The Growth of the Low-Skill Service Jobs and the Polarization of the US Labor Market

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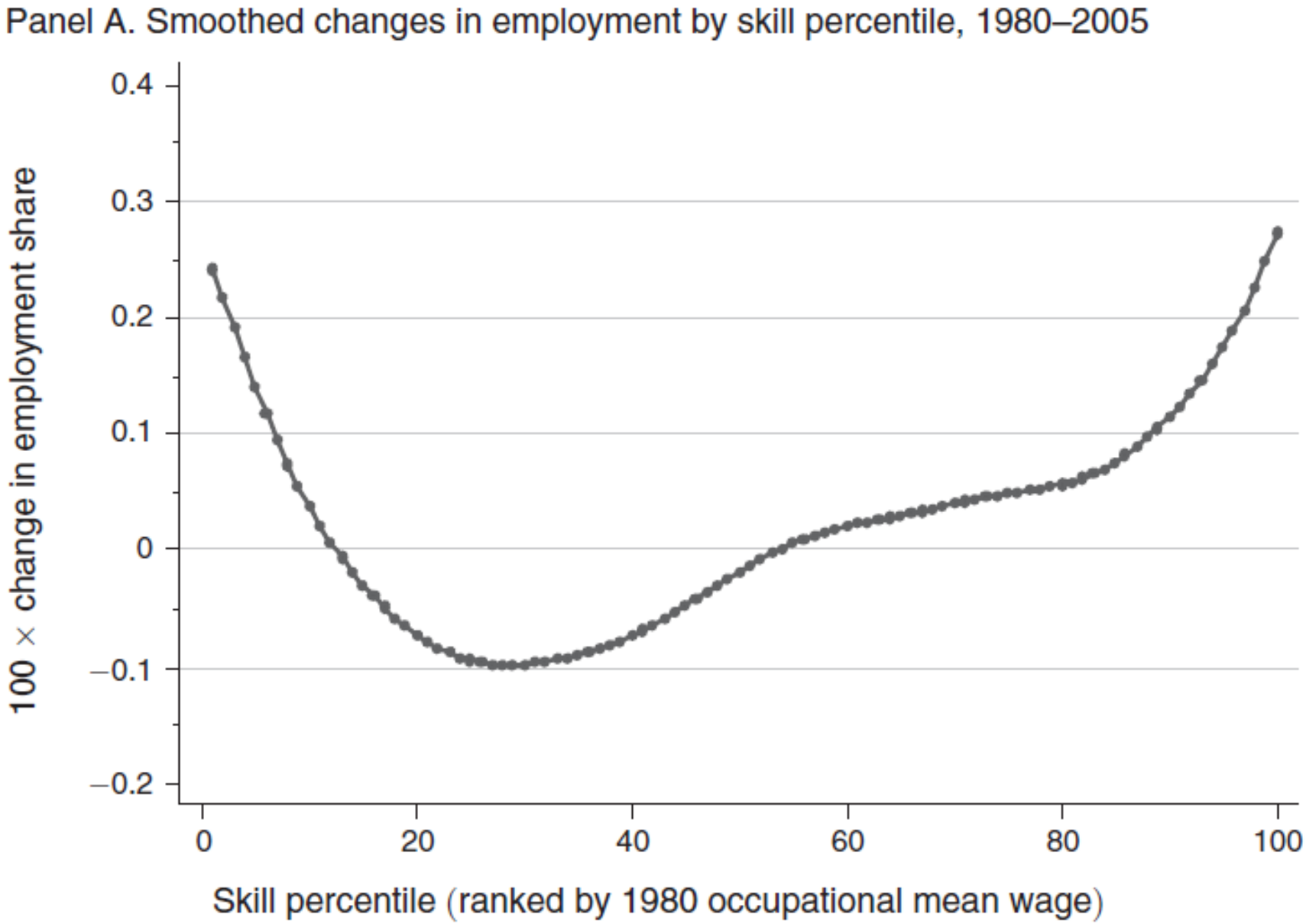
Motivation 1: Polarization in Employment



