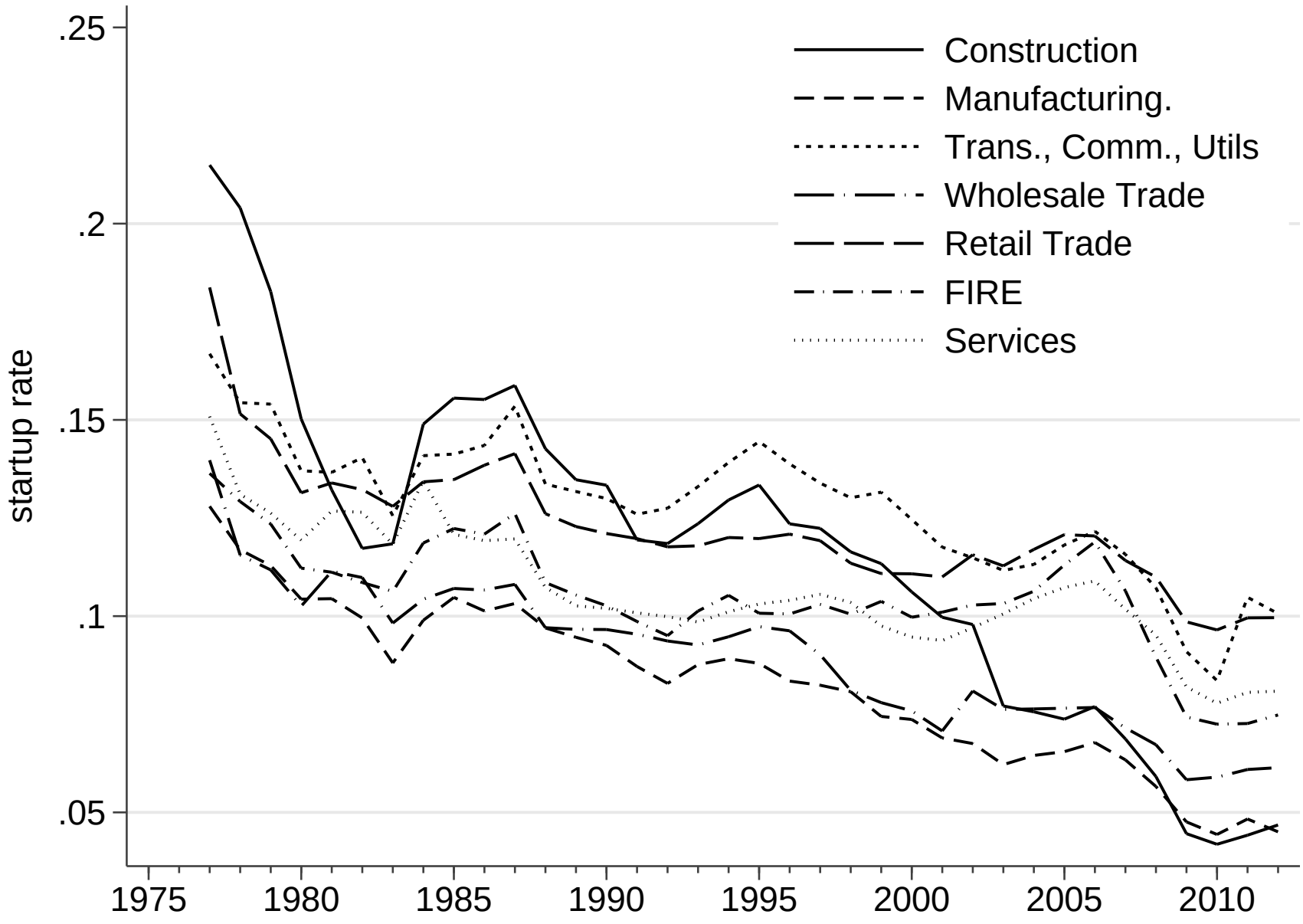


Startup firm share

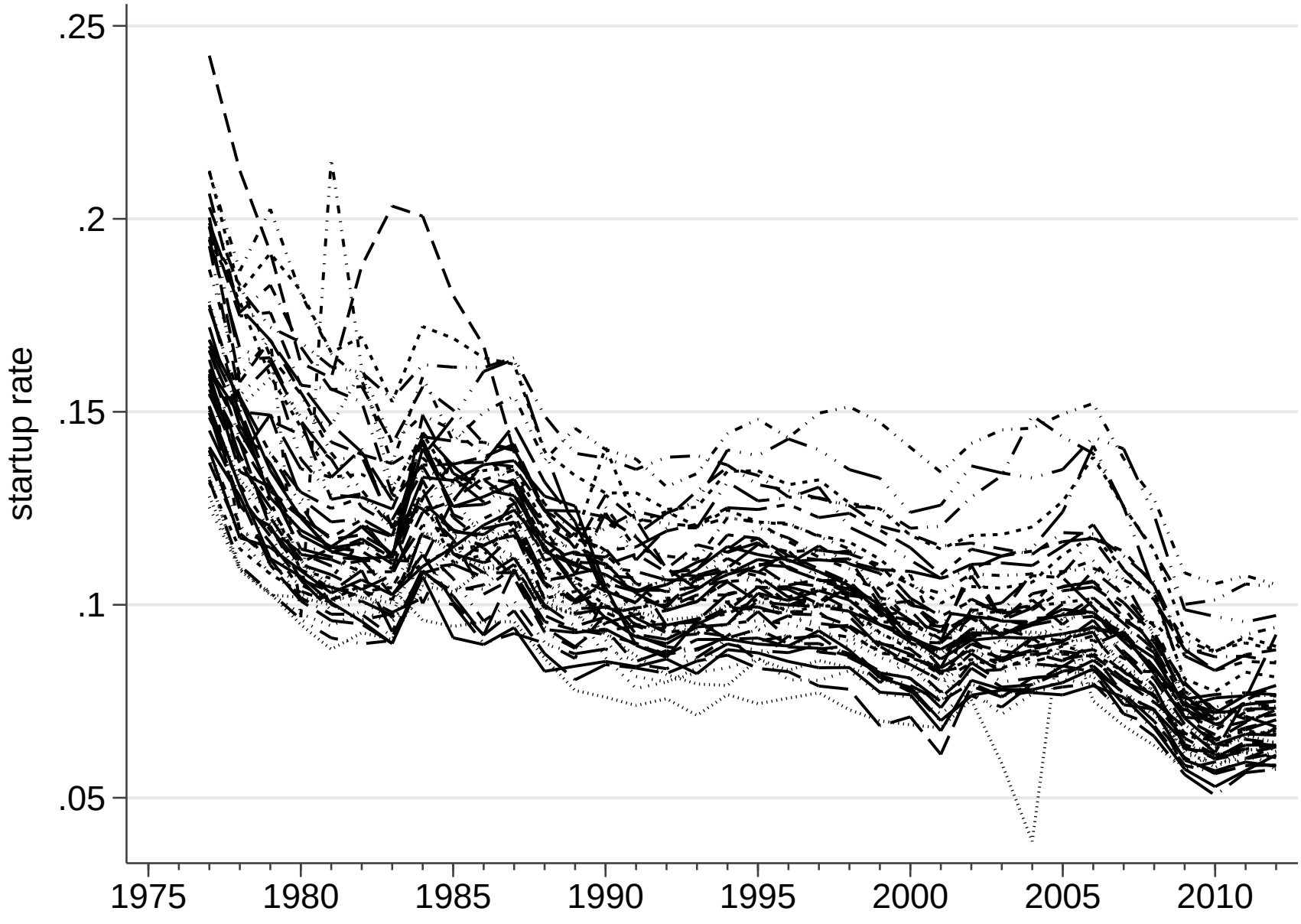


Startup employment share

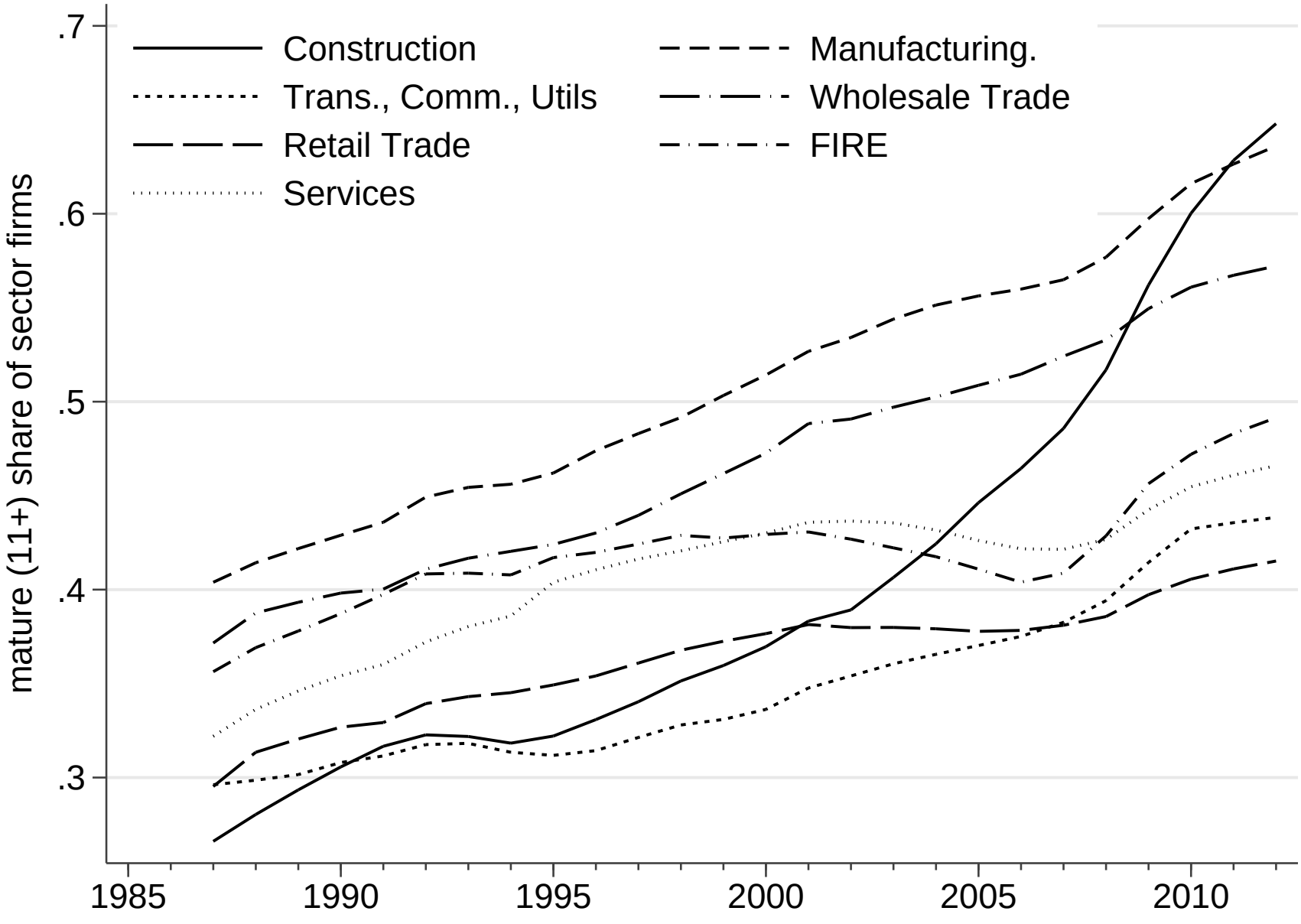
Startup rate within sector



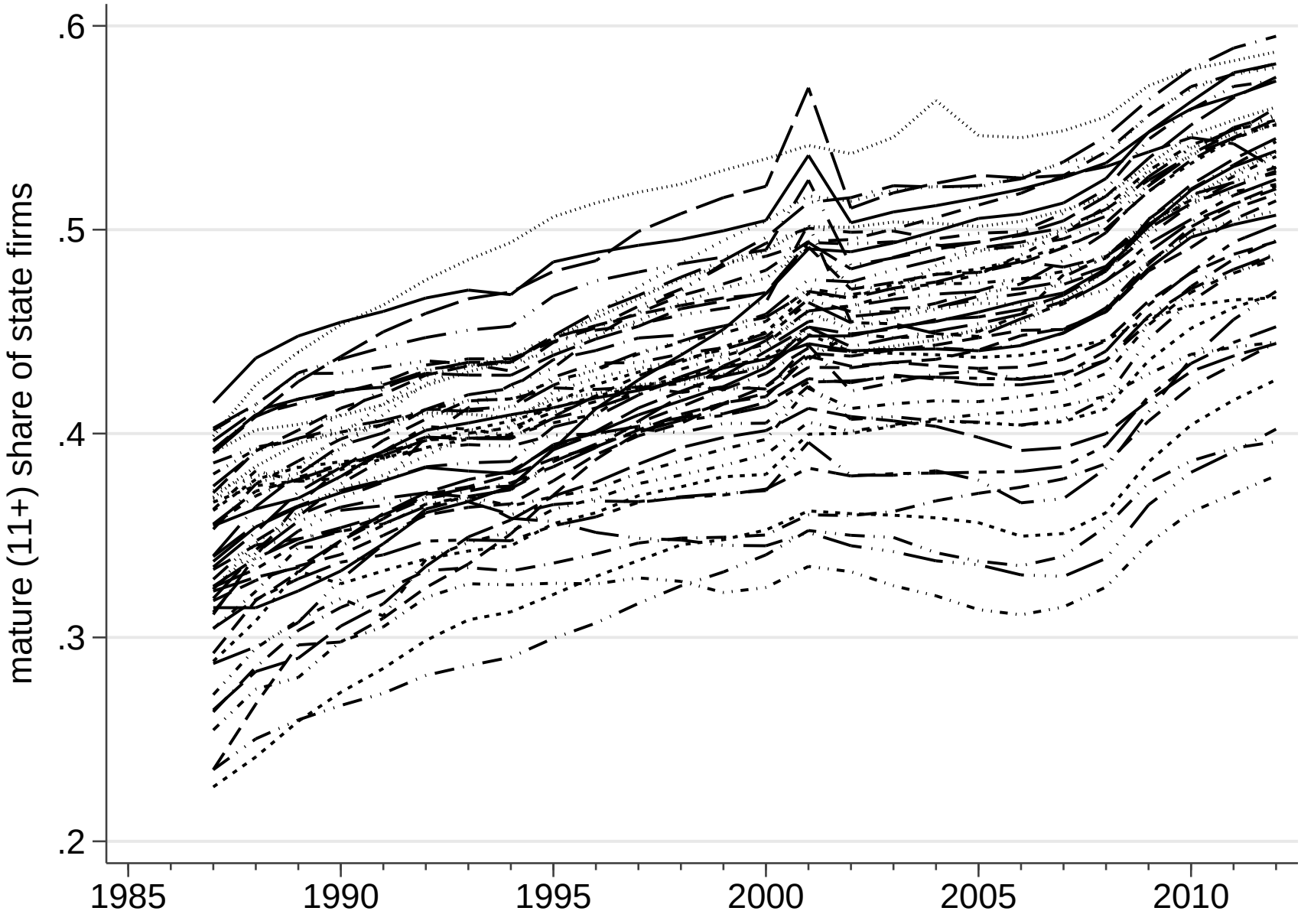
Startup rate witin state



Mature firm share within sector



Mature firm share within state



Why age instead of size?

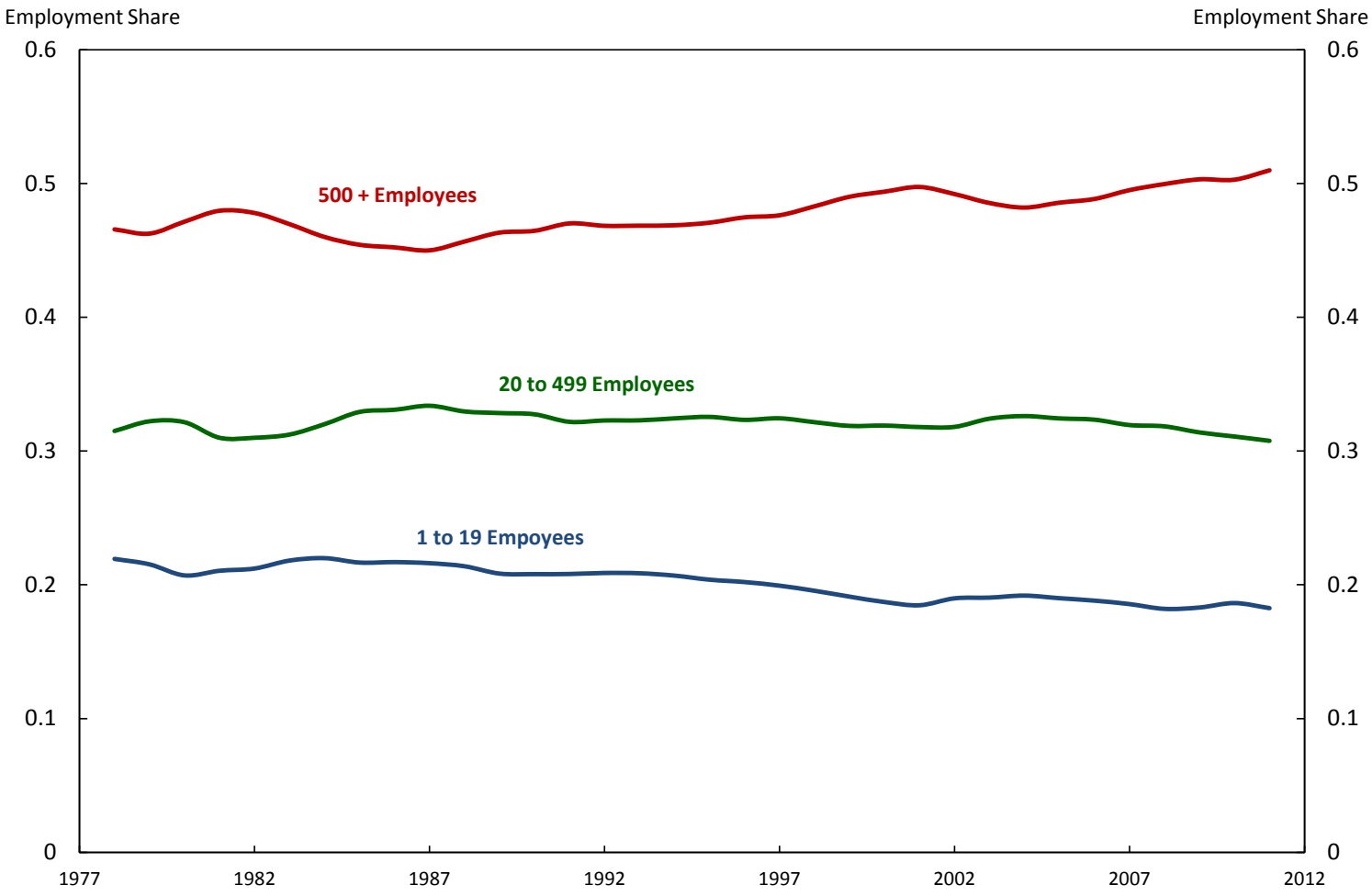
Most of the previous literature focused on size not age. In particular, small/large distinction has been used to capture

- differential credit access
- differences in growth potential

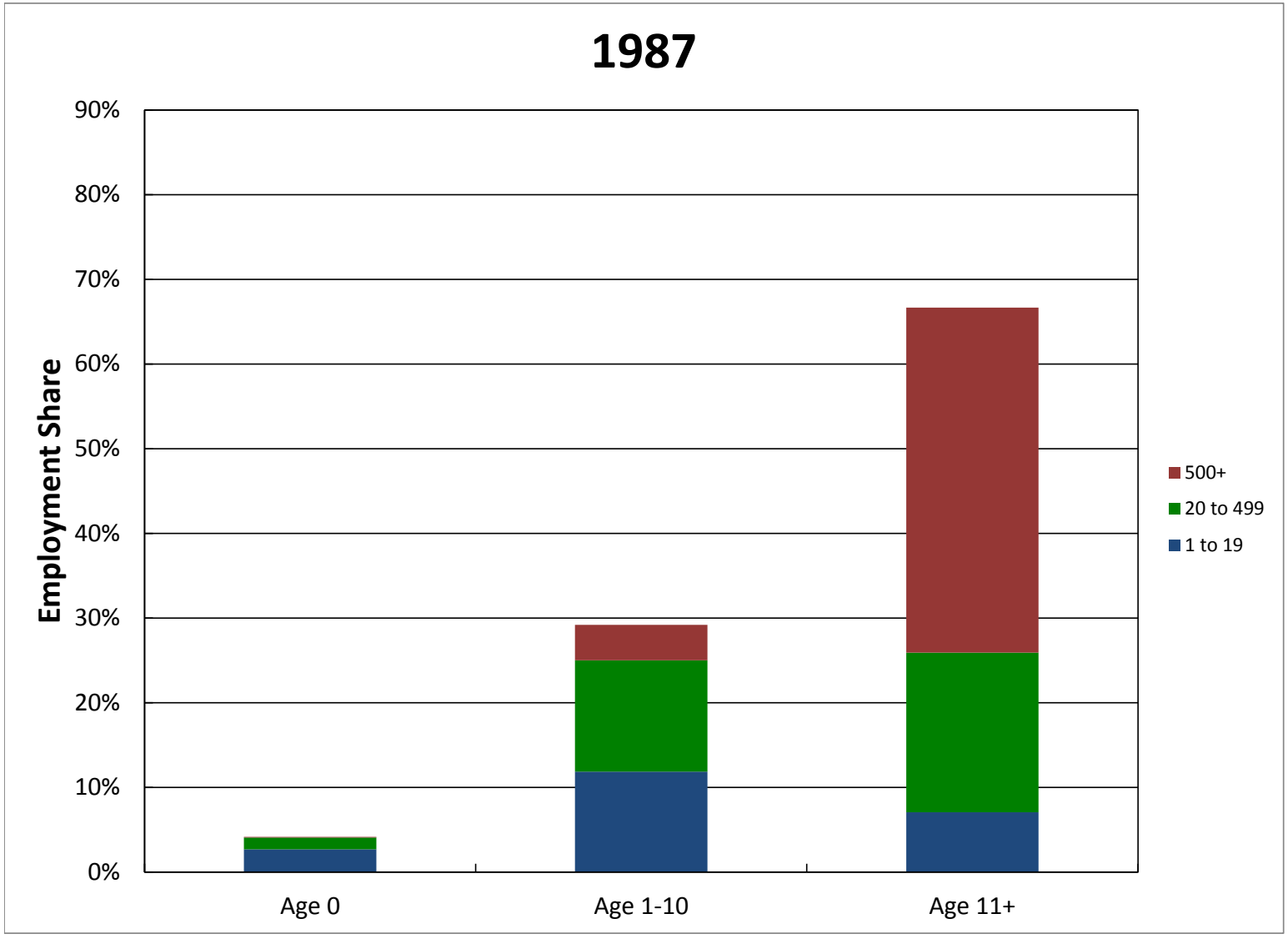
We focus on firm age for 3 main reasons:

1. The choice of firm size was mostly motivated by the availability of firm size data. As Gertler and Gilchrist (1994) noted:
   The informational frictions that add to the costs of external finance apply mainly to younger firms...
2. Age is an important factor in explaining the different behavior of small/large firms since young firms tend to be smaller. (Haltiwanger, Jarmin and Miranda, 2013)
3. Unlike the age distribution, the size distribution is relatively stable over the 30 year period we study

