Self-Selection in the Labor Market (and Elsewhere): The Roy Model

14.662 Spring 2011

David Autor, MIT and NBER

U.S. Female/Male Wage Ratio: 1960-1973

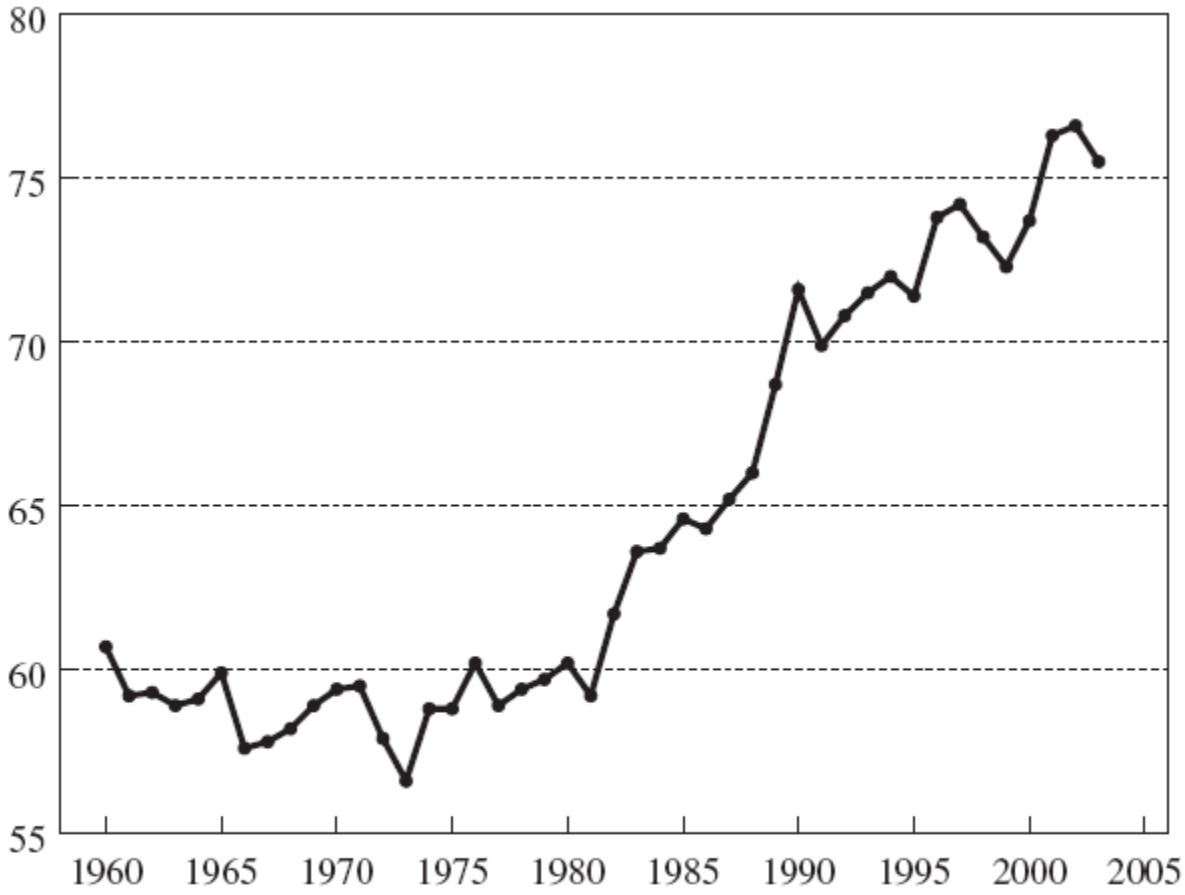


FIGURE 7. WOMEN'S EARNINGS AS A PERCENTAGE OF MEN'S EARNINGS: 1960 TO 2003

Goldin, 2006

Male + Female Labor Force