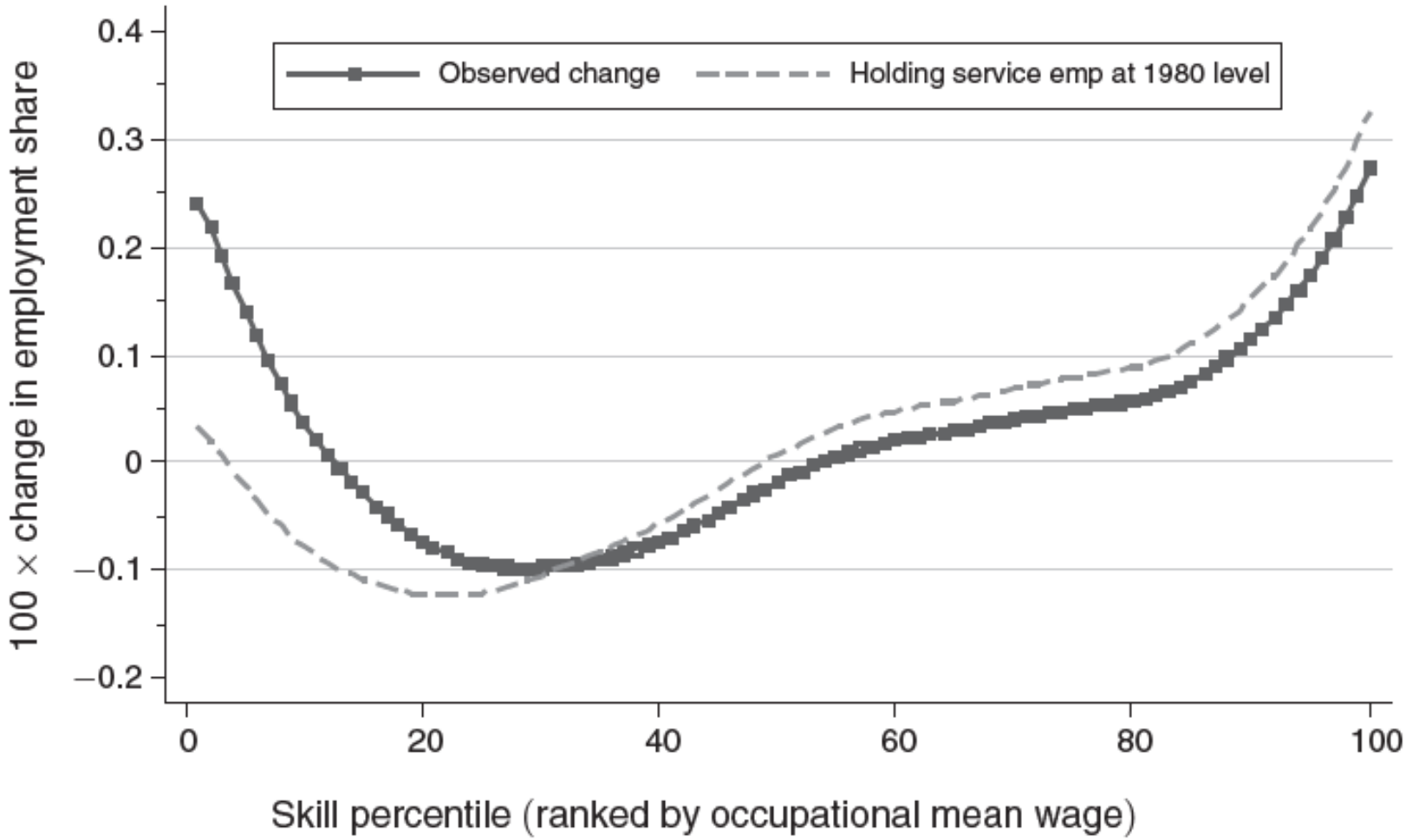
Motivation 2: Polarization in Wages

What can explain the observed patterns?