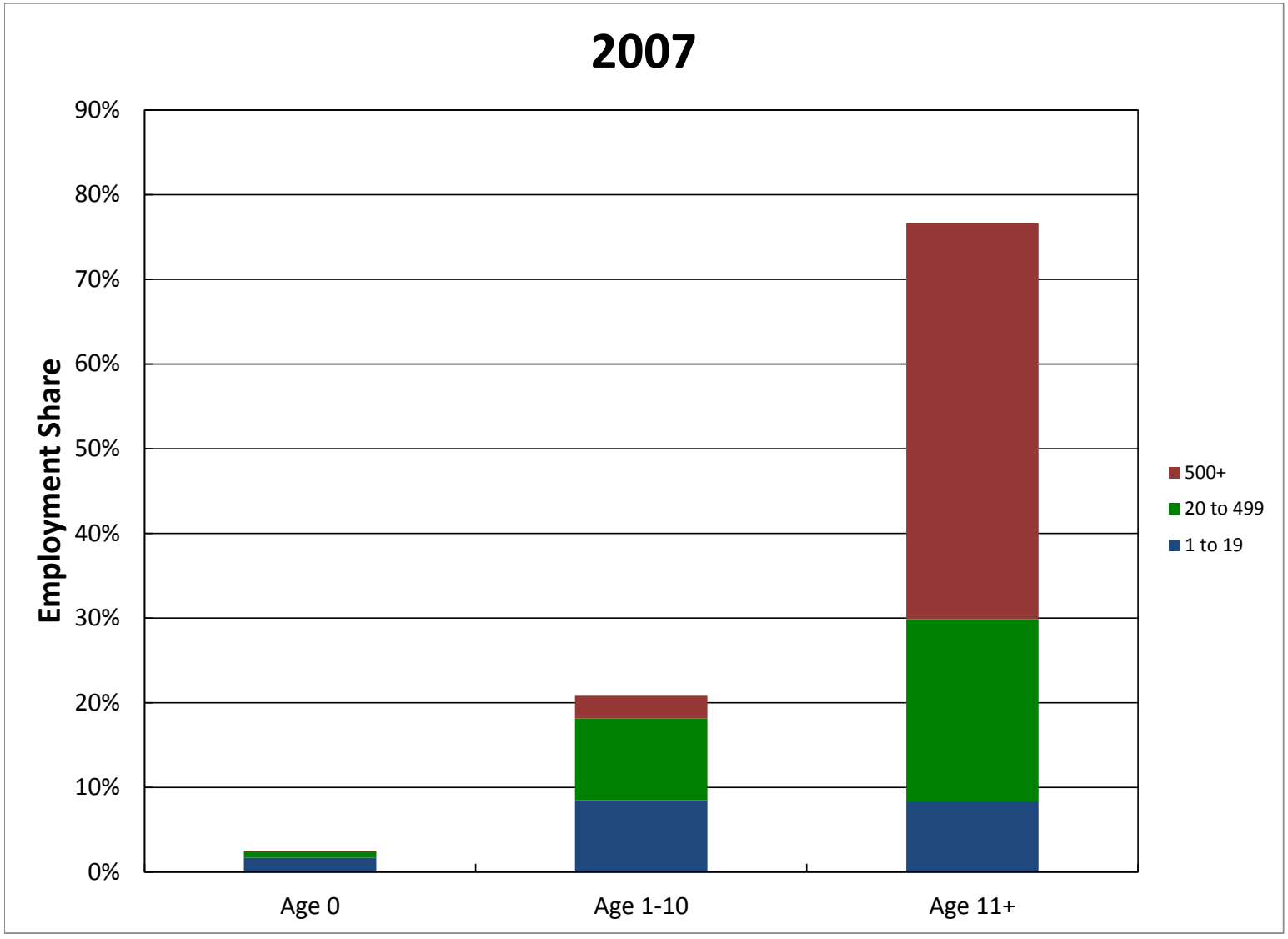
Employment Share by Firm Size



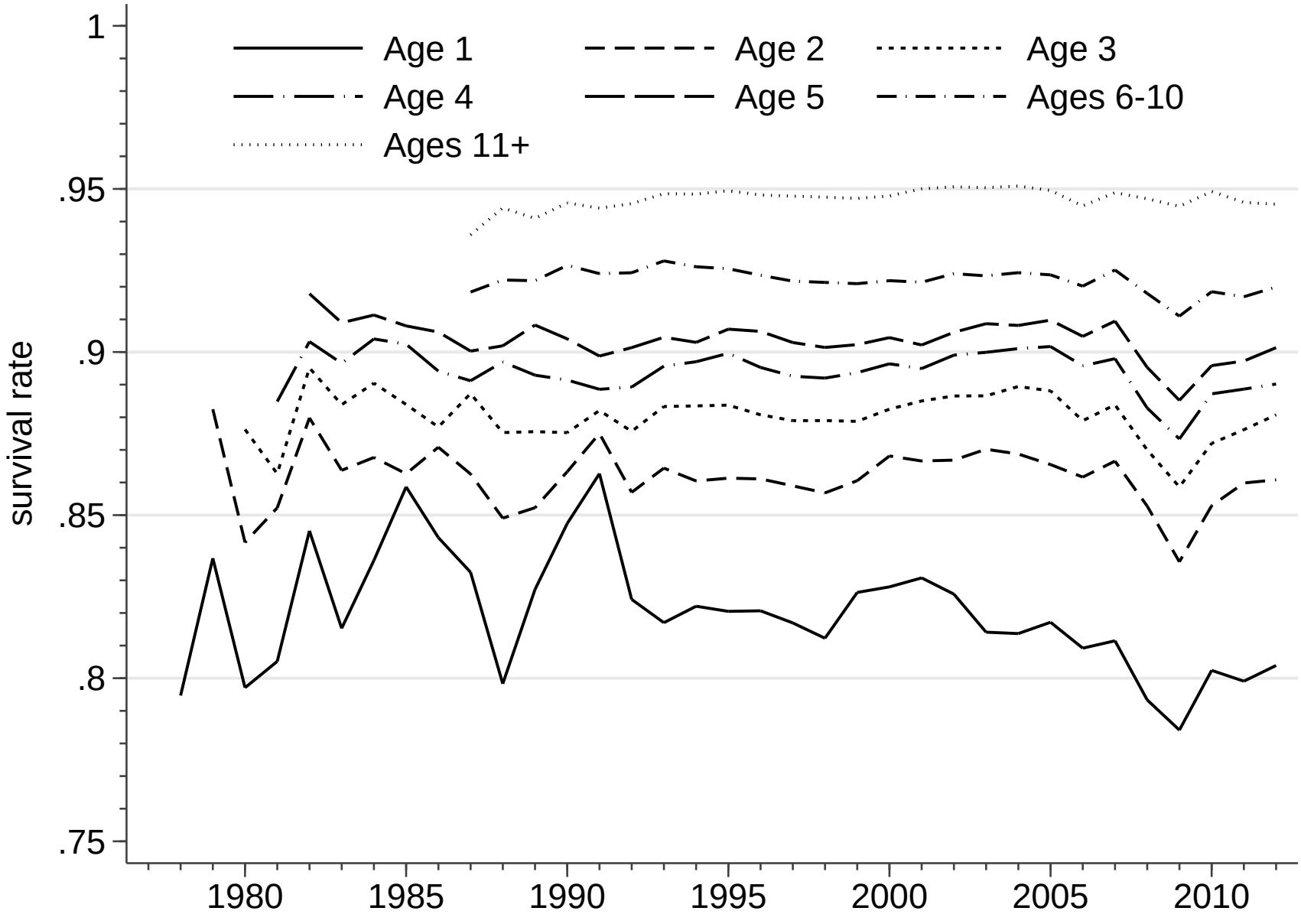
Employment share by size and age 1987



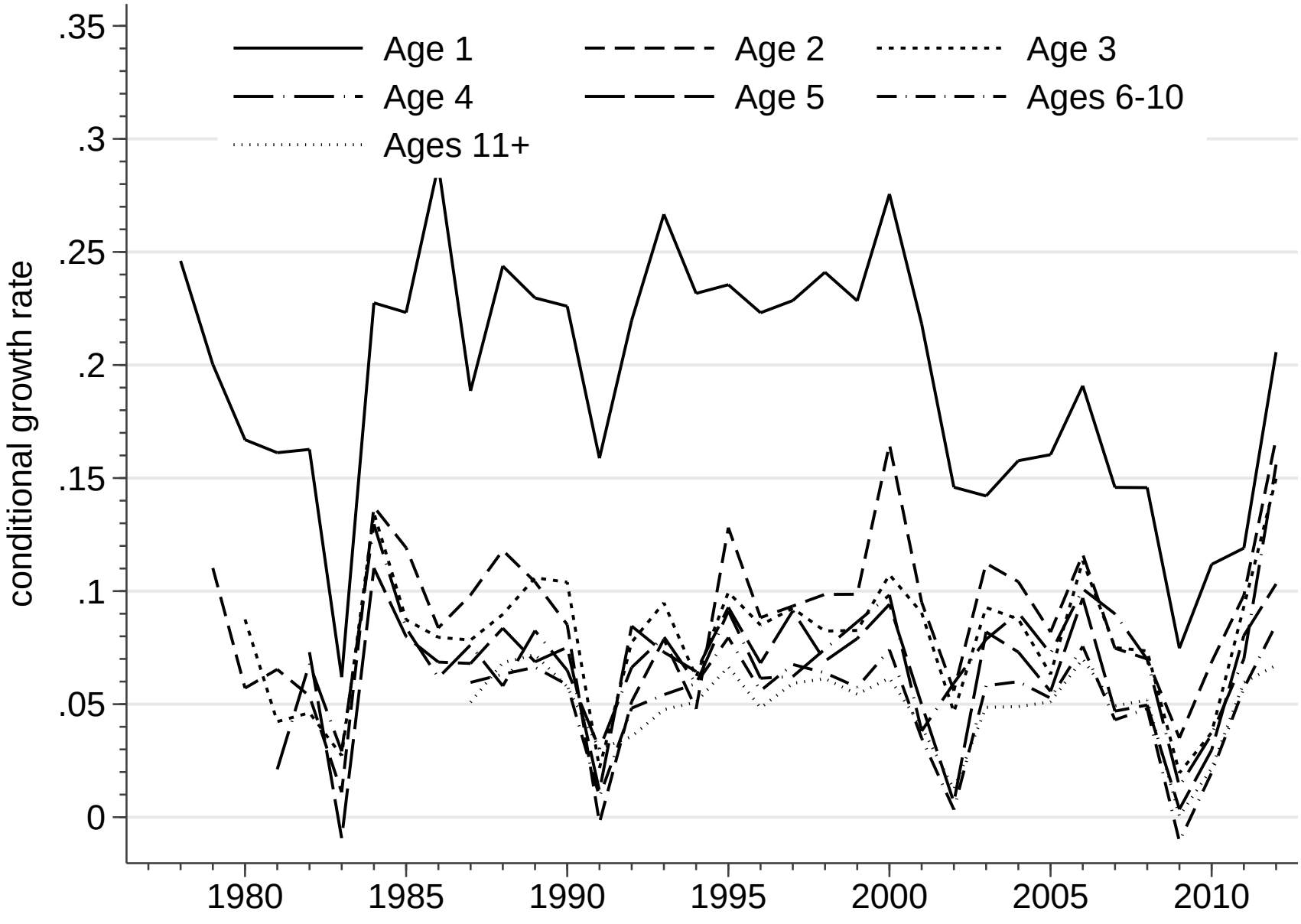
Employment share by size and age 1987



Survival probabilities by detailed age group



Conditional growth rate by detailed age group



Average size by detailed age group

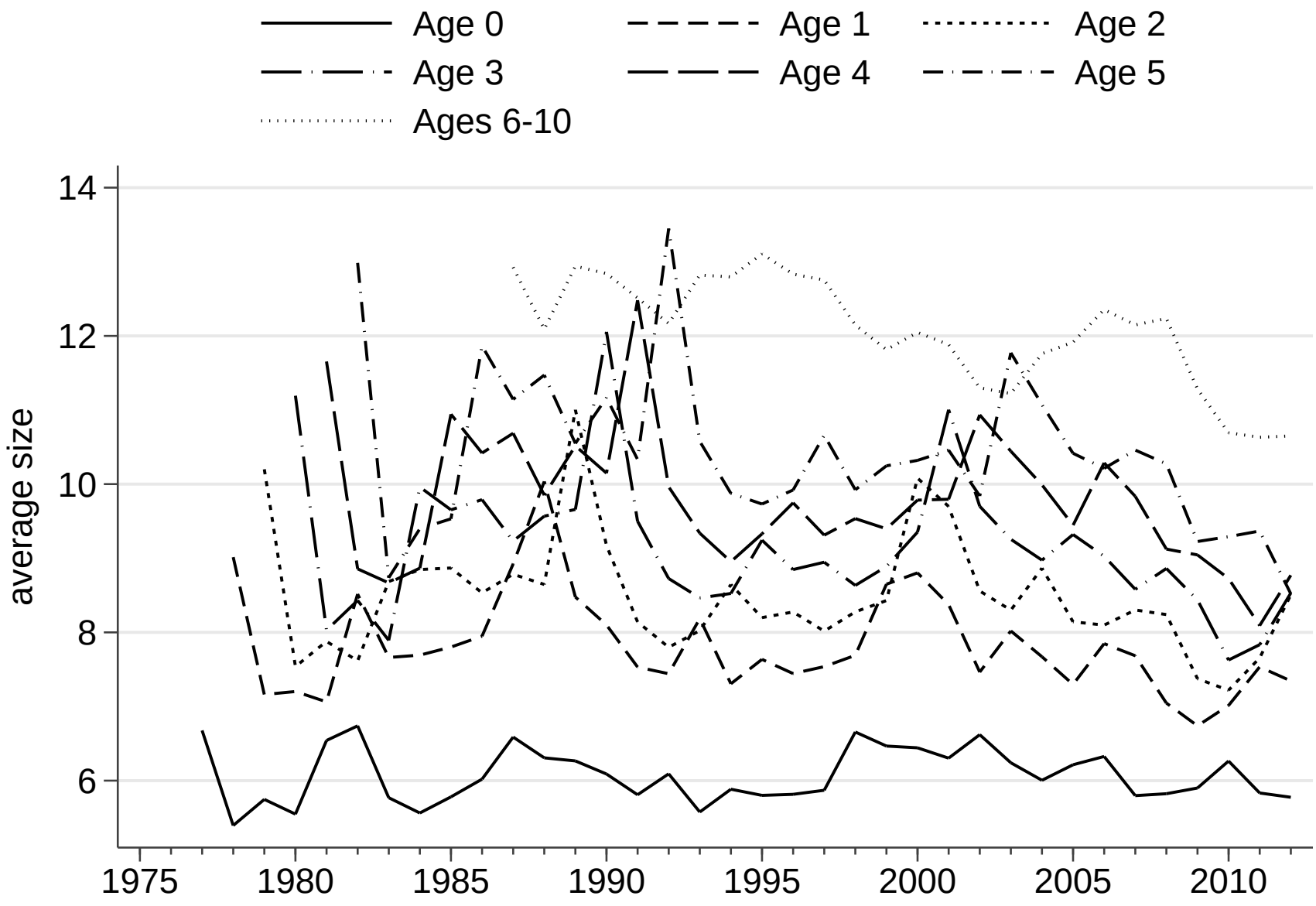


Table: Change in measures of startup rate from 1980-1984 to 2003-2007 periods

Age 0 Firm Share					*Age 0 Employment Share*				
$F^{-1}(0)$	Mean	P10	P50	P90	$F^{-1}(0)$	Mean	P10	P50	P90
83.45	-0.03	-0.08	-0.03	0.01	82.75	-0.02	-0.06	-0.02	0.01

