The Quiet Revolution and the Decline of Routine Jobs

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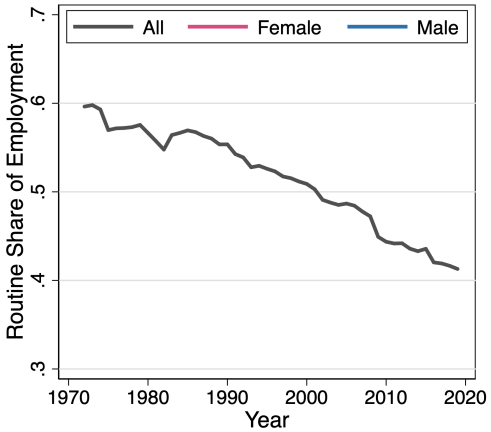
Motivation



Data: CPS ASEC. Classification: Cortes et al. (2020).

Examples

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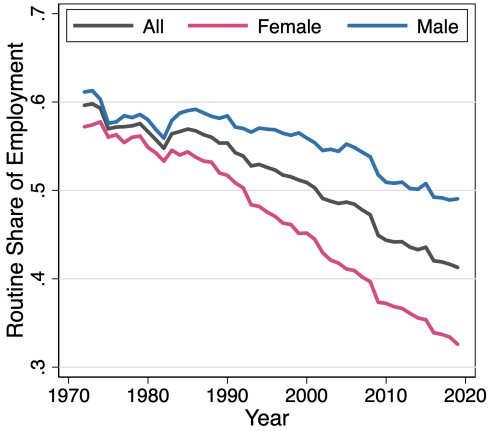

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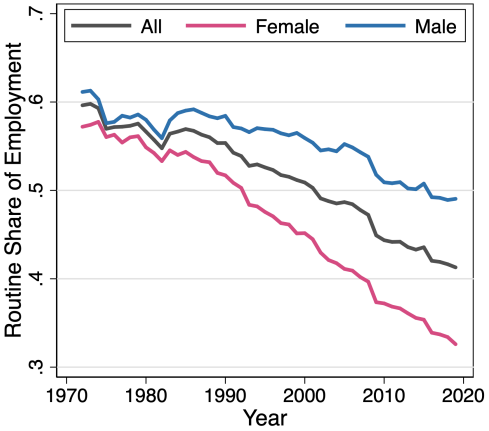

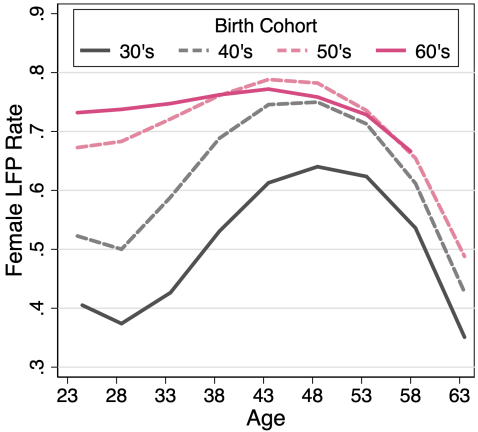

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Examples

This Paper

Question: What is the contribution of the Quiet Revolution to the decline of routine jobs?

- Focus on routine and non-routine white-collar jobs Trend

Descriptive Evidence: Correlation between women's expected LFP/norms and occupation

Method: Develop and calibrate an equilibrium model of the labor market featuring

1. Quiet Revolution ⋆
2. Gender wage gap
3. Automation

Results: Quiet Revolution explains 20% of female emp. shift from R to NR 1970-2000

- QR combined with falling wage gap explains 75%

Model: Labor Supply

- Equal populations of men and women
- Skill heterogeneity ϵ across routine R, non-routine N, and manual M, plus home H
- Invest in education h and pick occupation j when young, before 3 working periods
- Earn w per efficiency unit ℓ (women additionally face "tax" τ as in Hsieh et al. (2019))
- Consume labor income each period, no savings

$$V(\epsilon, w) = \max_{j \in \{R,N,M,H\}} \left(\max_{h \geq 0} \sum_{t=a}^{a+2} \beta^{t-a} \log \left(w_{j,t} \underbrace{\ell_{j,t}(\epsilon_j, h)}_{\text{Efficiency Units}} \right) - \underbrace{\frac{h^{\zeta}}{\phi_j}}_{\text{Education Cost}} \right)$$