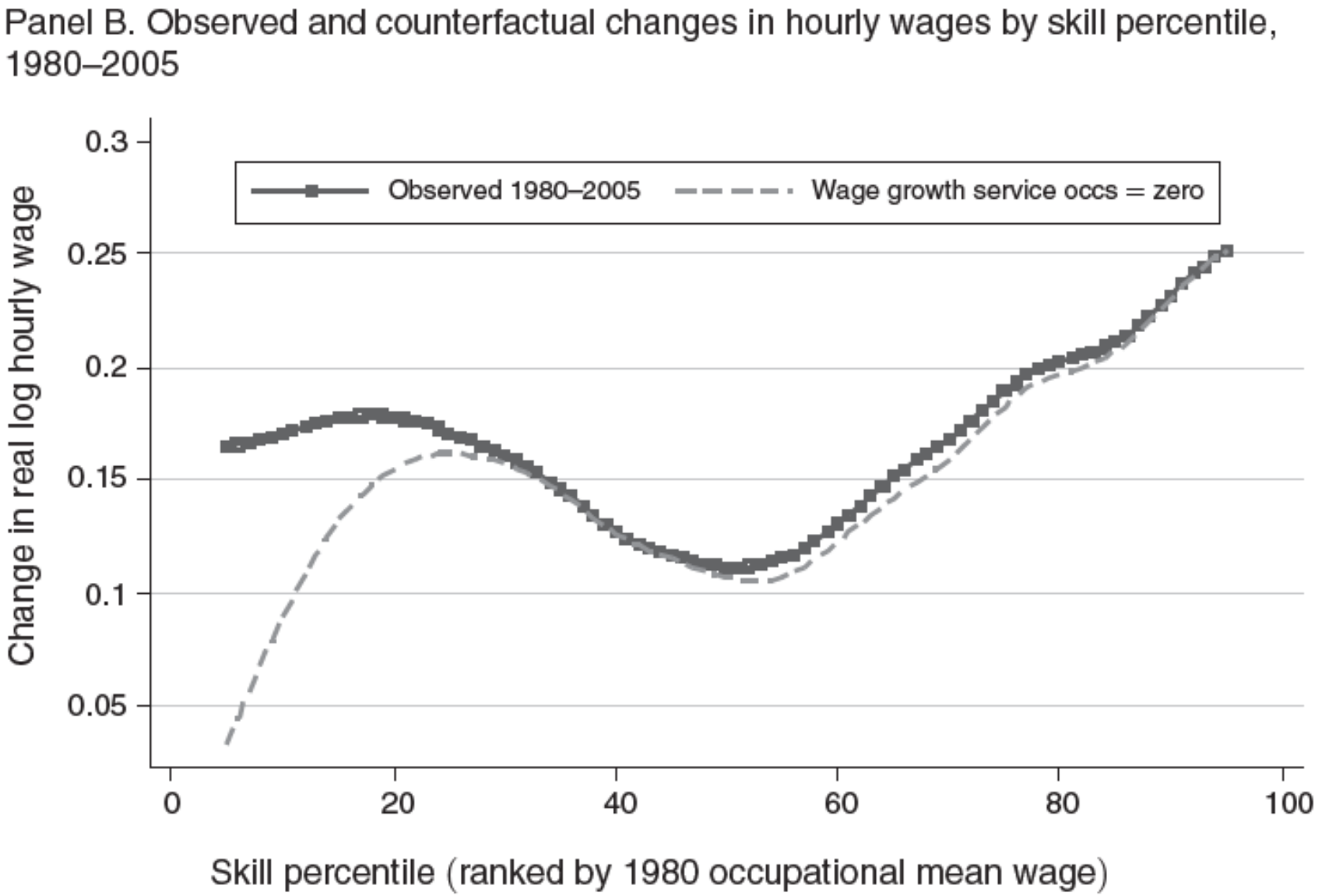
- Canonical SBTC model cannot account for observed nonlinearities
- Need a new theory to explain observed patterns
- Start from additional stylized facts related to polarization

Employment Polarization and Services

Panel A. Observed and counterfactual changes in employment by skill percentile, 1980–2005



Wage Polarization and Services



This Paper

Claim

- Understanding employment/wage developments in services key for understanding overall polarization

Hypothesis

- polarization = consumer preferences $\times$ technological change
- preferences: variety over specialization – goods and services complementary in consumption
- technology: non-neutrality focused on routine, codifiable jobs

Contribution

- develop task based GE model to study these mechanisms
- test predictions on detailed US local labor markets

Outline

- Model
- Data
- Results

Model: environment

- variant of the Acemoglu and Autor (2011) model
- 2 sectors, goods g and services s
- 2 types of workers: high- and low-skilled
- 4 factors of production:
  - computer capital K, providing routine task services
  - abstract labor, supplied by high-skilled labor
  - routine labor, supplied by low-skilled labor
  - manual labor, supplied by low-skilled labor
- Labor productivity
  - low-skilled labor homogeneous in producing L_m
  - low-skilled labor *heterogeneous* in producing L_r
  - low-skilled routine efficiency $\eta \sim F(\eta)$. Assume $f(\eta) = e^{-\eta}$
- low-skilled workers supply routine labor iff $w_r(t)\eta \geq w_m(t)$