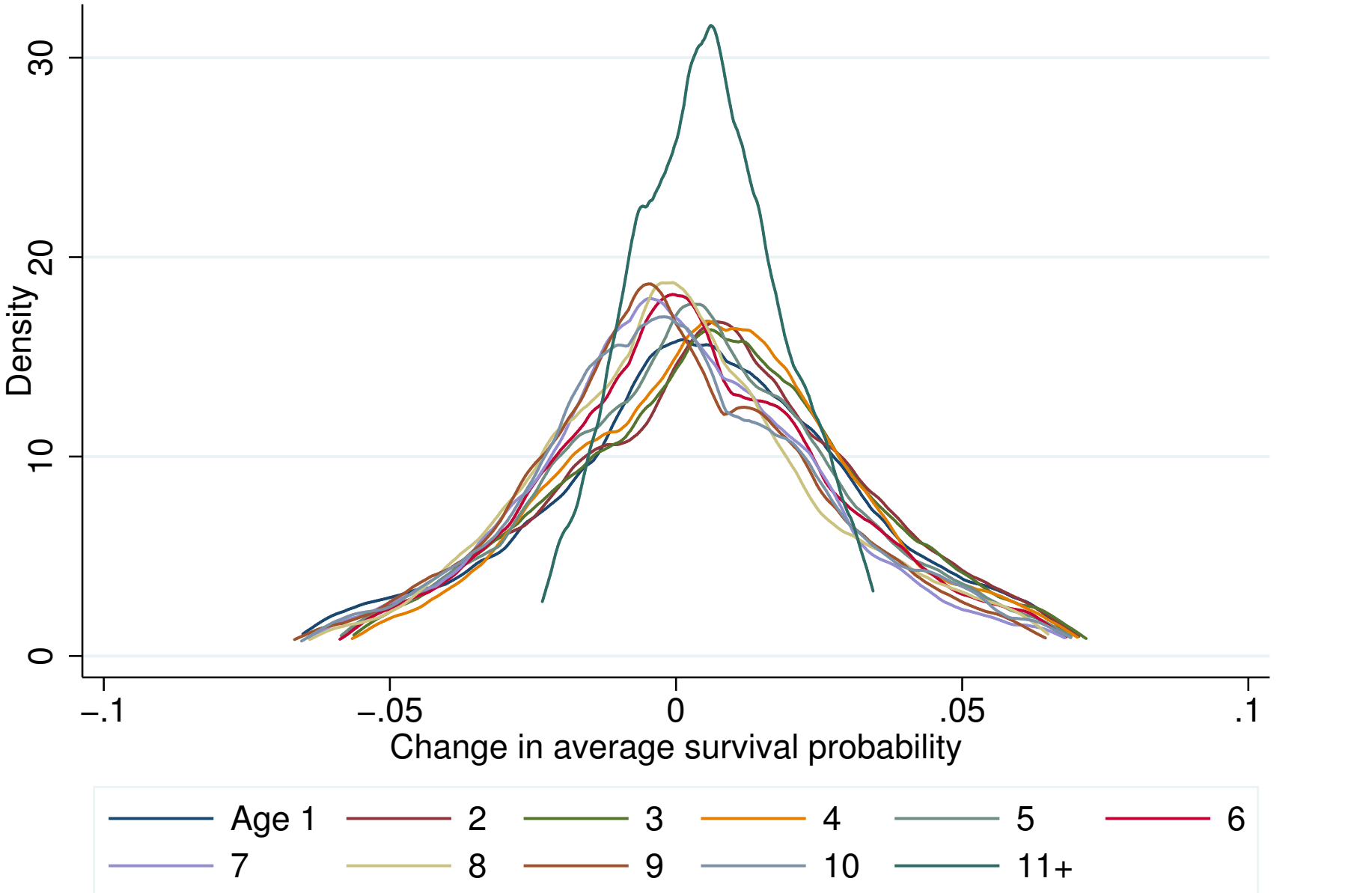
Notes: Distribution of within 4-digit industry and state changes in age 0 firm/employment share from 1980-1984 average to 2003-2007 average. $F^{-1}(0)$ is the percentile corresponding to no change.

Table: Change in conditional life-cycle dynamics from 1987-1991 to 2003-2007 periods

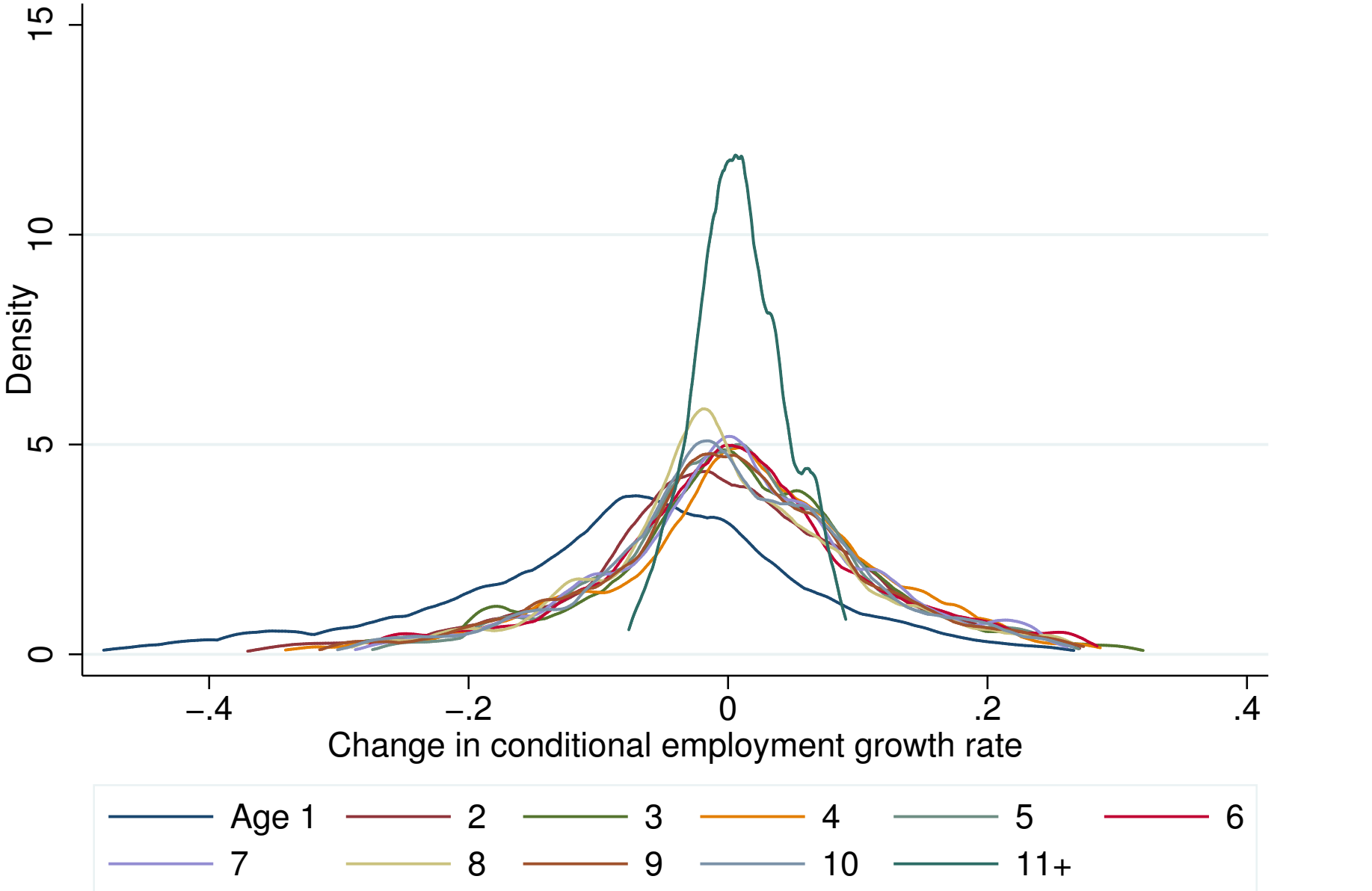
	Survival Rate					*Conditional Growth Rate*				
Age	$F^{-1}(0)$	Mean	P10	P50	P90	$F^{-1}(0)$	Mean	P10	P50	P90
1	43.1	0	-0.04	0	0.05	70.9	-0.08	-0.33	-0.07	0.12
2	39.7	0.01	-0.04	0.01	0.05	52.4	-0.01	-0.2	-0.01	0.17
3	40.1	0.01	-0.04	0.01	0.05	46.6	0.01	-0.18	0.01	0.18
4	40.6	0.01	-0.04	0.01	0.05	44.2	0	-0.18	0.01	0.18
5	43.5	0	-0.04	0	0.05	47.6	0	-0.16	0.01	0.17
6	46.7	0	-0.04	0	0.05	47.6	0.01	-0.17	0.01	0.19
7	52	0	-0.04	0	0.04	47	0.01	-0.16	0.01	0.18
8	50.4	0	-0.04	0	0.04	54.3	-0.01	-0.17	-0.01	0.17
9	53.8	0	-0.04	0	0.04	49	0	-0.18	0	0.18
10	50.7	0	-0.04	0	0.05	51.2	0	-0.17	0	0.17
11+	36	0.01	-0.01	0.01	0.03	42	0.01	-0.05	0.01	0.07

Notes: Distribution of within 4-digit industry and state changes in one-year survival and conditional growth rates by age-group from 1987-1991 average to 2003-2007 average. $F^{-1}(0)$ is the percentile corresponding to no change.

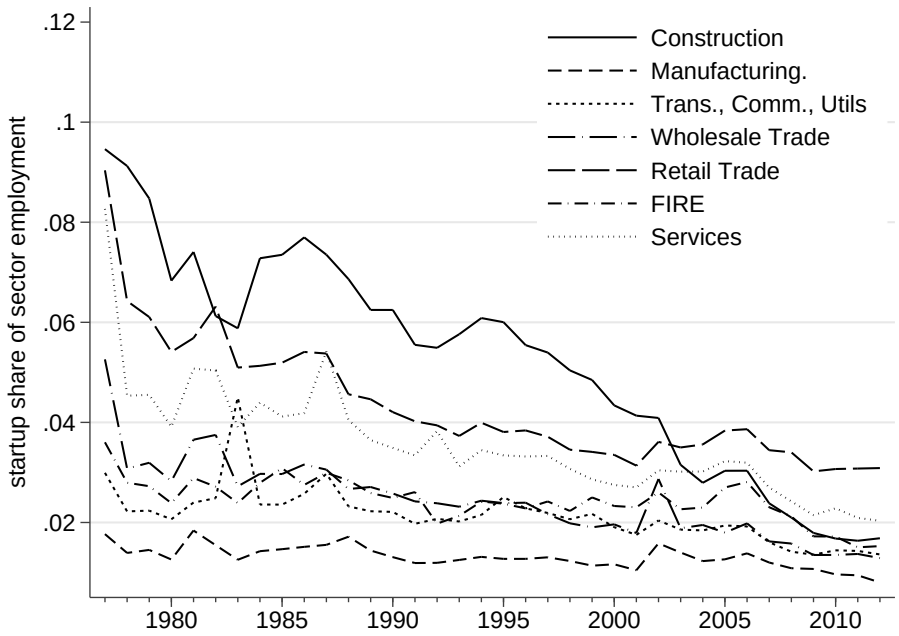
Change in survival rates across 4-digit industries and states

