Occupation and Growing Wage Inequality in the United States, 1983-2002

PRC-Brown Bag

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	Presentation about
Contents	1 Pookaround
Background Occupation & Inequality	T. DACKYTUUTU
Theory Data Model	2. Fact Finding: What is the relation between occupation and wage Inequality?
Results Conclusion Appendix A	3. Causality Study: Why inequality is growing?
Appendix B	

Background Question

Contents	1. In
Background	Lloite
Inequality and Occupation	Unite
 Importance of Occupation 	
 Occpuation: New Attention 	
Occupation & Inequality	2 0
Theory	analy
Data	SOCIO
Model	
Results	3 D
Conclusion	wide
Appendix A	
Appendix B	

1. Inequality has been growing during last 25 years in the United States (as well as most other developed countries).

2. Occupation has been the single most important unit of analysis in the studies of stratification and inequality in sociology.

3. Relation between occupation and growing inequality is widely unknown.

Background Question

Occupation has been the single most important unit of analysis in sociology.

Contents

Background

- Inequality and Occupation
- Importance of Occupation
- Occpuation: New Attention

Occupation & Inequality

Theory

Data

Model

Results

Conclusion

Appendix A

- Marx
- Durkheim
- Conflict Theory: Wright (1984)
- Functional Theory: Status Attainment Theory
- Treiman Constancy (Hout 2003)

Background Question

A new attention on occupation in the studies of social stratification recently.

Background
 Inequality and Occupation
 Importance of Occupation
 Occpuation: New Attention
Occupation & Inequality
Theory
Data
Data
Model
Results
Conclusion
Appendix A
Appendix B

Contents

- Grusky and Sørensen (1998, AJS): Possible remedy of the ongoing retreat from class analysis → "Disaggregate structuration"
- Weeden (2002, AJS): Detail occupation is "a promising complement to individualistic explanations of earnings inequality."
- Grusky and Sørensen (1998, AJS): "Does disaggregation greatly increases the explanatory power of class models?"

Explanatory Power of Occupation on Wage



Appendix B

 $Wage_i = \alpha + \beta_j OCC_j + \varepsilon_i$ (Y-axis in graph is R^2)

3

Explanatory Power of Occupation on Wage

Contents



Growth of Hourly Wage Inequality



Between- & Within- Occupational Inequality

		Theil Index	% Δ fr 83-85	% Δ fr 90-92
Contents	1983-1985			
Background	Total	.16551		
Occupation & Inequality Explanation Power of Occupation 1 	Between	.06019		
Explanation Power of Occupation 2	Within	.10532		
Wage InequalityBetween Within Inequality	% of Within	(.636)		
Where Inequality is Growing Meanwage and Inequality	1990-1992			
Meanwage and mequality Social Scientists Mean Wage and Inequality	Total	.17450	.05432	
Summary: Occupation and Inequality	Between	.06576	.09254	
Theory	Within	.10874	.03247	
Data	% of Within	(.623)	(.380)	
Model	2000-2002			
Results	Total	.19762	.19401	.13249
	Between	.06974	.15866	.06052
Conclusion	Within	.12788	.21420	.17602
Appendix A	% of Within	(.647)	(.703)	(.828)
Appendix B				· - /

Where is Inequality Growing?

Contents

Background

Occupation & Inequality

- Explanation Power of Occupation 1
- Explanation Power of Occupation 2
- Wage Inequality
- Between Within Inequality
- Where Inequality is Growing
- Meanwage and Inequality
- Social Scientists
- Mean Wage and Inequality
- Summary: Occupation and Inequality

Theory

Data Model Results Conclusion

Appendix A

- No matter what is unit of measurement: Hourly Wage, Annual Income, Household Income.
- Everywhere: Universal Phenomenon
 - 1. No matter which industry
 - 2. No matter what educational level
 - 3. No matter which gender
 - 4. No matter which race
- Within Group Inequality > Between Group Inequality
- Different Inputs, but the Same Results?

Change of Mean Wage and Ineq. within Occ.