Model: Intermittency and Skill Dynamics

1. With probability $\rho \geq 0$, women stay at home in second period of life ("child-rearing")
   - Quiet Revolution modeled as a decline in ρ

2. Efficiency units ℓ_j evolve over life cycle
   - Returns to experience (γ), depreciation (δ), education requirements (ϕ)
   - Differ across occupations $\Rightarrow$ strongest in non-routine professions

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Key Mechanism: Intermittency ($\rho > 0$) reduces female labor in "dynamic" occupations

Prefer j over k if: $$\frac{\epsilon_j}{\epsilon_k} \geq \chi_{jk} = \underbrace{\frac{w_k(1-\tau_k)}{w_j(1-\tau_j)}}_{\text{Wages}} \times \underbrace{\left(\frac{\gamma_k}{\gamma_j}\right)^{\frac{3-3\rho}{3-\rho}}}_{\text{Experience}} \times \underbrace{\left(\frac{1-\delta_k}{1-\delta_j}\right)^{\frac{\rho}{3-\rho}}}_{\text{Depreciation}} \times \underbrace{e^{\frac{\eta(\zeta-1)}{\zeta}\left(h^*(\phi_k,\rho)-h^*(\phi_j,\rho)\right)}}_{\text{Education Investment}}$$

Model: Labor Demand

A representative firm hires labor (M, R, N) and produces a final consumption good:

$$Y = \left((A_M M)^{\frac{\sigma-1}{\sigma}} + S^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \rightarrow \text{Final good}$$

$$S = \left(N^{\frac{\lambda-1}{\lambda}} + \tilde{R}^{\frac{\lambda-1}{\lambda}} \right)^{\frac{\lambda}{\lambda-1}} \rightarrow \text{White-collar services } (\lambda < 1)$$

$$\tilde{R} = \left(R^{\frac{\psi-1}{\psi}} + C^{\frac{\psi-1}{\psi}} \right)^{\frac{\psi}{\psi-1}} \rightarrow \text{Routine tasks } (\psi > 1)$$

Automation:

- Firm buys C at constant marginal cost p_C in terms of S
- p_C falls over time → improvement in automation

Calibration

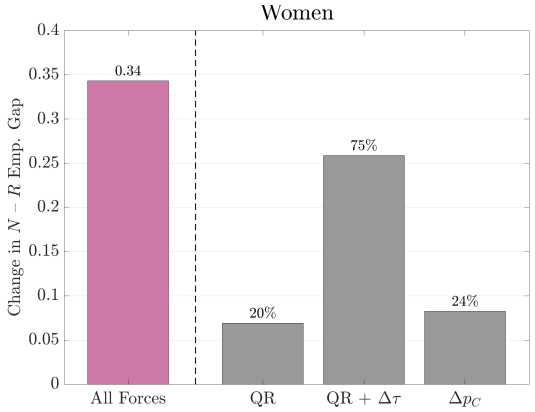
Data: U.S. Census (1970 & 2000) and National Longitudinal Survey of Young Women

Procedure:

1. Labor supply parameters
   - Intermittency (ρ): Variability of FLFP over life-cycle FLFP
   - Skill dynamics: Life-cycle income growth & schooling by occupation Skill Dynamics
   - Gender wage discrimination (τ's): Selection-adjusted earnings of young
   - Skill distribution: Correlation between expected LFP and occupation Indirect Inference

2. Technology parameters
   - Exogenously set EOS from the literature
   - p_C, A_M calibrated so allocation & mean income satisfy equilibrium

Decomposition of Widening Gap between N and R Employment Shares



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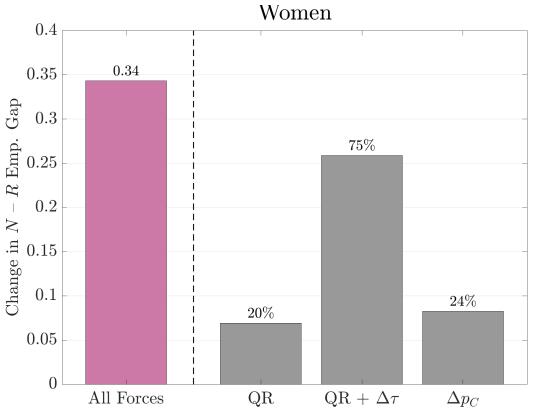