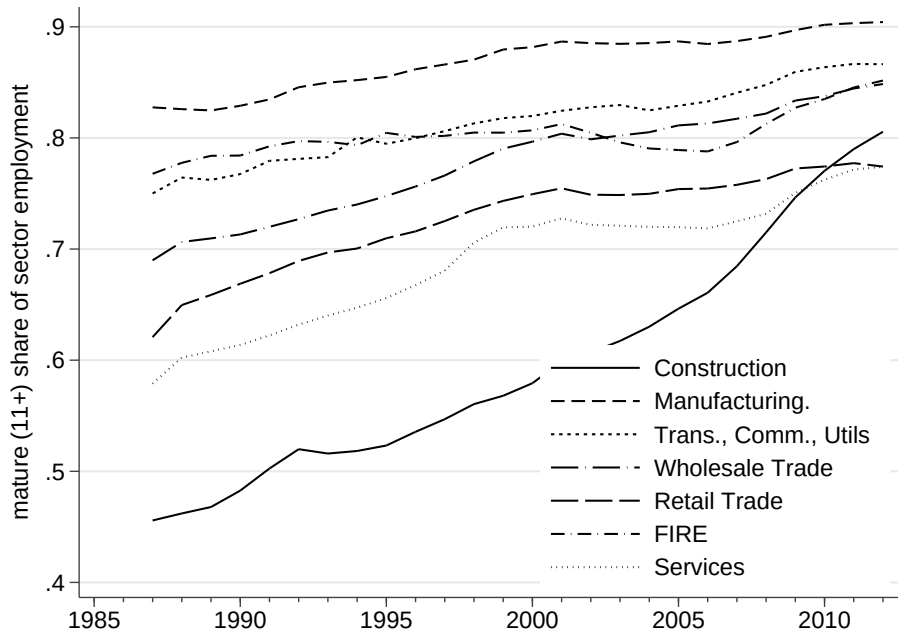


Change in growth rates across 4-digit industries and states



Within sector





Startup rates Mature firm share

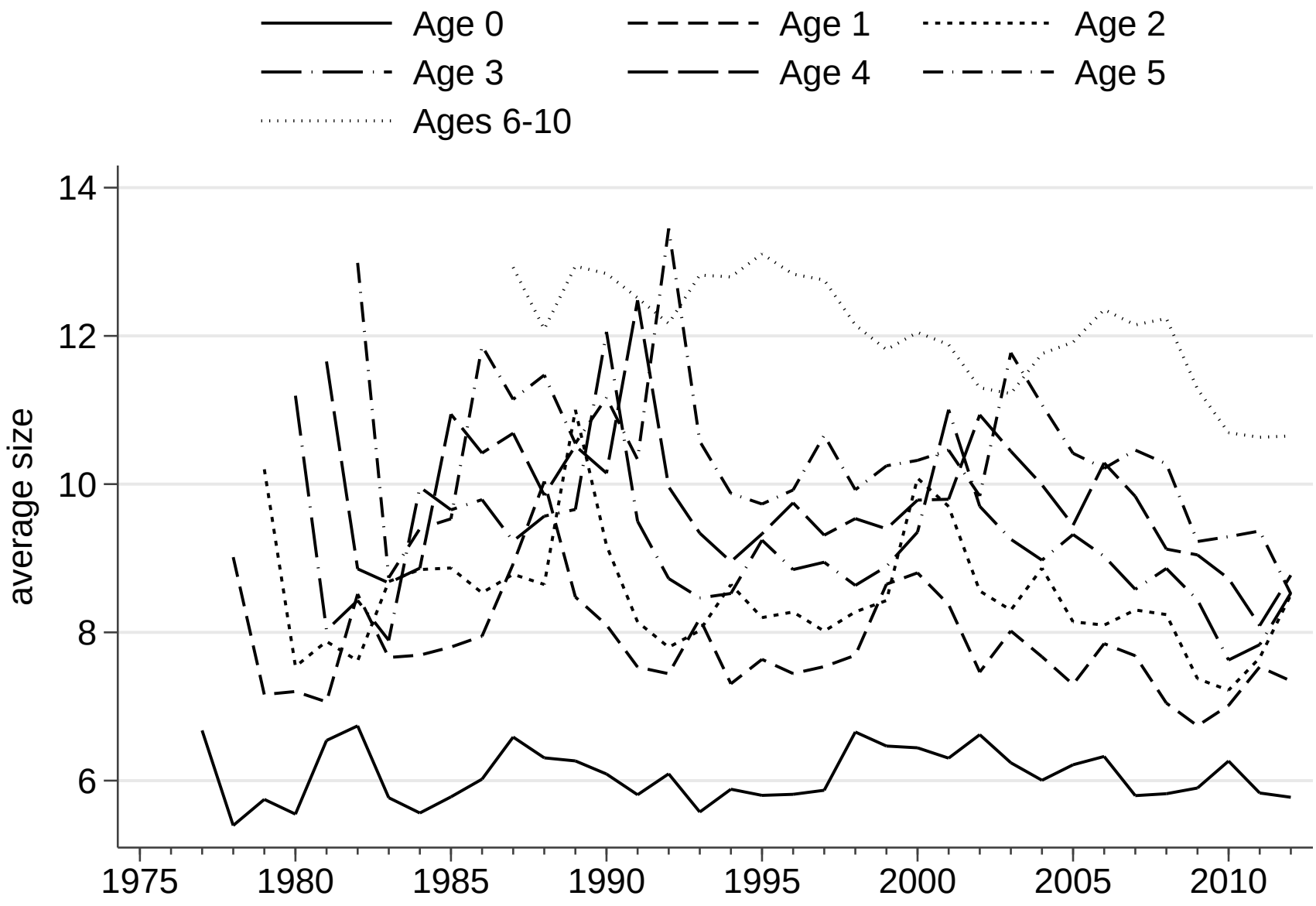
Estimated cyclical sensitivity of g_t^a

	(1) Personal Inc	(2) GDP/GSP	(3) Change in U	(4) Cyclical U
	A. National Measures			
$\hat{\beta}^y$	0.984***	1.249***	-2.056***	-0.0675
	(0.340)	(0.222)	(0.539)	(0.332)
$\hat{\beta}^m$	0.546**	0.813***	-1.462***	-0.410*
	(0.220)	(0.137)	(0.380)	(0.227)
p-value of $\beta^y = \beta^m$	0.014	0.002	0.021	0.140
	B. State Level Measures			
$\hat{\beta}^y$	0.717***	0.436***	-2.058***	-0.942***
	(0.0716)	(0.0598)	(0.210)	(0.163)
$\hat{\beta}^m$	0.438***	0.277***	-1.156***	-0.700***
	(0.0388)	(0.0291)	(0.119)	(0.0870)
p-value of $\beta^y = \beta^m$	0.000	0.000	0.000	0.083
Years	1987-2012	1987-2012	1987-2012	1987-2007

Estimated cyclical sensitivity of g_t^s

	(1)	(2)	(3)	(4)
$\hat{\beta}^s$	0.41	0.05	1.71**	1.18**
	(1.54)	(1.41)	(0.57)	(0.37)
N	35	31	1,785	1,581
R^2	0.001	0.000	0.553	0.536
Year FE	-	-	Yes	Yes
State FE	-	-	Yes	Yes
Detrending	Linear	HP	Linear	HP
Years	1980-2007	1980-2007	1980-2007	1980-2007

Average size by detailed age group



Estimate linear trends in age group x_t and n_t

- Use time series variation in national data to estimate for $y_t^a \in \{x_t^a, n_t^a\}$

$$y_{nkst}^a = \alpha + \lambda^a t + \gamma_n^a + \psi_s^a + \phi_k^a + \varepsilon_t^a$$

- Estimate any first order shift λ in survival rates x_t and conditional growth rates n_t^a over time
- Looking within size group with fixed effect γ_n
- Looking within sector with fixed effect ϕ_k
- Looking within state with fixed effect ψ_s
- For robustness, first remove cyclical frequencies from y_t^a

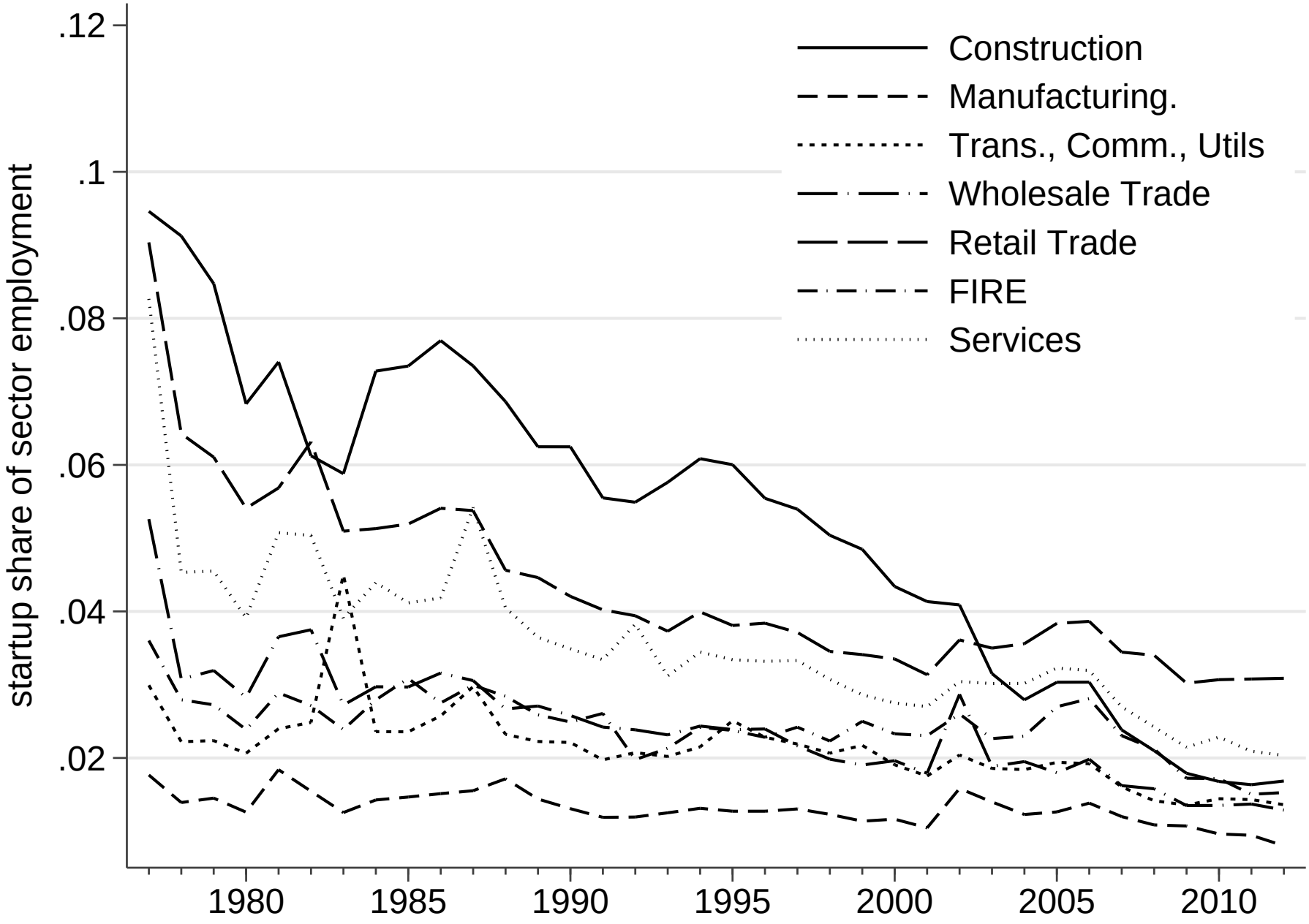
Estimated trend declines in x_t

	(1)	(2)	(3)
	A. Young Firms (Ages 1-10)		
Trend	-0.0003	-0.0002	-0.0002**
	(0.0002)	(0.0001)	(0.00008)
R^2	0.1	0.8	0.6
N	26	234	1326
	B. Mature Firms (Ages 11+)		
Trend	0.0002	0.0001	0.0002***
	(0.0001)	(0.0001)	(0.00004)
R^2	0.2	0.8	0.6
N	26	234	1326
Years	1987-2012	1987-2012	1987-2012
Sector FE	-	Yes	-
State FE	-	-	Yes