Model 2: production technology

- Production of goods

$$Y_g = L_a^{1-\beta}[(\alpha_r L_r)^\mu + (\alpha_k K)^\mu]^{\beta/\mu}$$

  - *production elasticity* between K and L_r is $\sigma_r = 1/(1-\mu)$

- Production of services

$$Y_s = \alpha_s L_m$$

  - $\alpha_s \equiv 1 \rightarrow \alpha_r$ is relative efficiency of routine labor

- Production of capital

$$K = Y_k(t)e^{\delta t}/\theta$$

  - implies price $p_k(t) = Y_k/K = \theta e^{-\delta t}$ falling over time

Model 3: Discussion of complementarities

Role of computer capital

- complement to high-skilled sector in production of goods
- substitute for low-skilled labor in production of *goods*
- neutral wrt. low-skilled labor in service production

Closing the model

- consumer preferences: $u = (c_s^\rho + c_g^\rho)^{1/\rho}$, $\rho < 1$
- *consumption elasticity* given by $\sigma_c = 1/(1-\rho)$

Model 4: Polarization

- look at long-run ($t \to \infty$) allocation of low-skilled labor between goods and service production
- inequality measured by wage ratios w_m/w_r and w_a/w_m.

Result 1
If consumption elasticity σ_c is larger than production elasticity σ_r, then low-skilled wages in goods sector will fall relative to low-skilled wages in the service sector inducing employment reallocation and polarization.

Result 2
If, in addition, goods and services are at least weak complements in consumption ($\sigma_c \leq 1$), then w_m converges to w_a, leading to wage polarization.

Model 5: Spatial Equilibrium Sketch

- extend framework to multi-regional setting with regions $j \in 1, ..., J$
- regions are heterogeneous in skilled-labor intensity of production β_j
- high-skilled labor fully mobile, low-skilled labor immobile
- high-skilled real wage changes through interaction between declining capital price and skill intensity of production
- therefore, real wage changes heterogeneous across regions

Model 6: Testable Predictions

For declining $p_k(t)$, a region j with lower β_j will experience

1. greater adoption of computer technology, i.e. greater reduction of L_r
2. greater reallocation of low-skilled labor from routine to manual/service occupations
3. wage polarization, i.e. over-proportional increase in w_a and w_m through complementarities between K and L_a and consumption complementarity between goods/services
4. larger net inflows of L_a, due to complementarities with K

Data Sources

- Census IPUMS for 1950, 1960,..., 2000 (1-5% of population)
- American Community Survey for 2005 (.5% of population)
- Sample: individuals aged 16–64 working in previous year
- Labor supply: # weeks worked $\times$ usual # hours/week
- Local labor market definition: Commuting Zones (CZ)
- MSAs not consistent over time, which precludes use for this paper

Routine Task Intensity (RTI) 1: Definition

- based on *Dictionary of Occupational Titles* (DOT)
- DOT categorizes occupations by task requirements
- range of tasks, w/ different levels of intensity $T \in (1, 10)$
- From these tasks, construct routine, abstract and manual task content
  - $T^R = 1/2 \times$('set limits/tolerances/standards' + 'finger dexterity')
  - $T^M =$ 'eye-hand-foot coordination'
  - $T^A = 1/2 \times$('direction control/planning' + 'GED math')
- RTI by occupation k is defined as

$$RTI_k = \ln(T^R_{k,1980}) - \ln(T^M_{k,1980}) - \ln(T^A_{k,1980})$$

Routine Task Intensity (RTI) 2: Occupational Groups

TABLE 2—TASK INTENSITY OF MAJOR OCCUPATION GROUPS

	RTI index	Abstract tasks	Routine tasks	Manual tasks
Managers/prof/tech/finance/public safety	−	+	−	−
Production/craft	+	+	+	−
Transport/construct/mech/mining/farm	−	−	+	+
Machine operators/assemblers	+	−	+	+
Clerical/retail sales	+	−	+	−
Service occupations	−	−	−	+

Notes: The table indicates whether the average task value in occupation group is larger (+) or smaller (−) than the task average across all occupations. Shaded fields indicate the largest task value for each occupation group.