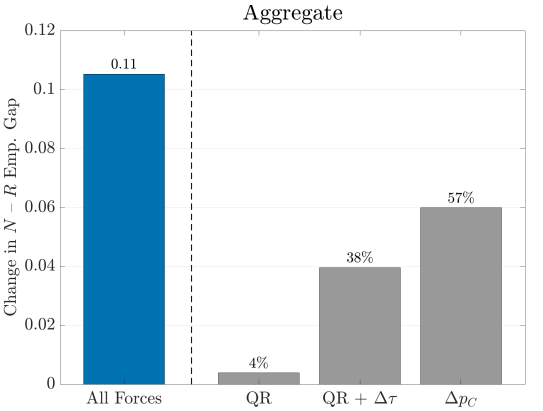

Compare QR & $\Delta\tau$

Conclusion

- Investigate the role of changes in female labor supply in the decline of routine jobs
- Through quantitative model, find substantial role for non-technological factors
  - Quiet Revolution explains 20% of shift of female employment from R to N
  - Combined with falling discrimination: explains 75% (38% aggregate)
- Suggests “purely technology” interpretation of this phenomenon is not full story
- New questions:
  - Did female labor supply changes generate incentive to innovate and automate?

Appendix

Occupation Classification Examples

	Routine	Non-Routine
Cognitive	Cashiers, Secretaries, Retail Salespeople, Office Administrators, Typists, Proofreaders	Chief Executives, Computer Scientists, Lawyers, Economists, Physicians and Surgeons
Manual	Mining Machine Operators, Iron and Steel Workers, Engine Assemblers, Rail Transportation Workers	Cleaners, Chefs, Hairdressers, Janitors, Medical Aides, Waiters, Childcare Workers

Example occupation titles from the 2010 Census Occupational Classification, grouped into categories according to Cortes et al. (2020).

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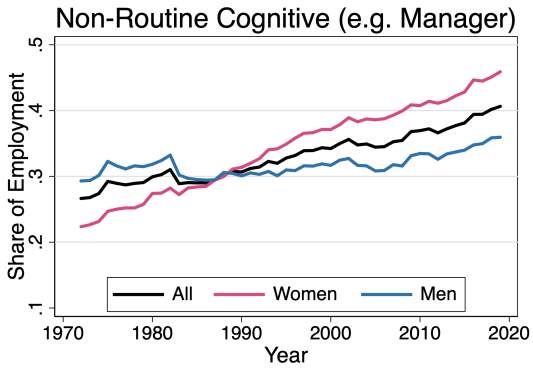
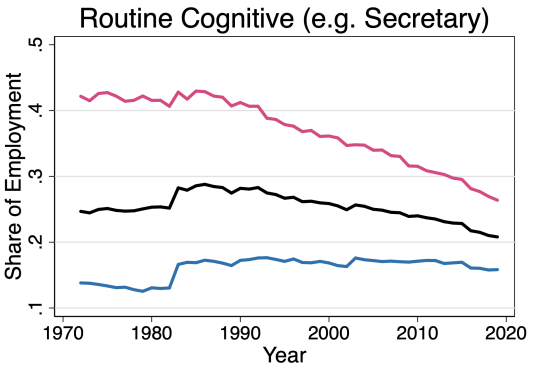
Non-Routine and Routine Cognitive Employment Trends





Source: CPS ASEC. Classification: Cortes et al. (2020).