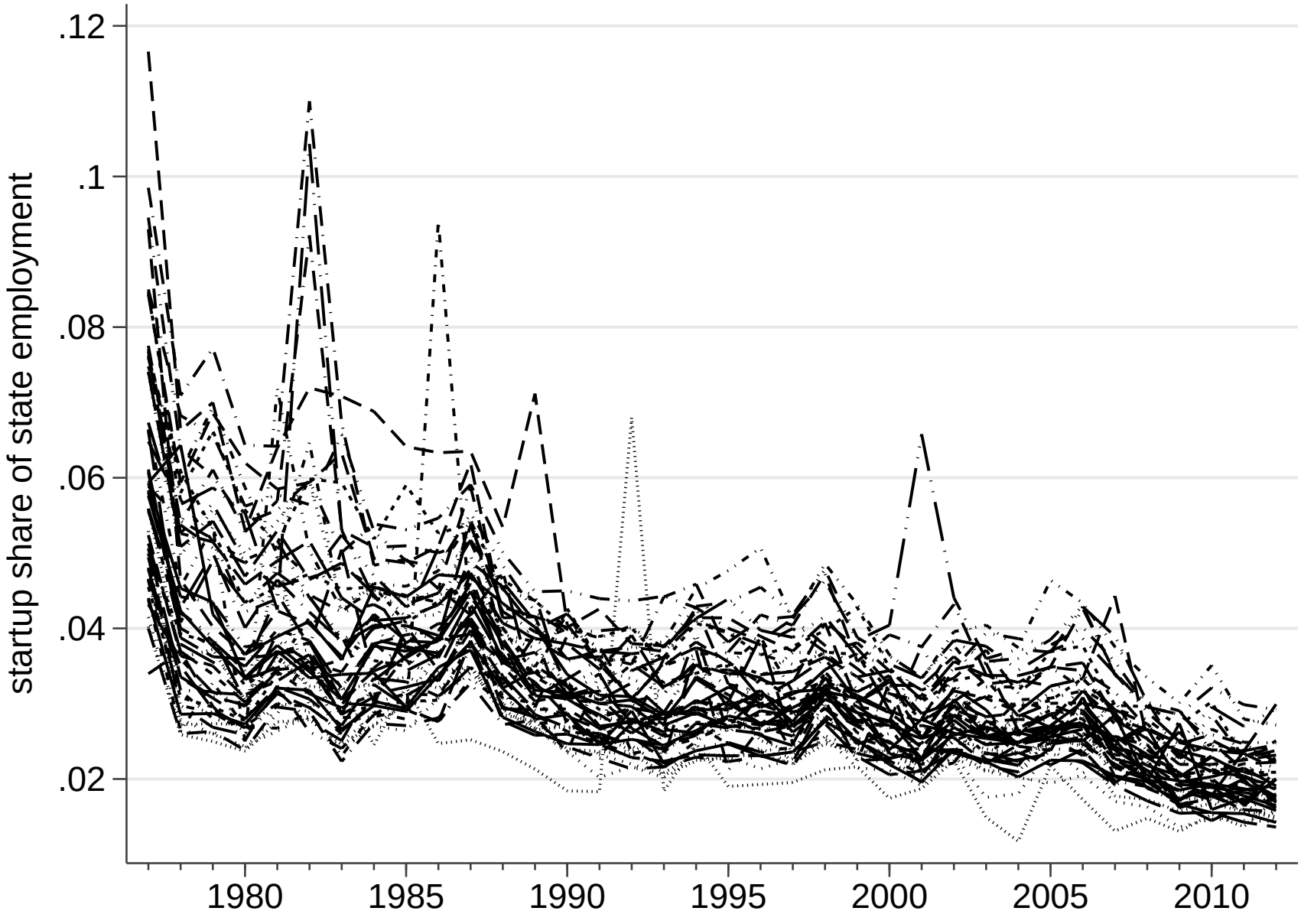
Estimated trend declines in n_t

	(1)	(2)	(3)
	A. Young Firms (Ages 1-10)		
Trend	-0.0007	-0.0009**	-0.0008***
	(0.0008)	(0.0002)	(0.0002)
R^2	0.04	0.2	0.08
N	26	234	1326
	B. Mature Firms (Ages 11+)		
Trend	-0.0005	-0.0007***	-0.0005***
	(0.0005)	(0.00009)	(0.00008)
R^2	0.05	0.4	0.1
N	26	234	1326
Years	1987-2012	1987-2012	1987-2012
Sector FE	-	Yes	-
State FE	-	-	Yes