Participation 1890 - 2004

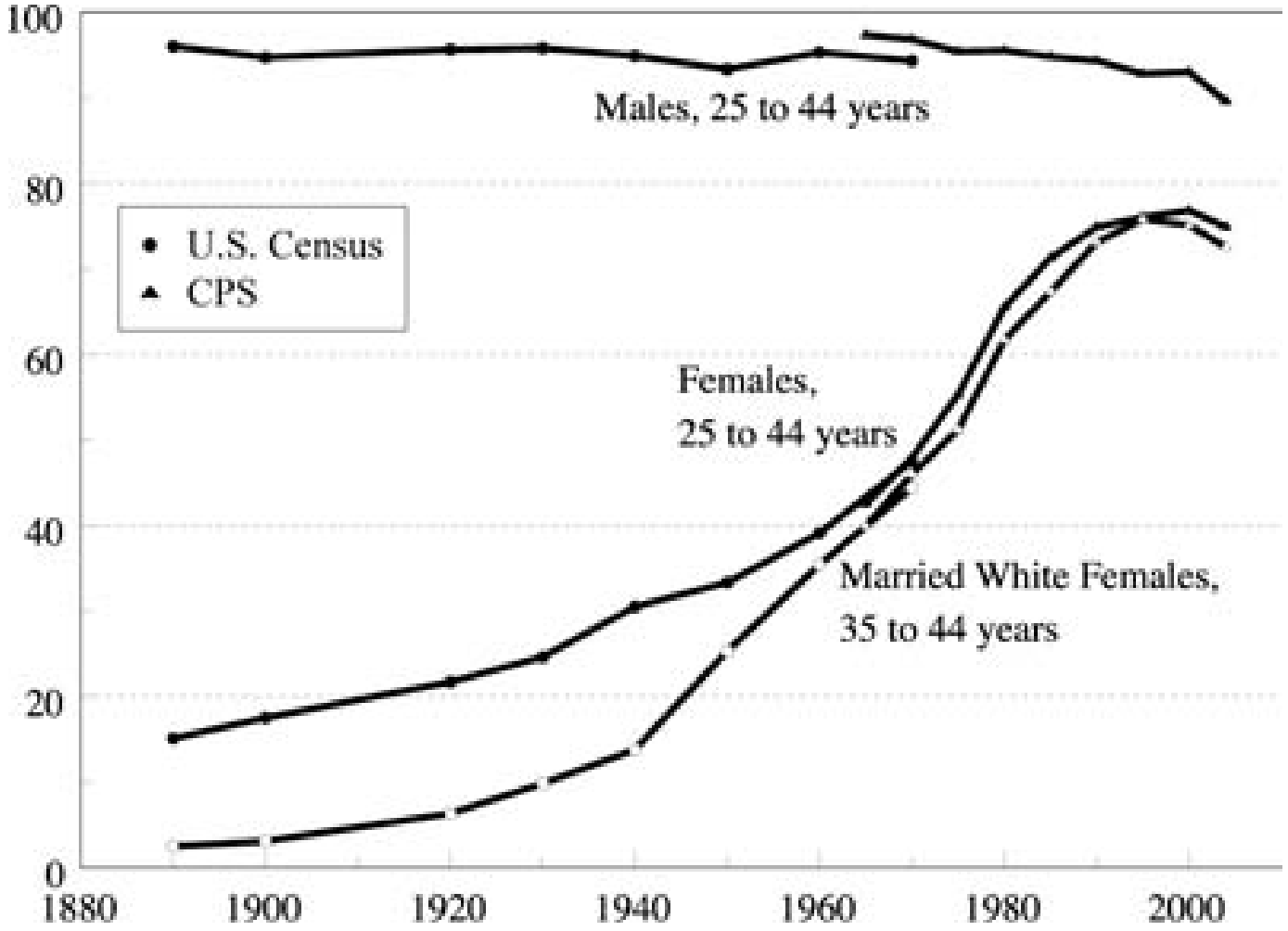


FIGURE 1. LABOR FORCE PARTICIPATION RATES FOR FEMALES AND MALES BY AGE AND MARITAL STATUS: 1890 TO 2004