Routine Task Intensity (RTI) 3: by wage ranking

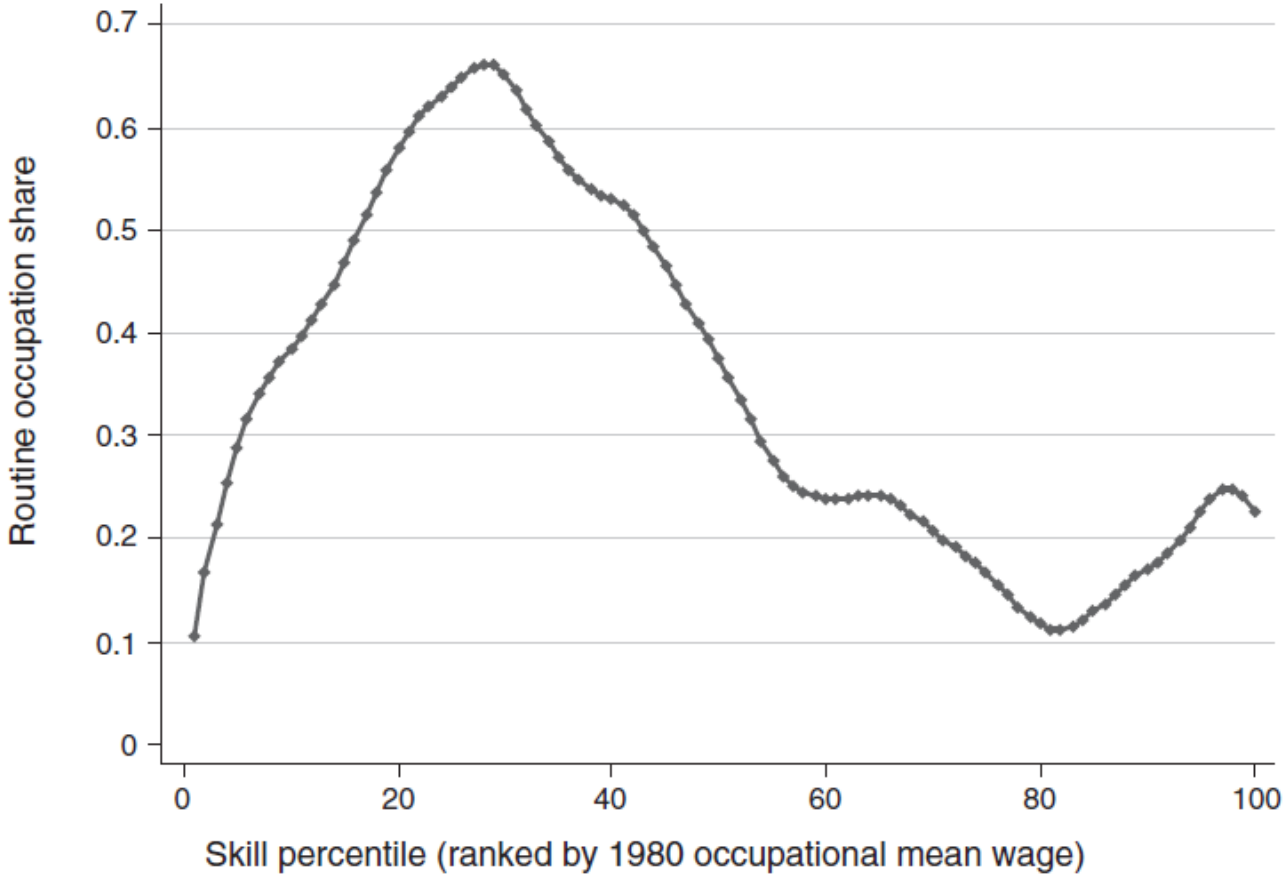
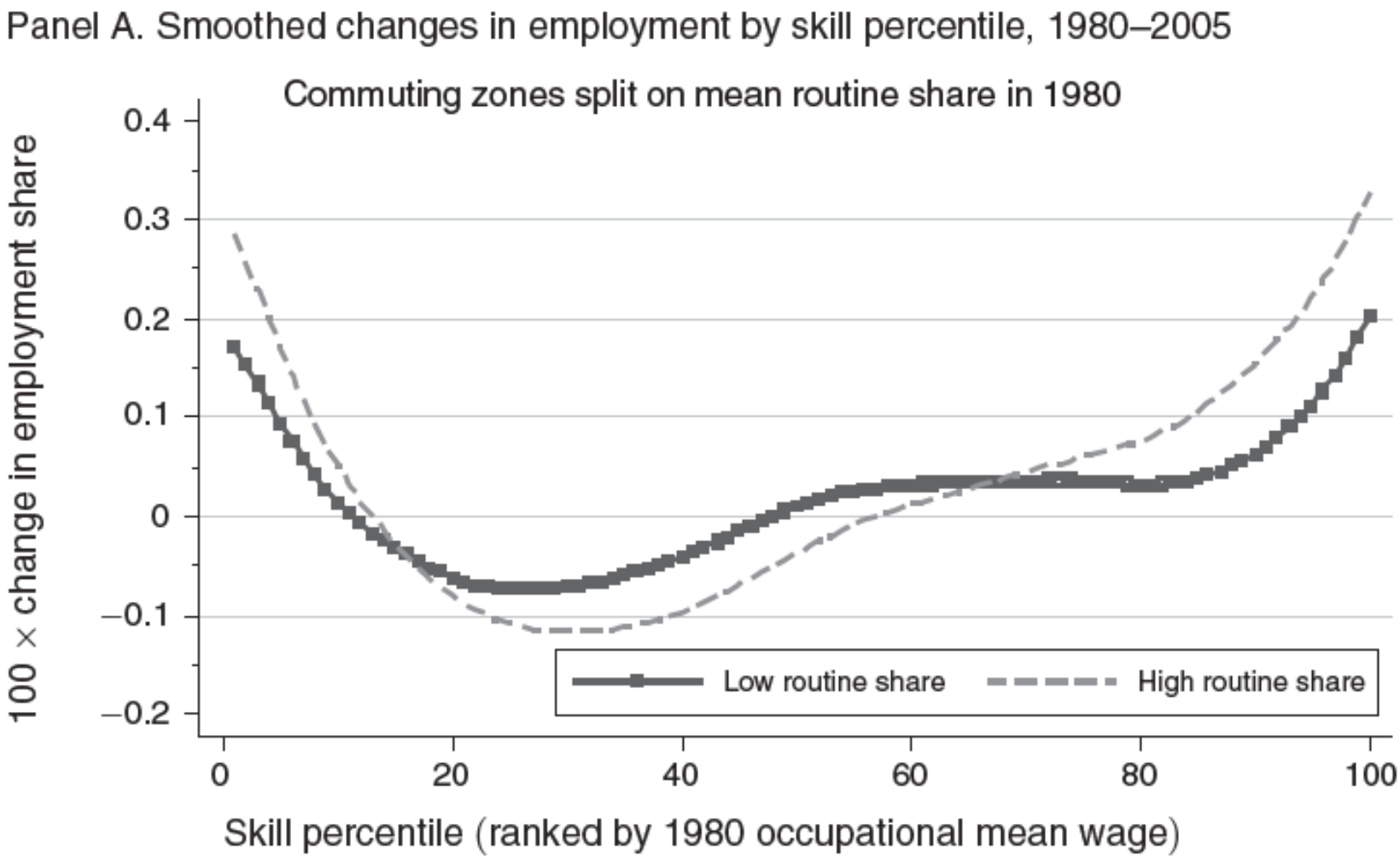