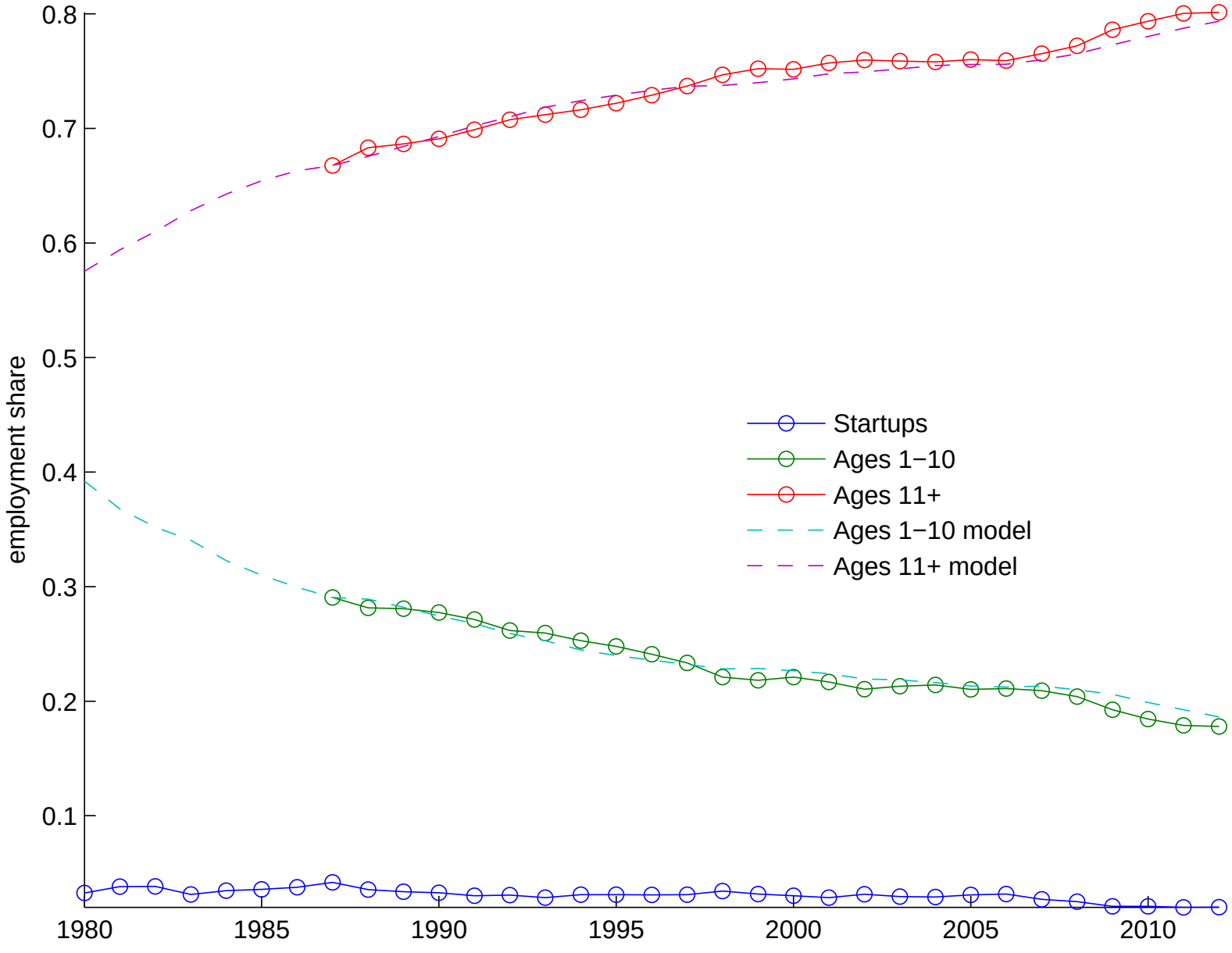
Startup employment share by sector



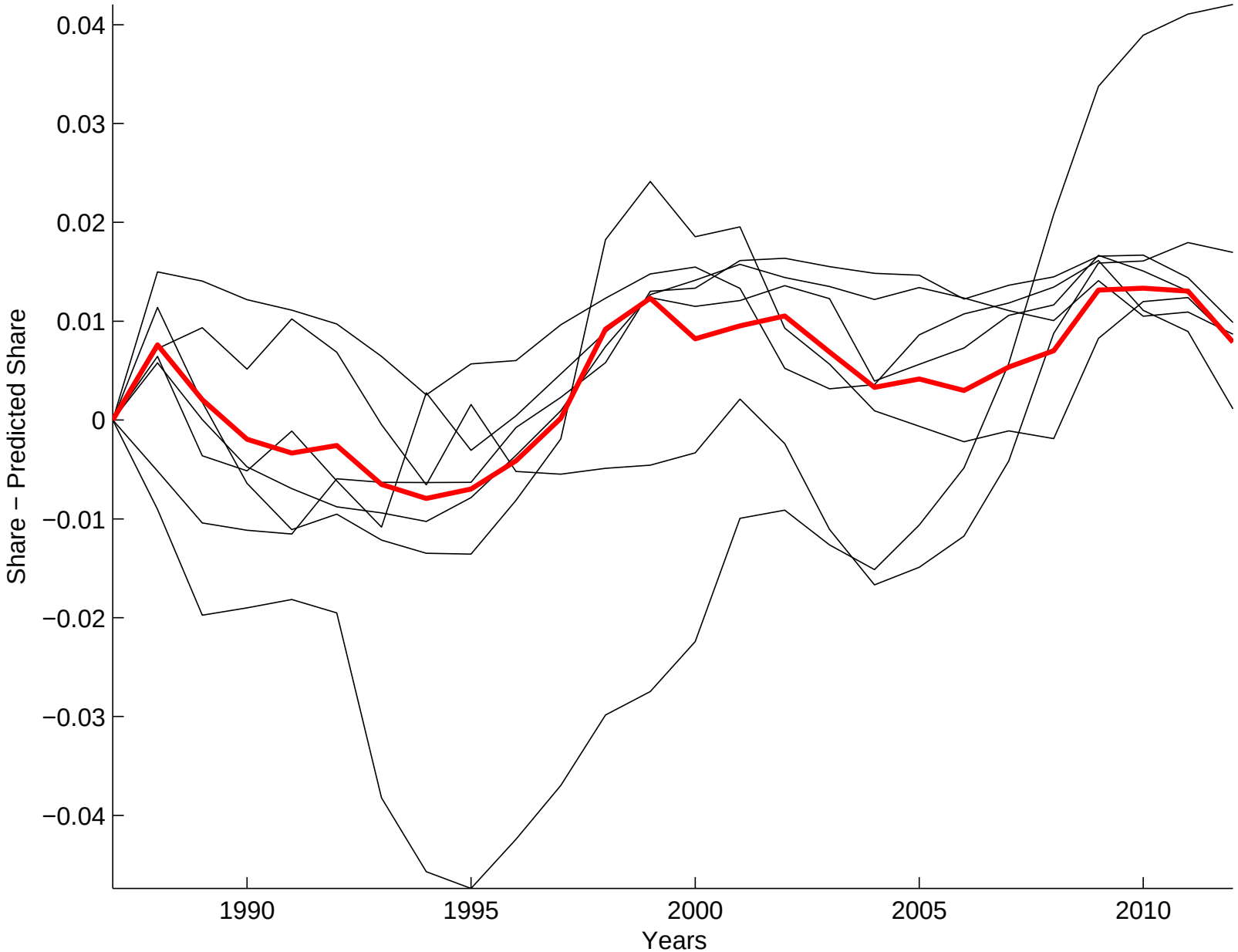
Startup employment share by state



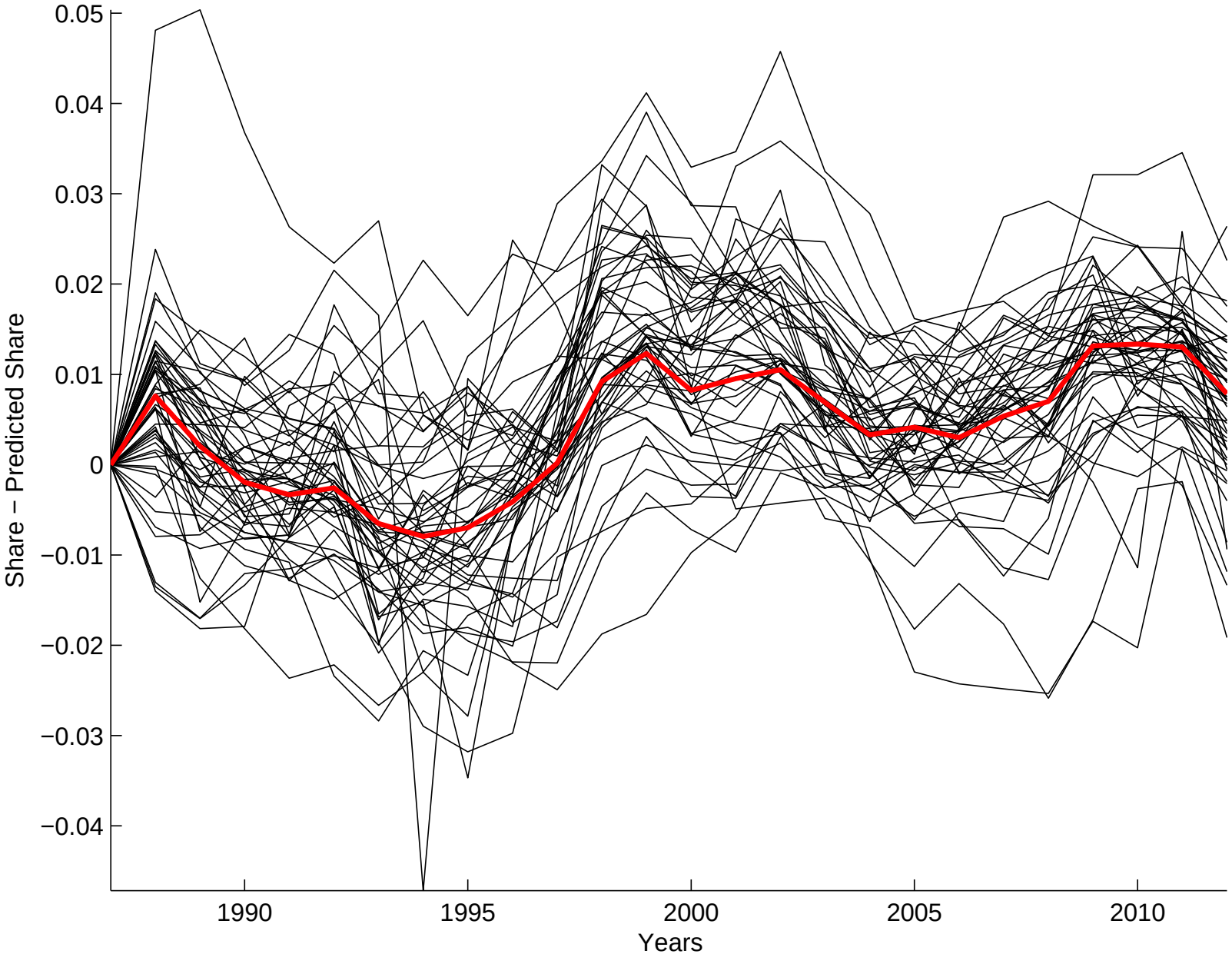
Predicted mature share 1980 to 2012



Prediction error for each sector

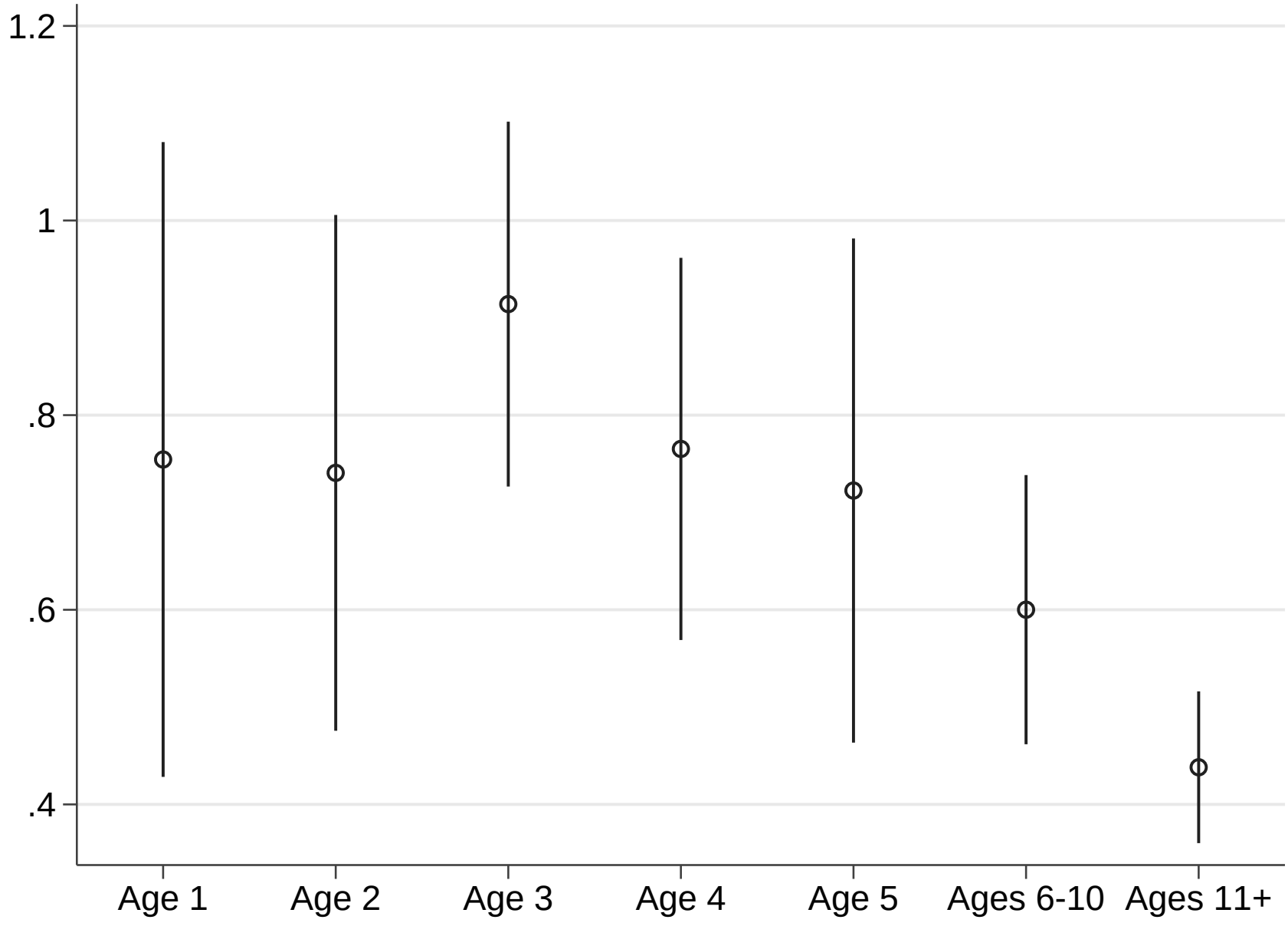


Prediction error for each state



Young includes trend decline in startup employment contribution

Estimated growth rate β by detailed age group



Estimated cyclical sensitivity of g_t^a

	(1)	(2)	(3)	(4)
	A. Young Firms (Ages 1 to 10)			
$\hat{\beta}^y$	0.984^{***}	0.965^{***}	0.717^{***}	0.723^{***}
	(0.337)	(0.337)	(0.0716)	(0.0662)
R^2	0.24	0.82	0.68	0.75
N	26	78	1,326	3,946
	B. Mature Firms (Ages 11+)			
$\hat{\beta}^m$	0.546^{**}	0.541^{**}	0.438^{***}	0.434^{***}
	(0.218)	(0.219)	(0.0388)	(0.0379)
R^2	0.18	0.69	0.71	0.76
N	26	78	1,326	3,978
Size FE	-	Yes	-	Yes
Year FE	-	-	Yes	Yes
State FE	-	-	Yes	Yes
Years	1987-2012	1987-2012	1987-2012	1987-2012

Estimated β^a using change in personal income

	(1)	(2)	(3)	(4)
	A. Young Firms (Ages 1 to 10)			
$\hat{\beta}^y$	0.984^{***}	0.965^{***}	0.717^{***}	0.723^{***}
	(0.337)	(0.337)	(0.0716)	(0.0662)
R^2	0.24	0.82	0.68	0.75
N	26	78	1,326	3,946
	B. Mature Firms (Ages 11+)			
$\hat{\beta}^m$	0.546^{**}	0.541^{**}	0.438^{***}	0.434^{***}
	(0.218)	(0.219)	(0.0388)	(0.0379)
R^2	0.18	0.69	0.71	0.76
N	26	78	1,326	3,978
Size FE	-	Yes	-	Yes
Year FE	-	-	Yes	Yes
State FE	-	-	Yes	Yes
Years	1987-2012	1987-2012	1987-2012	1987-2012

Sensitivities β^a are invariant to shifts in age distribution

We let

