

The Evolving U.S. Occupational Structure

Enghin Atalay

Phai Phongthientham

Sebastian Sotelo

Daniel Tannenbuam

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Motivation

Labor income inequality has increased over the last several decades.

- ▶ 90-10 ratio of real earnings \uparrow 27 log points between 1960 and 2000.
- ▶ The task approach to labor market:
 - ▶ Better, cheaper computers
 - ▶ Easier offshoring
 - ▶ \Rightarrow Changes in the demand for particular (routine, offshorable) tasks
- ▶ To assess the task-based model, past work combines:
 - ▶ occupations' task content, measured at given point in time (e.g., O*NET)
 - ▶ shifts in employment shares across occupations
- ▶ Occupations rich in routine tasks have shrunk, those centered on non-routine interactive tasks have grown.

Research Questions

- ▶ Are there within-occupations trends in the tasks which workers perform?
- ▶ Can within-occupation changes in task content help explain increasing earnings inequality?

New Measurements

- ▶ Construct a new data set drawing from the text of newspaper vacancy postings:
 - ▶ 4.2 million ads
 - ▶ 1960-2000
 - ▶ New York Times, Wall Street Journal, Boston Globe.

Main Results

Consistent with previous research:

- ▶ Routine tasks have declined markedly while nonroutine tasks have become increasingly more important

New, compared to previous research:

- ▶ Large share of aggregate changes in task content occurred within occupations, rather than between.
- ▶ Use changes in the task composition of occupations to account for inequality between 1960 and 2000
 - ▶ Using equilibrium methods: account for 20 log point increase in 90-10 earnings inequality
 - ▶ Using statistical decomposition: account for changes of a similar magnitude

Literature

Task approach: Autor, Levy, Murnane (2003), Autor and Dorn (2013), Acemoglu and Autor (2011), Goos, Manning, Salomons (2014), Spitz-Oener (2006), Firpo, Fortin, Lemieux (2014), Becker and Muendler (2015), and many other recent studies.

- ▶ Contribution: Time-varying task measurements

On-line vacancy postings: Deming and Kahn (2016), Hershbein and Kahn (2016), Marinescu and Wolthoff (2016), Modestino, Shoag, Ballance (2016).

- ▶ Contribution: Long-run measurements (pre-internet era)

Comparative advantage and occupational choice: Heckman and Sedlaceck (1985), Heckman and Scheinkman (1987), Burstein, Morales, Vogel (2015), and Hsieh, Hurst, Jones, Klenow (2016)

- ▶ Contribution: embed task bundling in a quantitative, GE model of sorting

Roadmap

1. Turning job ads into data
2. Trends in task-related words
3. Wrap up:
 - ▶ Rest of the paper: Tasks and the earnings distribution
 - ▶ Other work.

Processing newspaper text files

ProQuest processes images of newspaper pages into text files (OCR)

- ▶ Job ads from New York Times (1960-2000), Wall Street Journal (1960-1998), and Boston Globe (1960-1983)
- ▶ Steps to construct the data set:
 1. Distinguish vacancy postings from other advertisements
 2. Find the boundaries between vacancy postings
 3. Identify the ad's job title \Rightarrow SOC code
 4. Extract task-related information

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Display Ad 133 -- No Title

Boston Globe (1960-1985); Nov 4, 1979; ProQuest Historical Newspapers: The Boston Globe
pg. E51

BUSINESS HELP

Grow with us at Fidelity!

Call 367-8960
Sunday, 3PM-7PM

or Monday thru Friday, 9AM-5PM

Fidelity is a leading financial services organization which is experiencing rapid growth through continued innovation and diversification. If you are a highly motivated person who takes pride in your work and the company you work for, consider a career with Fidelity.

MUTUAL FUNDS CLERKS

Individuals with 1-2 years' mutual funds transfer experience to process Keogh/IRA accounts and adjustments.

PAYMENTS CLERKS

Varied responsibilities processing new account applications and payments.

SHAREHOLDER SERVICES CLERKS

Interesting positions offering diversified responsibilities, processing and maintaining client accounts.