				Mean Wage		Total	
Contents			Decrease	No Change	Increase		
Background		Decrease	38	24	5	67	
Occupation & Inequality Explanation Power of Occupation 1 			(.123)	(.096)	(.011)	(.229)	
• Explanation Power of Occupation 2	Ineq-	No Change	49	63	34	146	
Wage InequalityBetween Within Inequality	uality		(.103)	(.088)	(.100)	(.291)	
Where Inequality is Growing		Increase	28	47	43	118	
 Meanwage and Inequality Social Scientists Mean Wage and Inequality 			(.059)	(.254)	(.167)	(.480)	
 Summary: Occupation and Inequality 	Total		115	134	82	331	
Theory			(.285)	(.438)	(.278)	(1.000)	
Data	(1) $INEQ_{jt} = \beta_{0j} + \beta_{1j}YEAR + \varepsilon_{jt}$ (331 regressions)						
	(2) $MEANWAGE_{jt} = \beta_{0j} + \beta_{1j}YEAR + \varepsilon_{jt}$ (331 regressions)						
Results	Decreas	Decrease or Increase: significant β_{1j} at $\alpha = .05$					
Conclusion	Number	Number in Table: number of occupational categories					
Annondix	Number	in (): % share	of workers in	2002			

Appendix A

We, Social Science Teachers?

Contents

Background

Occupation & Inequality

- Explanation Power of Occupation 1
- Explanation Power of Occupation 2
- Wage Inequality
- Between Within Inequality
- Where Inequality is Growing
- Meanwage and Inequality
- Social Scientists
- Mean Wage and Inequality
- Summary: Occupation and Inequality

Theory

Data

Model

Results

Conclusion

Appendix A

- One of the fastest inequality growing occupations.
- Ranked 42nd among 331 occupations.
- Gini Index: from .26268 in 1983-85 to .29641 in 2000-02

Change of Mean Wage and Ineq. within Occ. from 1983 to 2002



- p. 13/43

Change of Mean Hourly Wage and Wage Inequality, between 1983-85 and 2000-02



Summary: Occupation and Inequality

Contents

Background

Occupation & Inequality

- Explanation Power of Occupation 1
- Explanation Power of Occupation 2
- Wage Inequality
- Between Within Inequality
- Where Inequality is
 Growing
- Meanwage and Inequality
- Social Scientists
- Mean Wage and Inequality
- Summary: Occupation and Inequality

Theory

Data

Model

Results

Conclusion

Appendix A

- 1. Explanatory power of occupation on hourly wage has declined over last two decades
- 2. Within-occupational-inequality has grown faster than between-occupational-inequality.
- 3. Heterogeneity within an occupation has increased and homogeneity in an occupation has diminished.
- 4. But increasing within-occupational-inequality is not universal across occupation, there is variability across occupation.

Theory

Contents	
Background	
Occupation & Inequality	
Theory	
Theory	
Data	
Model	
Results	
Conclusion	
Appendix A	
Appendix B	

Why inequality has increased over time?

- 1. Influx of Female Workers
- 2. Deindustrialization (Declining Manufacturing Sector)
- 3. Privatization (Declining Public Sector)
- 4. Skill Biased Technological Change (College Premium)
- 5. Union Effect (Declining Union Membership)
- 6. Insecure Employment Relation (Part Time)
- 7. Organizational Culture Change

Data

Contents
Background
Occupation & Inequality
Theory
Data Stage 1 Stage 2 Stage 3 Data
Model
Results
Conclusion
Appendix A
Appendix B

• **Stage 1**:

- 1. Raw Data: Current Population Survey-MORG, 1983-2002 \rightarrow Combine each three consecutive years' data (18 periods)
- 2. Population: Aged 18-65, Employed, Both male and female
- 3. Hourly Wage: Earn at least 50cents per hour. Top Coding: Log Normal Distribution, Inflation: Adjusted by CPI-X.
- 4. Occupation: At least 100 samples per each year, otherwise record. 331 occupations.

Stage 2:

	Data
	• Stage 1:
Contents	
Background	
Occupation & Inequality	
Theory Data Stage 1 Stage 2	 Stage 2. 1. Inequality: 331 occupations' within-occupational-inequality. Gini Index, Entrophy Indexes, Atkinson Indexes (7 indexes)
Stage 3Data	2. Meanwage: 331 occupations' mean wage
Model Results	3. Explanatory Variables: 331 occupations' characteristics (ex. % of female, % of BA+)
Conclusion	4. Repeat 18 periods
Appendix A	
Appendix B	
	• Stage 3:

1	Data
	• Stage 1:
Contents	
Background	
Occupation & Inequality	
Theory	
Data • Stage 1 • Stage 2 • Stage 3 • Data	• <u>Stage 2</u> :
Model	
Results	
Conclusion	
Appendix A	• Stage 3
Appendix B	1. Merge them.
	2. 331 occupation \times 18 periods = 5,958 cases