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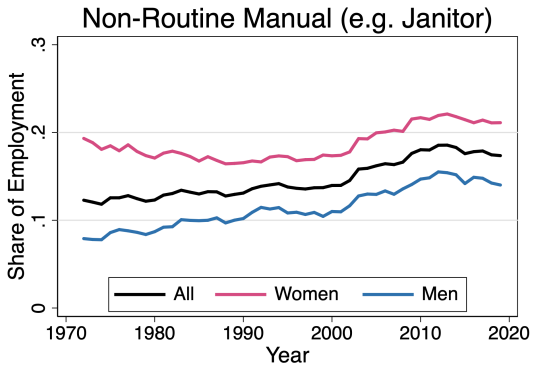
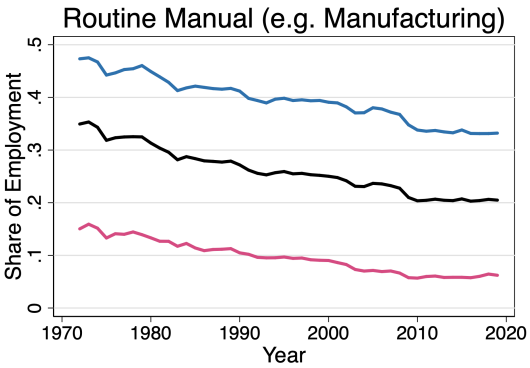
Similar Trends in Manual Jobs





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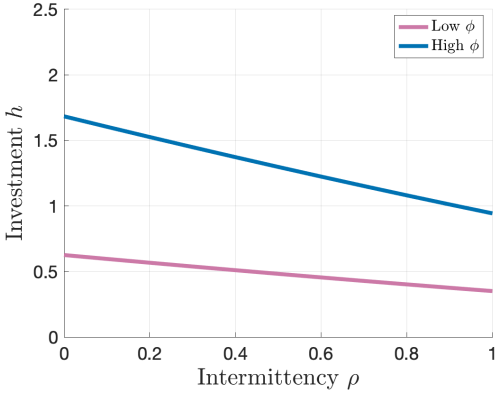
Intermittency Reduces Human Capital Investment

If invest h in education, then $\ell_j = \epsilon_j e^{\eta h}$

$$h^*(\phi_j, \rho) = \left((3-\rho)\eta\phi_j\right)^{\frac{1}{\zeta-1}}$$

- $\phi_j > 0$: Education requirement
- $\eta > 0$: Mincer return to education
- $\zeta > 1$: the convexity of disutility from h



When women face $\rho > 0$, they invest less than men in a given occupation j

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Variability of FLFP Over Life Cycle

Model Age	Life Phase	Mean Age	$25^{th} - 75^{th}$ Pctile	FLFP
1	Never married	25	19 – 27	0.65
2	Married w. kid ≤ 5	31	26 – 36	0.30
3	Other Married	41	34 – 49	0.56

Source: 1970 Census

$$\rho = \frac{LFP_{1,3} - LFP_2}{LFP_{1,3}}$$

→ Share who enter market occ. but leave in period 2

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Intermittency and Skill Dynamics

- Returns to experience (γ): life-cycle income growth of men by occupation
- Depreciation (δ): life-cycle income growth of women by occupation

Occupation	Male Inc. Growth	Estimate of γ	Female Inc. Growth	Estimate of δ
N	1.51	1.23	1.05	0.43
R	1.30	1.14	0.99	0.27
M	1.12	1.06	0.99	0.20

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Innate Skill Distribution

Two parameters:

- Dispersion of Fréchet skills (θ)
- Parameter governing correlation b/t cognitive skills (routine and non-routine)

Calibrate using indirect inference:

- Calculate female employment shares in partial equilibrium under $\rho = 1$ and $\rho = 0$
- Difference matches NLS-YW regression

	M	R	N
Panel A: Model			
$\rho = 0$ Emp. Share	0.31	0.39	0.30
$\rho = 1$ Emp. Share	0.41	0.47	0.11
Difference	-0.11	-0.08	0.19
Panel B: Regression Coefficients			
Regression Coef.	-0.11	-0.08	0.19

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Why the Quiet Revolution Has Small Effect on Aggregate $N - R$ Emp.

Counterfactual	$\Delta\ N - R$ Gap	Women Sorting	Men Sorting	Continuity
QR	0.004	0.020	-0.011	-0.008
$\Delta\tau$	0.032	0.065	-0.035	–

- Both the QR and $\Delta\tau$ shift female employment toward non-routine
- Both the QR and $\Delta\tau$ crowd-out men from non-routine
- But the QR has additional effect via continuity
  - Mechncially increases share of workforce who are women

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