PERSONNEL CLERK

Interesting and diversified position for a well organized individual with strong record-keeping abilities. To process personnel changes and maintain insurance records. Typing 50 wpm.

ACCOUNTING CLERKS

With A/R, A/P experience. To reconcile account activity in our Data Control Department. Experience with computerized systems a plus.

STATISTICAL TYPIST

To work in our Word Processing Department. Typing 55 wpm minimum.

MAIL CLERKS

Monday thru Friday, 12:30 AM-6:30 AM

Diversified responsibilities in our Customer Services Department involving sorting and distribution of mail, message logs, mail processing.

SECRETARIES: Investments, Sales, Brokerage

Interesting opportunities in dynamic and rapidly growing environments with diversified responsibilities. Typing 50 wpm.

Fidelity provides an outstanding fringe benefits package for our employees. We are located in downtown Boston, convenient to the MBTA, Government Center and Quincy Market.

We encourage you to grow with Fidelity
and share in our success.

an equal opportunity employer M/F

BUSINESS HELP



A SPECIAL TIME FOR SPECIAL PEOPLE.

SPECIAL INTERVIEWING HOURS
WEDNESDAY, NOVEMBER 7th & 14th
5:30 P.M. to 7:30 P.M.
100 FEDERAL STREET, BOSTON

SPECIAL CONVENIENCE

Now, you can explore the world of The First at your convenience. If you're looking for a position that's really special, look to The First.

And, since our Wednesday interviews are held at our 100 Federal Street, Boston location, you'll find The First easy to get to in a convenient downtown location. You'll be close to all the action, shopping, and Quincy Market.

SPECIAL BENEFITS

In addition to excellent starting salaries, The First provides you with a generous package of insurance and vacation benefits. Plus additional special benefits, such as free checking, reduced rates on auto loans and master charge for eligible employees.

SPECIAL JOBS

SECRETARIES

When you join The First, you have a choice. If you have shorthand skills or the equivalent, you can explore and work in all many job environments as you like. Move from branch to branch or department to department, until you find the spot that suits you best.

SPECIAL PEOPLE

The world at The First is a warm, congenial world. Friendly people working together making your day just a little bit brighter.

SPECIAL FUTURES

When you join The First, you can rest assured that there are great things in store for you. Here you'll find tremendous advancement opportunities that are limited only by your own talents and ambitions.

Be someone special in a special position. Explore The First. And discover why we could be very special to you.

If you are interested in any of these positions, visit our employment center on the 11th floor of 100 Federal Street in Boston from 9 AM-4 PM, Monday through Friday, or Wednesday evening for the next two weeks November 7th and 14th from 5:30-7:30 PM. Or call 434-8444. If it's more convenient, visit our Morrissey Blvd. employment center, 40 Morrissey Blvd., Dorchester, weekdays from 9 AM-4 PM, or call 434-6618.

Processing newspaper text files - Unprocessed

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rapid growth through continued innovation and
diversification If you are highly motivated person who takes
pride in your work and the company you work for consider
career with Fidelity \n MUTUAL FUNDS CLERKS \n
Individuals with 1-2 years funds transfer experience to
process Keogh IRA accounts and adjustments \n PAYMENTS
CLERKS \n Varied les processing new account applications and
payments \n StI nt flt ner fr nlr ct tfl \n Mnirk \n and
maintaining client \n strong record-keeping 50 wpm \n Data
Control Department \n sorting and \n Brokerage \n
environments with \n benefits package for our Boston
convenient to the Market \n gr WilnliE lU5lty \n success \n
-1 l?Q1.a1 ol P-1Sllv MPloV \n Fidelit \n Group \n
82 DEVONSHIRE STREET BOSTON MA 02109 \n 111 \n -1 \n
TERMINAL OPERATOR \n
Position involves typing policy related information Into
computer terminal No previous computer experience required
Typing 5055 wpm Excellent benefits plus work Incentive
program in addition to starting salary of S150-165.
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Note: Snippet of the raw text from Boston Globe, 11/4/79,
Display Ad #133