Goldin, 2006

Female Entry into the Professions by Cohort

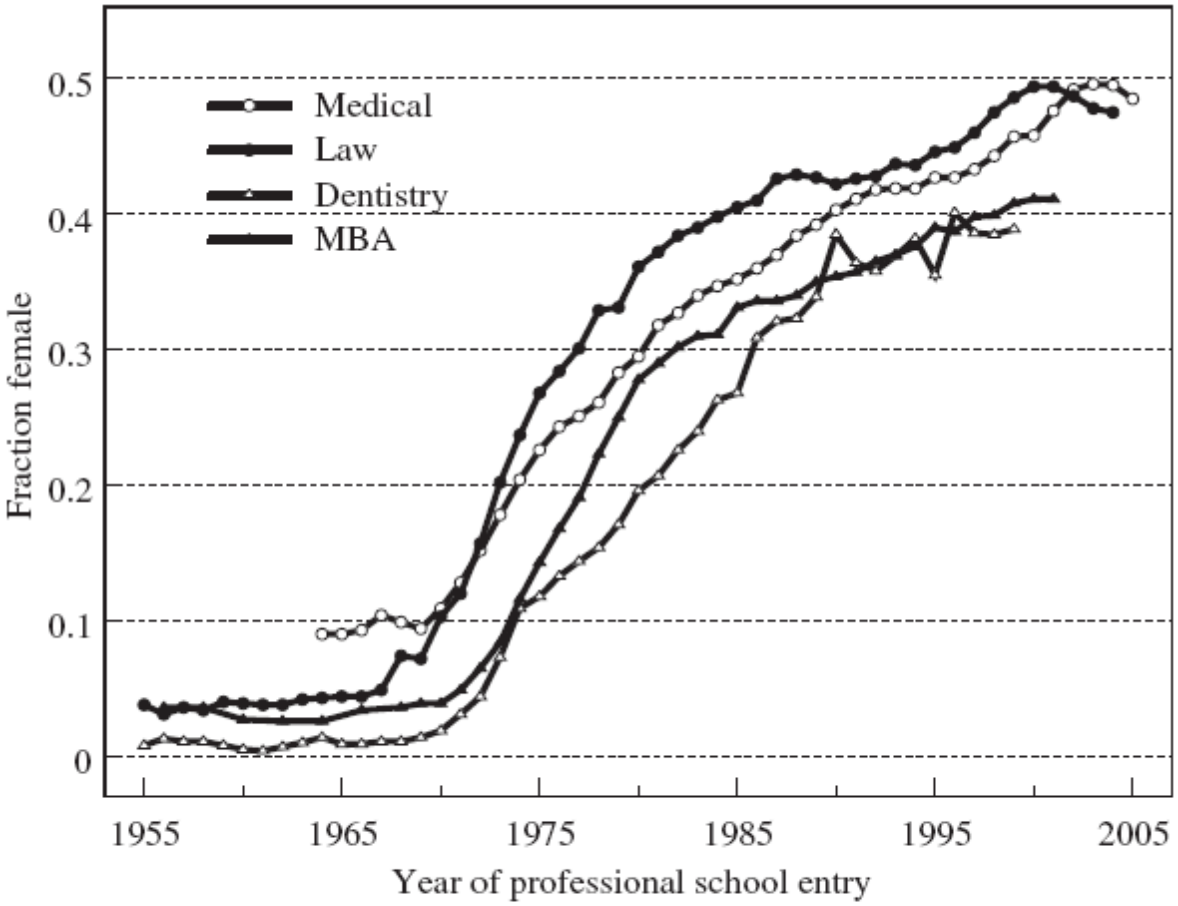
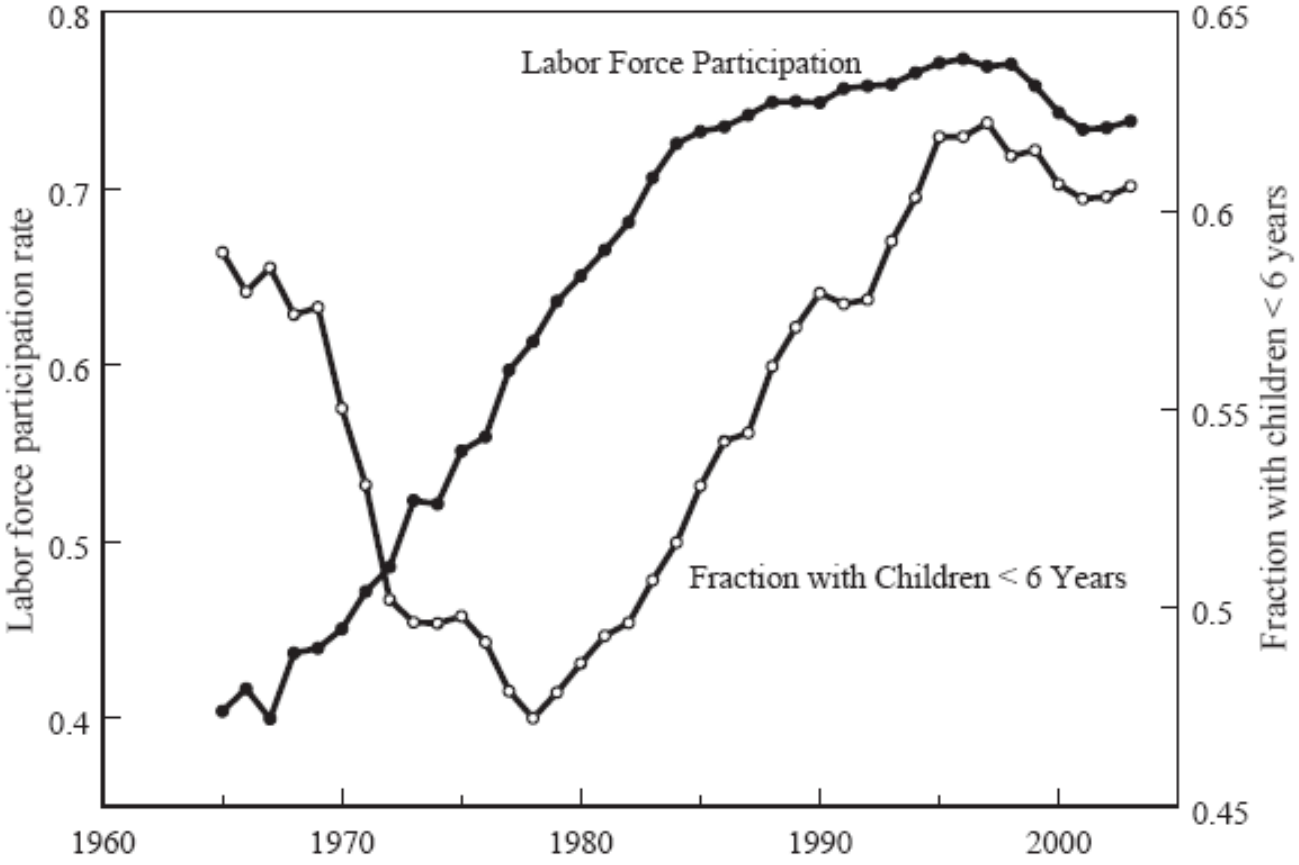