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Data

	Year	OCC	Inequality	Meanwage	Female
Contents	1984	1	.1583	20.33	.2358
Background	1985	1	.1682	22.85	.2544
Occupation & Inequality	1986	1	.1699	22.99	.2613
Theory			:		
Data Stage 1			:		
 Stage 2 Stage 3 Data 	2001	1	.1721	23.11	.2812
Model	1984	2	.1583	20.33	.2358
Results	1985	2	.1682	22.85	.2544
Conclusion	1986	2	.1699	22.99	.2613
Appendix A			:		
Appendix B			:		
	2001	2	.1721	23.11	.2812

	Multilevel Growth Model				
Contents Background	OLS Model $INEQ_{jt} = \alpha + \beta T_t + \varepsilon_{jt}$	(1)			
Occupation & Inequality Theory Data Model Basic Model Full Model Model Assumption Results	Multilevel Model $INEQ_{jt} = \alpha_j + \beta_j T_t + \varepsilon_{jt}$ $\alpha_j = \alpha + u_{1j}$ $\beta_j = \beta + u_{2j}$	(2)			
Conclusion Appendix A Appendix B	Multilevel Model in Composite Form $INEQ_{jt} = \alpha + \beta T_t + [u_{1j} + u_{2j}T_t + \varepsilon_{jt}]$ where <i>j</i> occupation, <i>t</i> time.	(3)			

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Multilevel Growth Model

Contents

Background

Occupation & Inequality

Theory

Data

Model

Basic Model

• Full Model

Model Assumption

Results

Conclusion

Appendix A

$$INEQ_{jt} = \alpha_j + \beta_j T_t + \gamma X_{jt} + \delta(T_t \times \bar{X}_{j.}) + \zeta \bar{X}_{j.} + \varepsilon_{jt} \quad (4)$$

- T_t : Time t centered to initial value (1983-85).
- X_{jt} : change of proportion.
- $T_t \times \bar{X}_{j}$: interaction of mean of explanatory variables over time with time itself.
- \bar{X}_{j} : group mean of each explanatory variable.
- γ : effect of independent variable by 1% point change.
- δ : change of the effect of explanatory variable itself without compositional change

Multilevel Growth Model

Contents

Background

Occupation & Inequality

Theory

Data

Model

Basic Model

• Full Model

Model Assumption

Results

Conclusion

Appendix A

Appendix B

$$INEQ_{jt} = [\alpha + \beta T_t + \gamma X_{jt} + \boldsymbol{\delta}(T_t \times \bar{X}_{j.}) + \boldsymbol{\zeta} \bar{X}_{j.}] + [u_{1j} + u_{2j}T_t + \varepsilon_{jt}]$$
(5)

$$MEANWAGE_{jt} = [\alpha + \beta T_t + \gamma X_{jt} + \boldsymbol{\delta}(T_t \times \bar{X}_{j.}) + \boldsymbol{\zeta} \bar{X}_{j.}] + [u_{1j} + u_{2j}T_t + \varepsilon_{jt}]$$
(6)

$$\varepsilon_{jt} \sim N(0, \sigma_{\varepsilon}^2 \Sigma) \quad \text{and} \quad \begin{bmatrix} u_{1j} \\ u_{2j} \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{21} & \sigma_2^2 \end{bmatrix} \right) \quad (7)$$

where Σ is assumed to be two band toeplitz. *j* occupation, *t* time.

Net Effect of Predictors on Within Inequality



Net Effect of Predictors on Mean Wage



Estimated Within Inequality Change

	Variable	Coefficient	% Change btw	Inequality	
Contents	Variable	Estimate	83-85 and 00-02	Change (Sig.)	
Background	Female	0470	2.9101	1368	* * *
Occupation & Inequality	BA+	.0056	2.1057	.0118	
Theory	Edu.Div	.0078	9426	0074	
	Public	0535	-2.9130	.1558	* * *
Data	PartTime	.0131	-2.6564	0348	
Model	Union	.0294	-6.3536	1868	**
Results	Manuf	0079	-3.2955	.0260	
 Net Effect on Inequality Net Effect on MeanWage 					
 Estimated Wth Ineq Change 	$YEAR \times BA+$.0023	24.86×17	.9720	* * *
SummaryVariance	YEAR×Edu.Div	.0006	64.03×17	.6531	
Conclusion	YEAR×Public	0012	17.22×17	3513	*
	YEAR×PartTime	0008	15.30×17	2081	
Appendix A	YEAR×Union	.0036	18.16×17	1.1114	* * *
Appendix B	YEAR×Manuf	0011	24.69×17	4617	**
	Total Inequality Cha	ange		1.5992	
	(Actual Average Ine	equality Change	otw 83-85 and 00-02)	(1.6400)	