$$\beta_t^a = \bar{\beta}^a + \beta_\lambda t$$

and estimate

$$g_{st}^a = \bar{g}^a + \psi_s^a + \lambda_t^a + \bar{\beta}^a Z_{st} + \beta_\lambda^a t \times Z_{ts} + \varepsilon_{ts}^a$$

using incumbent growth rates g_t^a and detrended startup growth g_t^s

Find little evidence of $\beta_\lambda \neq 0$ for startup and young β. Some downward drift for old because of changing composition of 11+

Trend change in g_t^a Trend change in g_t^s

Estimated trend component of β_t^a

	(1)	(2)	(3)	(4)
	Young Firms		Mature Firms	
Linear Trend $\hat{\beta}_\lambda^a$	0.001	-0.003	-0.010**	-0.010**
	(0.010)	(0.008)	(0.004)	(0.004)
N	1,326	3,946	1,326	3,978
R^2	0.67	0.75	0.71	0.76
Years	1987-2012	1987-2012	1987-2012	1987-2012
Size FE	-	Yes	-	Yes
Sector FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes

Estimated trend component of β_t^s

	(1)	(2)
Linear Trend $\hat{\beta}_\lambda^s$	-0.08	-0.05
	(0.07)	(0.05)
N	1,428	1,428
R^2	0.297	0.297
Years	1980-2007	1980-2007
Detrending	Linear	HP

Evolution of aggregate employment: **cyclical component**

The cyclical component of employment growth

$$g_t^{cyc} = (s_{t-1}\beta^s + (1-\omega_{t-1})\beta^y + \omega_{t-1}\beta^m)Z_t$$

- s_{t-1} has been $\downarrow$ while ω_{t-1} has been $\uparrow$
- $|\beta^s| > |\beta^y| > |\beta^m|$

$\longrightarrow$ *Decoupling*: smaller response of E to Z.

Evolution of aggregate employment: **trend component**

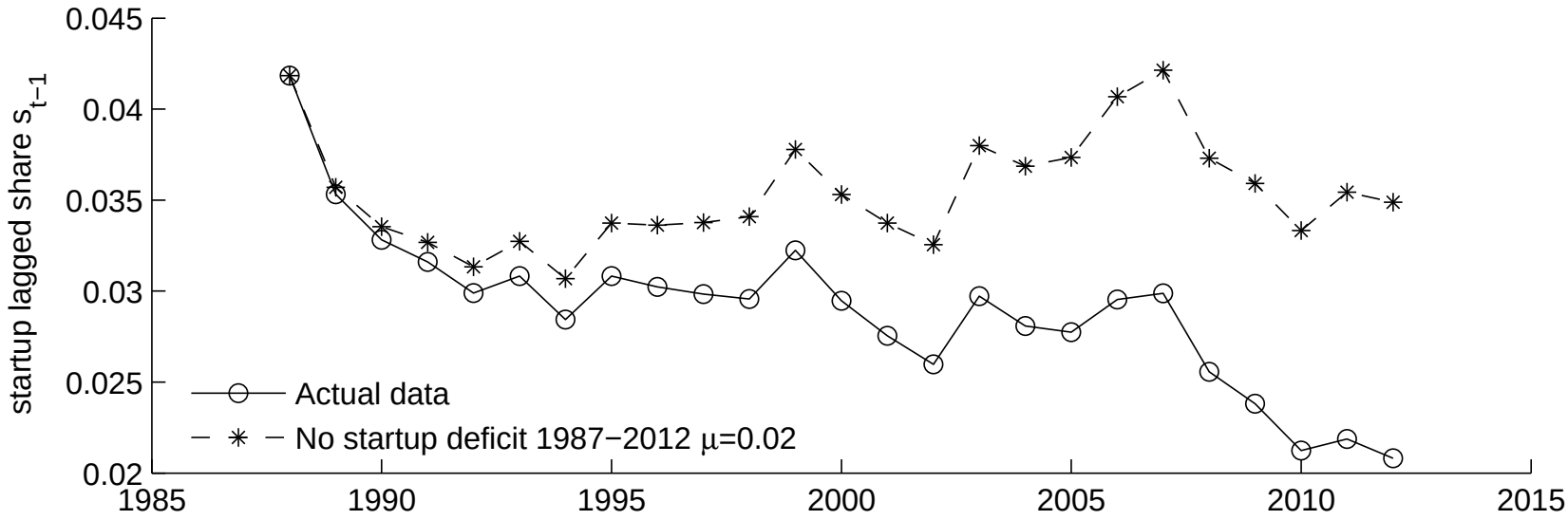
Trend component of employment growth

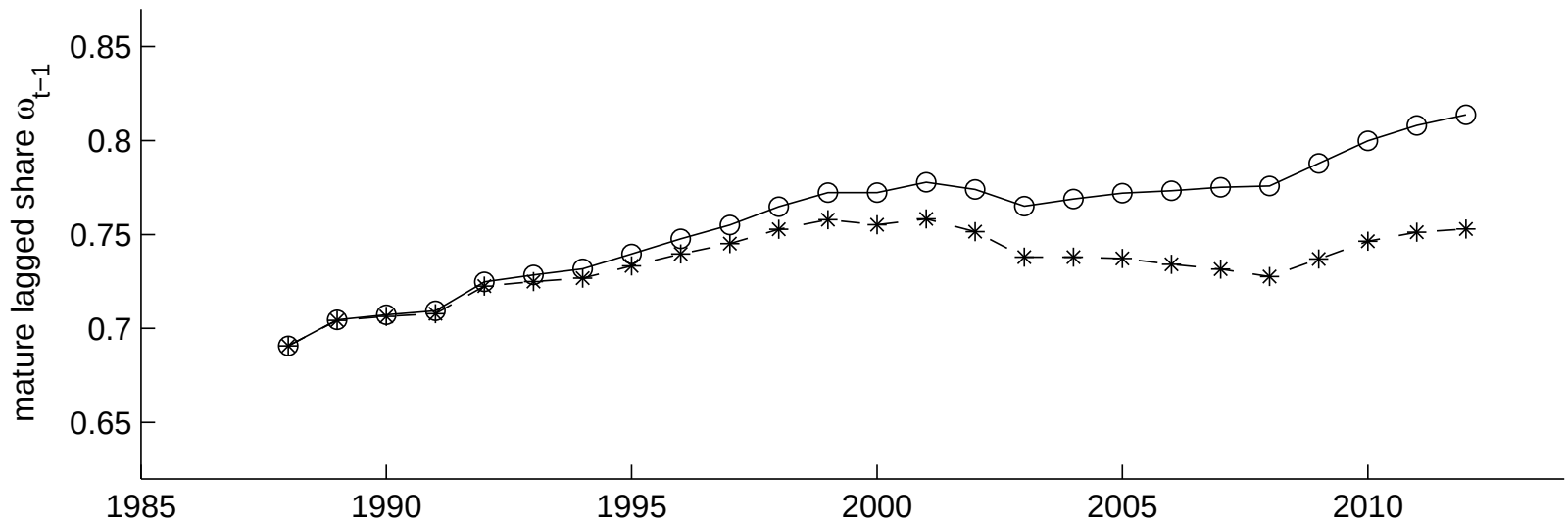
$$g_t^{trend} = s_{t-1}(1+\mu_t^s) + (1-\omega_{t-1})\bar{g}^y + \omega_{t-1}\bar{g}^m$$