FIGURE 4. SHARE OF ROUTINE OCCUPATIONS BY OCCUPATIONAL SKILL PERCENTILE

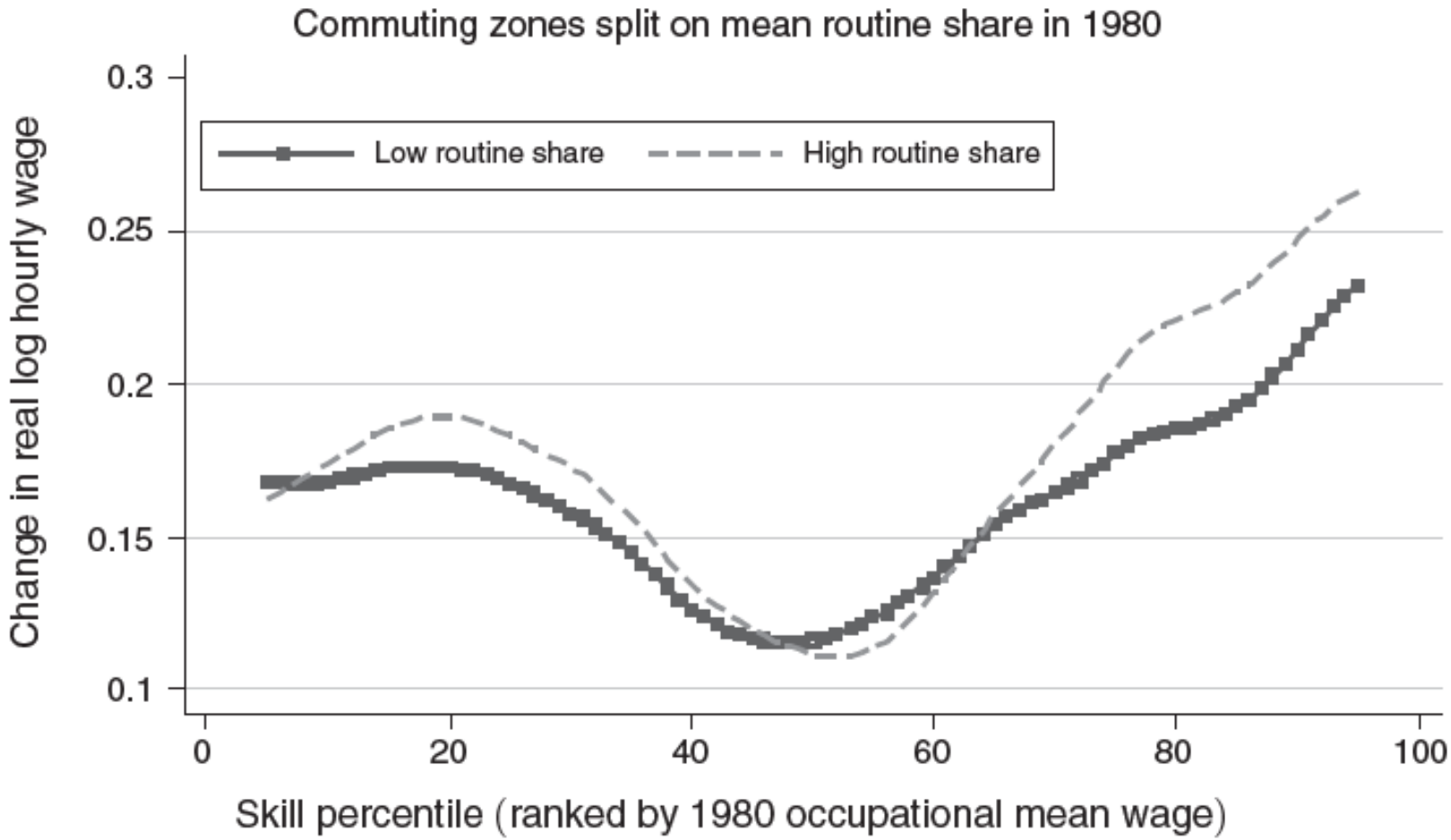
- *routine-intensive occupations:* top third of RTI in 1980
- routine employment share RSH: share of employment in routine-intensive occupations

Results 1: High Routine Share ⇒ High Polarization



Results 1: High Routine Share ⇒ High Polarization

Panel B. Smoothed changes in real hourly wages by occupational skill percentile, 1980–2005