Hypothesis and Result: Within Occupational Inequality

Contents			Hypothesis	Result	Amount
Background	Female		+	_	small
Occupation & Inequality	Manuf		_	0	small
Theory	Public		_	_	moderate
Data	Part		+	+	small
Model	Union	%p Δ	_	+	big
Results Net Effect on Inequality 		Within	0	+	
 Net Effect on MeanWage Estimated Wth Ineq Change 	BA+	%p Δ	+	0	big
SummaryVariance		Within	+	+	
Conclusion	Edu.Div.	%p Δ	+	0	small
Appendix A		Within	+	0	
Appendix B					

Hypothesis and Result: Mean Wage

Contents			Hypothesis	Result	Amount
Background	Female		_	_	small
Occupation & Inequality	Manuf		+	+	moderate
Theory	Public		0	_	moderate
Data	Part		—	—	small
Model	Union	%p Δ	+	+	big
Results Net Effect on Inequality 		Within	o/—	_	
 Net Effect on MeanWage Estimated Wth Ineq Change 	BA+	%p Δ	+	+	big
SummaryVariance		Within	+	+	
Conclusion	Edu.Div.	%p Δ	o/—	0	big
Appendix A		Within	0/—	_	
Appendix B					

Explanatory Power of Predictor on Variation



Conclusion: Between Occupational Inequality

	Constactor Dotteon Cocapational moquanty
Contents	
	Explained well by current hypothesis.
Background	
Occupation & Inequality	
Theory	1. Education, Union, and Public Sector
Data	2. Female participation reduces inequality.
Model	
Results	
Conclusion	
Conclusion-between Conclusion-within	
 Thank you 	
Appendix A	
Appendix B	

Conclusion: Within Occupational Inequality

 Contents 	
------------------------------	--

Background

Occupation & Inequality

Theory

Data

Model

Results

Conclusion

Conclusion-between

Conclusion-within

Thank you

Appendix A

Appendix B

• Facts

- 1. Current Hypotheses do not fit well.
- 2. Not % Change of union, but change within union members.
- 3. Not widening gap between different educational level, but change within the same education.
- 4. Lagged. First between-occupational change in 80s, then within-occupational change in 90s.
- 5. % increase of public sector reduces inequality.
- 6. (Moving southern area increases inequality.)
- Suggestion
- Future Research

1	Conclusion: Within Occupational Inequality			
	• Facts			
Contents				
Background				
Occupation & Inequality				
Theory	 Suggestion: Organizational Culture Change 			
Data	1. Related with skill change. Lagged.			
Model	2. Emphasis on versatile abilities.			
Results	3. Know individual productivity better than before.			
Conclusion • Conclusion-between • Conclusion-within • Thank you	4. Accept individual differences.			
Appendix A				
Appendix B				
	Future Research			

I	Conclusion: Within Occupational Inequality
	• Facts
Contents	
Background	
Occupation & Inequality	
Theory	
Data	. Our continue
Model	• Suggestion
Results	
Conclusion	
Conclusion-within Thank you	
Appendix A	
Appendix B	 Future Research: Increased horizontal mobility among high skill workers?

Contente	
Contents	

Background

Occupation & Inequality

Theory

Data

Model

Results

Conclusion

- Conclusion-between
- Conclusion-within
- Thank you

Appendix A

Appendix B

Thank you.

Inequality Index

Theil Index (Entrophy Index)

7

Contents

Background

Occupation & Inequality

Theory

Data

Model

Results

Conclusion

Appendix A

Inequality Decomposition

 Error Structure of Multilevel Model

Appendix B

$$Theil = \frac{1}{N} \sum_{i=1}^{N} \frac{y_i}{\bar{y}} \ln \frac{y_i}{\bar{y}}$$
(8)

They can be additively decomposed as $GE = GE_w + GE_b$, where GE_w refers to within-group-inequality, and GE_b refers to between-group-inequality. Within-group-inequality is weighted sum of each subgroup inequality, T_j and between-group-inequality is derived assuming every person within a given subgroup *j* received its mean income, y_j . Theil index is decomposed as;

$$Theil = \sum_{k} \frac{y_k}{\bar{y}} T_k + \sum_{k} \frac{y_k}{\bar{y}} \ln \frac{y_k/\bar{y}}{n/N}$$
(9)

where *N* refers to number of persons, y_i refers to wage of individual i, \bar{y} refers to the grand mean and y_k refers to mean wage of subgroup *k*.