Processing newspaper text files - Processed

rapid growth through continued innovation and diversification If you are highly motivated person who takes pride in your work and the company you work for consider career with Fidelity \n

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PAYMENTS CLERKS \n

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Mappings to Spitz-Oener (2006) classification

nonroutine analytic analyze, analyzing, design, designing, devising rule, evaluate, evaluating, interpreting rule, plan, planning, research, researching, sketch, sketching

nonroutine interactive advertise, advertising, advise, advising, buying, coordinate, coordinating, entertain, entertaining, lobby, lobbying, managing, negotiate, negotiating, organize, organizing, presentation, presentations, presenting, purchase, sell, selling, teaching

nonroutine manual accommodate, accommodating, accommodation, renovate, renovating, repair, repairing, restore, restoring, serving

routine cognitive bookkeeping, calculate, calculating, correcting, corrections, measurement, measuring

routine manual control, controlling, equip, equipment, equipping, operate, operating

*we include for each of these words, synonyms based on machine-learning text similarity

Relative importance of within versus between occupations

Question: What fraction of changes in aggregate use of task h are driven by changes in tasks within occupations?

- ▶ Aggregate use of task h at time t is $\bar{T}_{ht} = \sum_j \theta_{jt} \tilde{T}_{hj}$
- ▶ We decompose aggregate changes:

$$\bar{T}_{ht} = \bar{T}_{h,1960} + \underbrace{\sum_j \theta_{j,1960} \cdot (\tilde{T}_{hjt} - \tilde{T}_{hj,1960})}_{\text{"within"}} + \underbrace{\sum_j (\theta_{jt} - \theta_{j,1960}) \tilde{T}_{hjt}}_{\text{"between"}}$$

where:

- ▶ \tilde{T}_{hjt} is mentions of task h per thousand ad words for occupation j in year t .
- ▶ θ_{jt} is the share of employment in occupation j at time t (Census data)

Trends in keyword frequencies

Nonroutine Analytic	Total	Between	Within	Within Share
1960 Level	3.43			
1960-2000 Growth	2.61 (0.14)	0.20 (0.15)	2.41 (0.23)	0.92 (0.06)
Nonroutine Interactive				
1960 Level	4.95			
1960-2000 Growth	2.61 (0.15)	0.37 (0.16)	2.24 (0.27)	0.86 (0.06)
Routine Cognitive				
1960 Level	1.23			
1960-2000 Growth	-0.47 (0.06)	-0.14 (0.15)	-0.33 (0.20)	0.70 (0.41)
Routine Manual				
1960 Level	0.78			
1960-2000 Growth	-0.72 (0.03)	-0.02 (0.02)	-0.70 (0.03)	0.97 (0.03)

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The relation between task changes and inequality

1. Quantitative GE model of sorting and comparative advantage
 - ▶ Workers of different skill types have different comparative advantages in producing nonroutine vs. routine tasks.
 - ▶ Changes in the demand for nonroutine vs. routine tasks alter
 - ▶ the occupations which workers sort into, their earnings, overall earnings inequality.
 - ▶ Counterfactual exercise: Use within-occupation changes in tasks as a measure for changes in the demand for tasks \Rightarrow 23 p.p. increase in 90-10 earnings inequality.
2. Decompositions via recentered influence function regressions
 - ▶ Analogue of Oaxaca-Blinder decomposition for distributional statistics other than the mean.
 - ▶ Our measures of tasks account for a 22 p.p. increase in 90-10 inequality between 1960 and 2000...
 - ▶ ... and a more modest 5 p.p. increase when using measures which are fixed within occupations throughout the sample.

Conclusion

This paper

- ▶ New measurements of changes in task content of jobs over time; publicly available
- ▶ “Within-occupation” changes are at least as important as “between-occupation” changes in accounting for aggregate changes in job content
- ▶ Reduced-form and model-based decompositions suggest our task measures account for about a 20 percentage point increase in the 90-10 ratio

Related work

- ▶ adoption of technology ("New Technologies and the Labor Market")
- ▶ gender targeting in vacancy postings