- $\bar{g}^m > \bar{g}^y$ and $\omega_t \uparrow$
- Both μ_t^s and $s_{t-1} \downarrow$

$\longrightarrow$ *Lower growth rate*: decline in $s_{t-1}(1+\mu_t^s)$ dominates

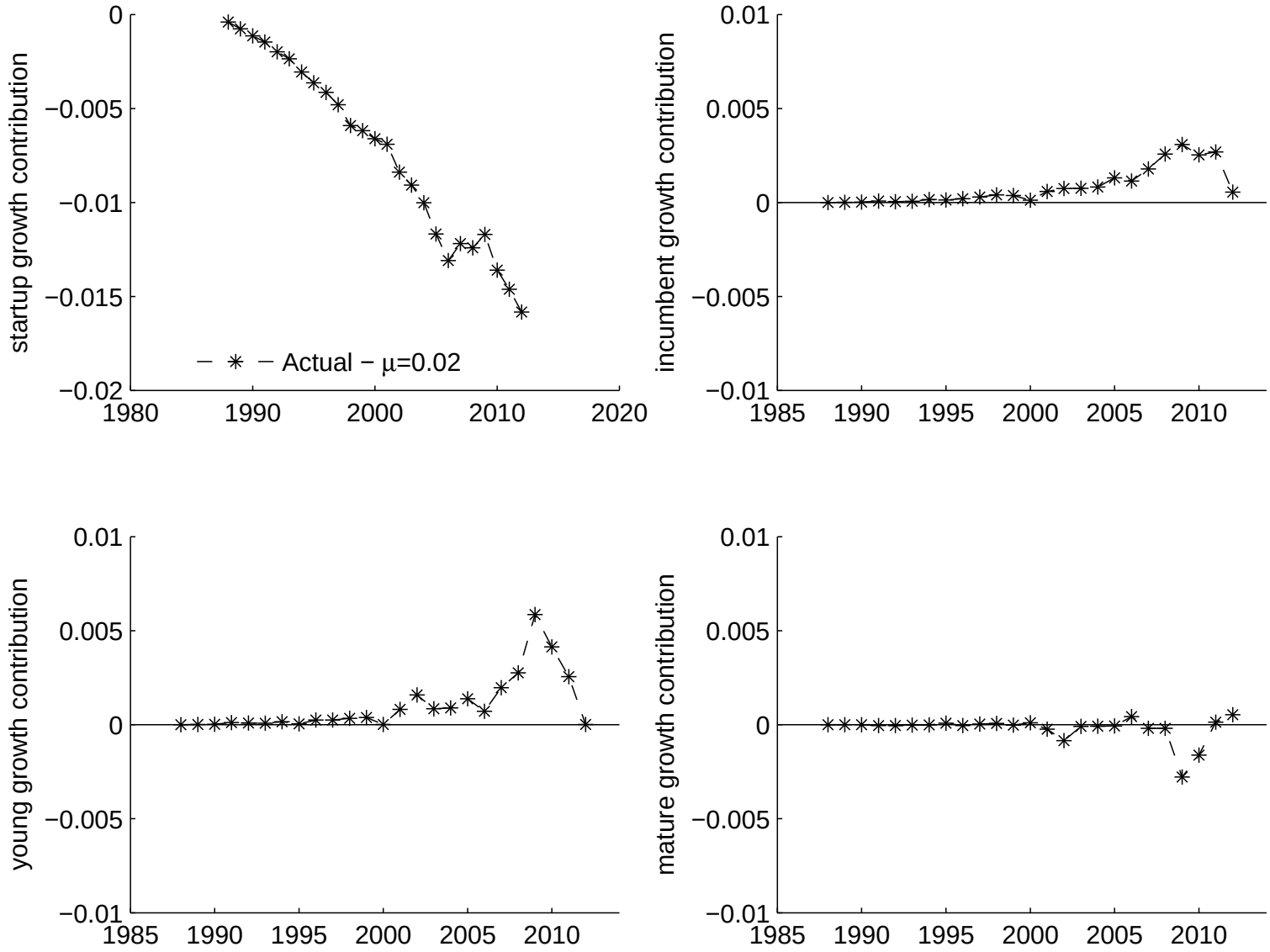
Cumulating effects of startup deficit in s_{t-1} and ω_{t-1}



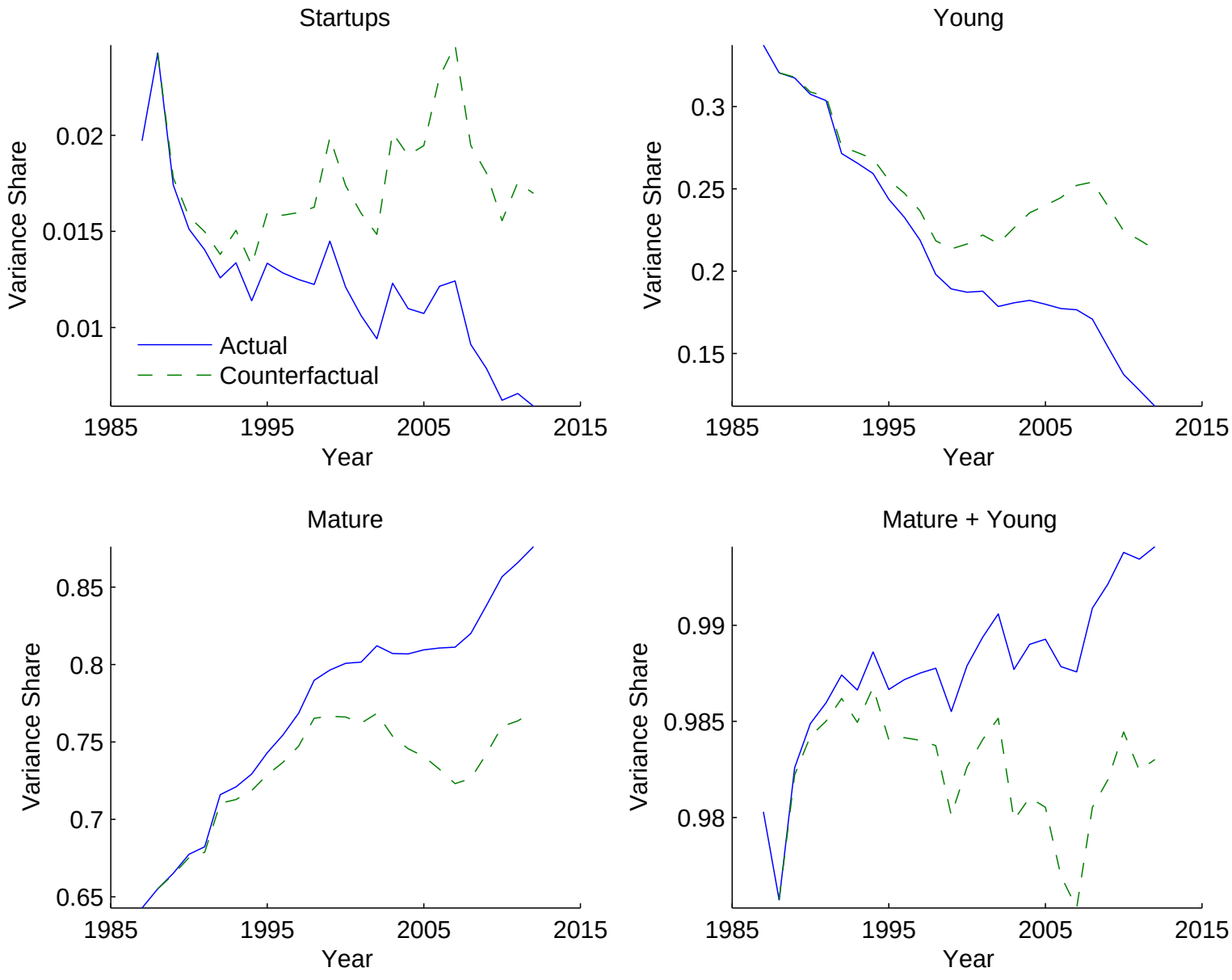


Differences in employment growth

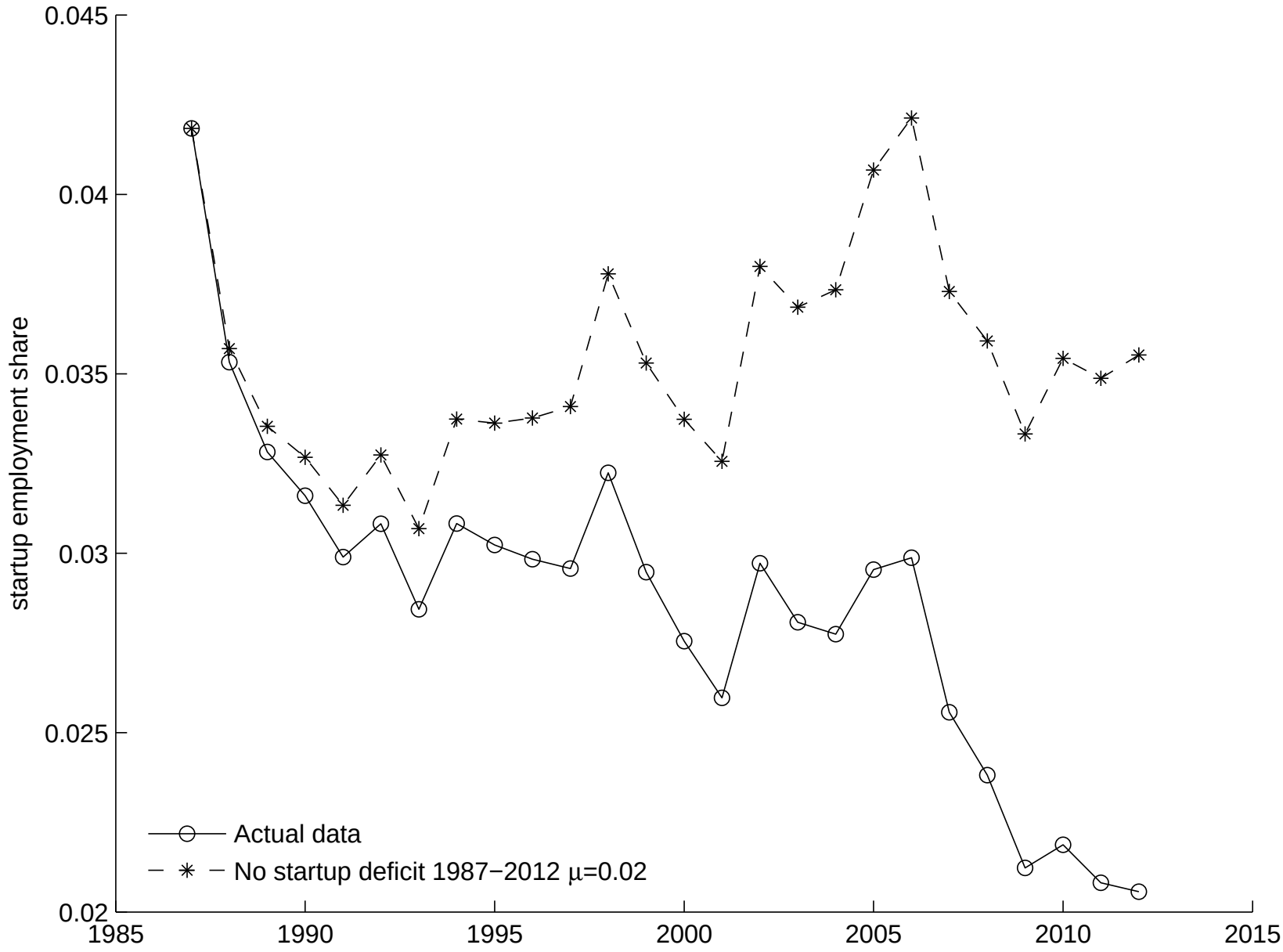
Actual - counterfactual



Variance decomposition by age group



Startup employment shares



Mature employment shares