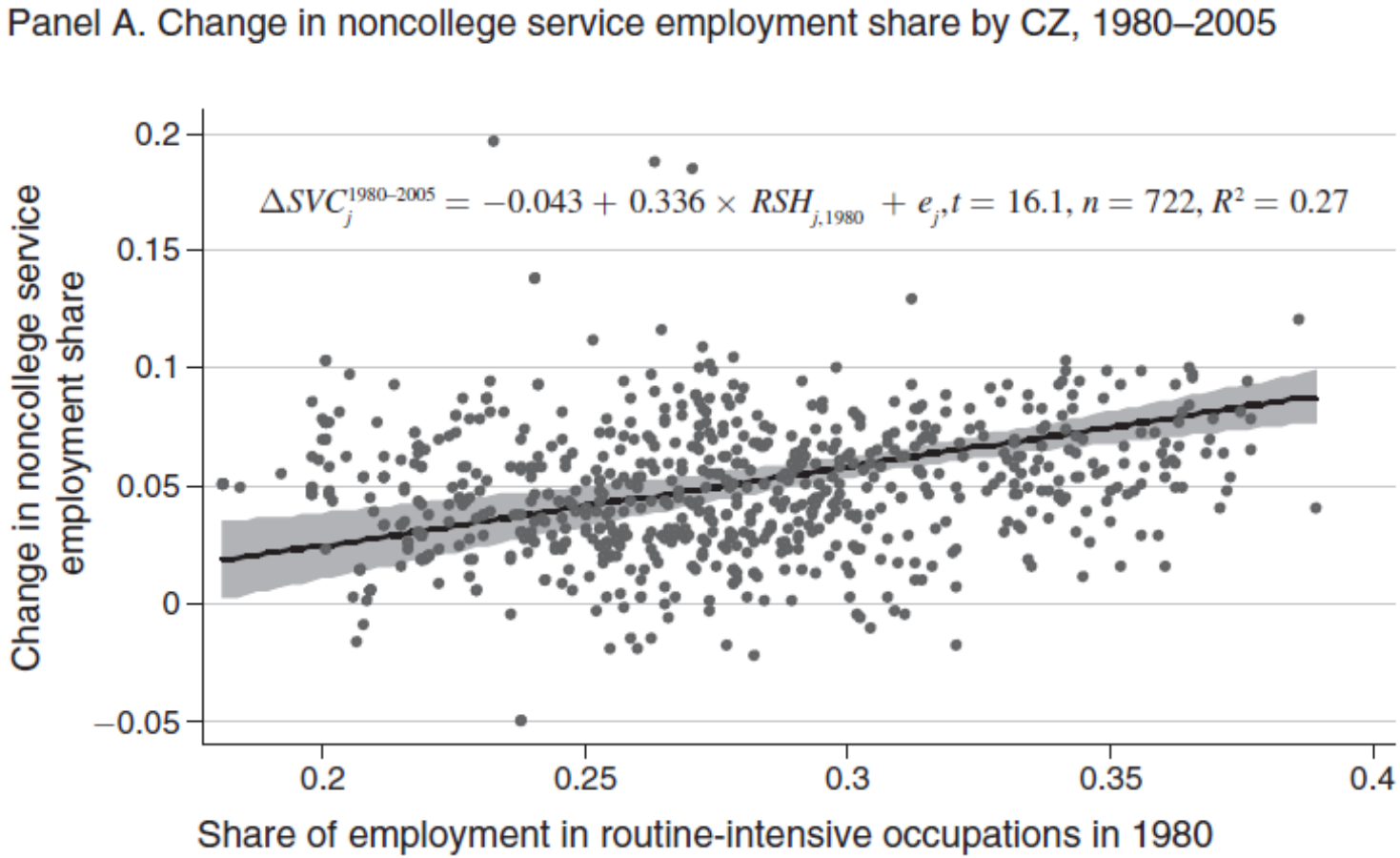


Results 2: PC adoption and routine labor displacement

TABLE 3—COMPUTER ADOPTION AND TASK SPECIALIZATION WITHIN COMMUTING ZONES, 1980–2005
(Dependent variables: 10 × annual change in adjusted PCs per employee, 10 × annual change in employment share of routine occupations)

	(1)	(2)	(3)
Panel A. Δ Adjusted PCs per employee, 1980–2000			
	1980–1990	1990–2000	1980–2000
Share of routine occs$_{-1}$	0.695***	0.490***	0.619***
	(0.061)	(0.076)	(0.044)
R^2	0.577	0.332	0.385
Panel B. Δ Share routine occupations, 1980–2005			
	All workers	College	Noncollege
Share of routine occs$_{-1}$	−0.254***	−0.153***	−0.295***
	(0.023)	(0.024)	(0.018)
R^2	0.433	0.206	0.429

Results 3: Growth of Service Sector Employment



- robust to replacing RSH_{1980} w/ RSH at start of decade
- robust to controls (labor supply/demand factors)
- robust to instrumenting initial β_j w/ β_j in 1950

Results 4: Alternative explanations

TABLE 6—PREDICTING CHANGES IN SERVICE OCCUPATION EMPLOYMENT WITH MEASURES OF OFFSHORABILITY, INCOME EFFECTS, AND SUBSTITUTION EFFECTS

(*Dependent variable*: *10 × annual change in share of noncollege employment in service occupations, 1980–2005*)

	A. Offshoring		B. Income effects		C. Substitution effects			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Share of routine occs$_{-1}$		0.164***		0.205***		0.209***	0.215***	0.181***
		(0.044)		(0.037)		(0.037)	(0.038)	(0.035)
Offshorability index$_{-1}$	0.007	−0.005						
	(0.005)	(0.006)						
Δ ln(P90) weekly wage			0.013	−0.017				
			(0.015)	(0.015)				
Δ Average annual hours per college grad/2,080					−0.111***	−0.127***		
					(0.032)	(0.031)		
Δ Average annual hours per male college grad/2,080							−0.069***	
							(0.018)	
Δ Average annual hours per female college grad/2,080								−0.083***
								(0.024)
R^2	0.17	0.18	0.17	0.17	0.19	0.19	0.18	0.19

Literature