Error Structure of Multilevel Model



Net Effect of Female

Contents	Inequality	% Female \uparrow , Inequality \uparrow	+	
Background	Mean Wage	% Female \uparrow , Wage of LWO \downarrow	_	
Occupation & Inequality		% Female \uparrow Wage of HWO \uparrow	+	
Theory				
Data	LWO: Low-Wag	ge-Occupation ($\leq \bar{\mu} - \sigma$)		
Model	HWO: High-Wa	age-Occupation ($\geq ar{\mu} + \sigma$)		
Results				
Conclusion	√ Result			
Appendix A	Inequality	% Female	0470	***
Appendix B	Mean Wage	% Female	0293	***
FemaleDeindustrializationPublic Sector		% Female×LowWage	Insignifi	cant
Part TimeUnionEducation		% Female × HighWage	0406	***

Net Effect of Manufacturing Sector

Contents	Inequality	% Manufacture \downarrow , Inequality \uparrow	_	
Background		Within Manufacture	No Ch	ange
Occupation & Inequality				ange
	Mean Wage	% Manufacture \downarrow , Mean Wage \downarrow	+	
Theory		Moon Wago of Manufacturo		
Data		Mean wage of Manufacture		
Model				
Results	✓ Result			
Conclusion				
Appendix A	Inequality	% Manuf	0079	Insig.
		Voory	0010	**
Appendix B		real×ivialiui	0010	
Deindustrialization	Mean Wage	% Manuf	0293	***
 Public Sector Part Time 	0			
• Union		Year×Manuf	0007	***
Education				

Net Effect of Public Sector

Contents	Inequality	% Public Sector \downarrow , Inequality \uparrow	_	
Background		Within Public Sector	No Ch	ange
Occupation & Inequality	Mean Wage	% Public Sector ↓, Mean Wage ↓	+	
Theory		Mean Wage of Public Sector	No Change	
Data				
Model				
Results	✓ Result			
Conclusion				
Appendix A	Inequality	% Public Sector	0535	***
Appendix B		Year×Public	0012	*
 Female Deindustrialization Public Sector 	Mean Wage	% Public Sector	0409	***
 Part Time Union 		% Public×LowWage	.0666	***
Education		Year×Public	0003	Insig.

Net Effect of Part Time Worker

Contents	Inequality	% Part Time \uparrow , Inequality \uparrow	+		
Background		Within Part Time Workers	No Char	No Change	
Occupation & Inequality	Mean Wage	% Part Time ↑. Mean Wage ∣	_	-	
Theory		3 • •			
Data		Mean Wage of Part Time	-(No Cł	-(No Change)	
Model	✓ Result				
Results					
Conclusion	Inequality	% Part Time	.0410	***	
Appendix A		% Part Time × Sales	0589	**	
Appendix B		% Part Time × Service	0645	***	
 Female Deindustrialization Public Sector 		Year×PartTime	0010	Insig.	
Part TimeUnion	Mean Wage	% Part Time	0265	***	
Education		% Part Time×HighWage	.0696	***	
		Year×PartTime	0005	Insig.	

Net Effect of Union

Contents	Inequality	Spillover: % Union \downarrow , Inequality \uparrow	_	
Background		Barrier: % Union \downarrow , Inequality \downarrow	+	
Occupation & Inequality		Within Union Workers	No Ch	ange
Theory	Mean Wage	% Union \downarrow , Mean Wage \downarrow	+	
 Model		Mean Wage of Union Workers	-(No (Change)
Results	√ Result			
Appendix A	Inequality	% Union	.0294	**
Appendix B		Year×Union	.0036	***
 Female Deindustrialization Public Sector 	Mean Wage	% Union	.0847	***
 Part Time Union Education 		% Union×LowWage	0441	***
		Year×Union	0011	**

Net Effect of Education

Contents	Inequality	% BA+ ↑, Inequality ↑	+
Background		% EduDiv ↑, Inequality ↑	+
Occupation & Inequality		Within BA+ Workers	+
Data		At the same EduDiv over Time	+
Model	Mean Wage	% BA+ \uparrow , Inequality \uparrow	+
Results		% EduDiv ↑, Inequality ↑	-(No Change)
Conclusion		Within BA+ Workers	+
Appendix A		At the same EduDiv over Time	-(No Change)

- Appendix B
- Female
- Deindustrialization
- Public Sector
- Part Time
- Union
- Education

Net Effect of Education

✓ Result

Contents	Inequality	% BA+	.0056	Insig.
Background		% EduDiv	.0078	Insig.
Occupation & Inequality		Year×BA+	.0023	***
Theory	Mean Wage	Year×EduDiv	.0006	Insig.
		% BA+	.0736	***
Results		% EduDiv	.0085	Insig.
Conclusion		Year×BA+	.0012	***
Appendix A		Year×EduDiv	0050	***

Appendix B

Female

• Deindustrialization

- Public Sector
- Part Time
- Union
- Education