FIGURE 5. FRACTION FEMALE AMONG FIRST-YEAR STUDENTS IN PROFESSIONAL PROGRAMS: 1955 TO 2005

Goldin, 2006

Female LFP and Fraction with Children



Goldin, 2006

Inverse Mills Ratio: A Hazard Function

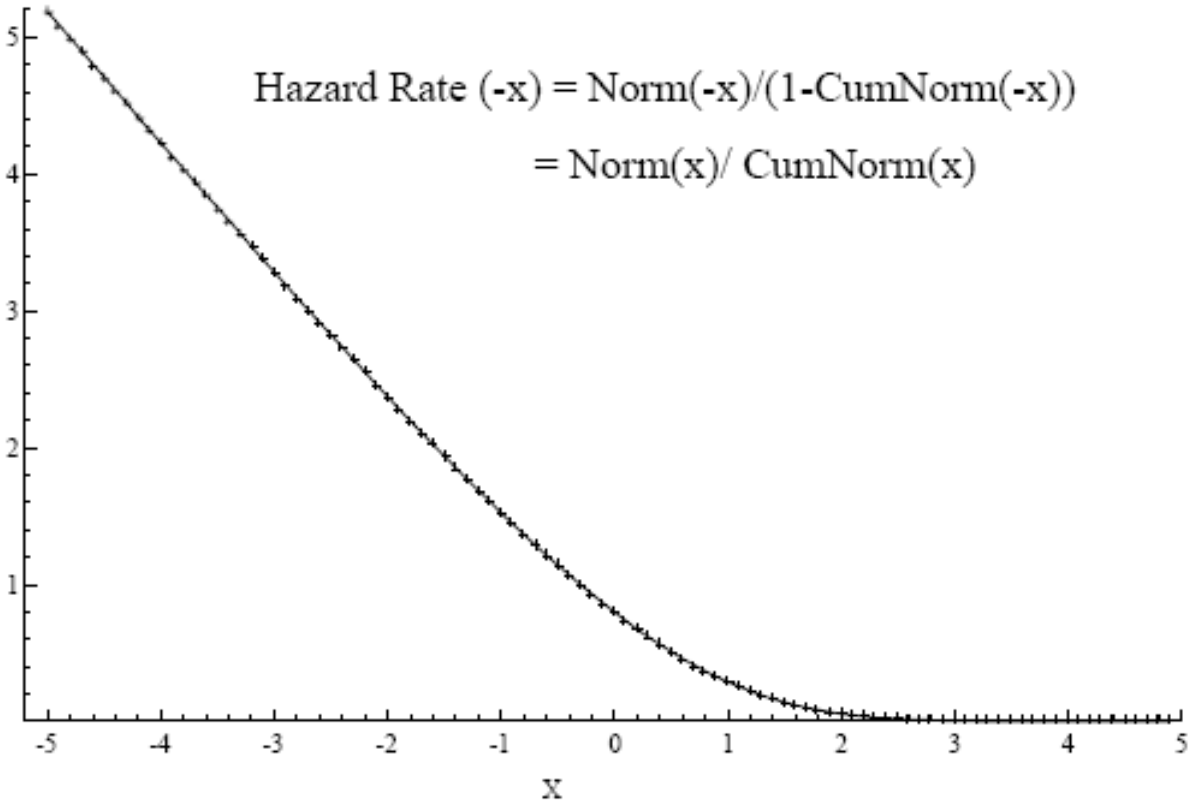


Figure 1: Plot of the Hazard Rate (negative argument)

TABLE 8—PROBIT REGRESSION ON THE EMIGRATION RATE[a]

Country of Origin Characteristics	Regression 1	Regression 2
Intercept	−.6060	−1.1614
	(−1.30)	(−2.46)
Politically Competitive System	.1206	.0801
	(1.13)	(.81)
Recent Loss of Freedom	.1096	−.0365
	(.95)	(−.32)
Number of Assassinations	−.0245	−.0337
	(−2.65)	(−3.65)
Income Inequality	−.0113	−.0145
	(−1.51)	(−2.00)
Distance from U.S.	−.1332	−.1271
	(−6.11)	(−2.68)
English Proficiency	.1661	.0488
	(.94)	(.30)
ln (per capita *GNP*)	−.1130	−.0441
	(−2.14)	(−.83)
Country in Asia or Africa	–	.3386
		(2.19)
Country in North or South America	–	.2923
		(1.52)
χ^2	98.45	108.82

[a] The dependent variable is the probability that an individual migrated to the United States in 1951–80, and is given by the second column of Table 2. The *t*-ratios are presented in parentheses.

Borjas 1987

U.S. Female/Male Wage Ratio: 1960-1973

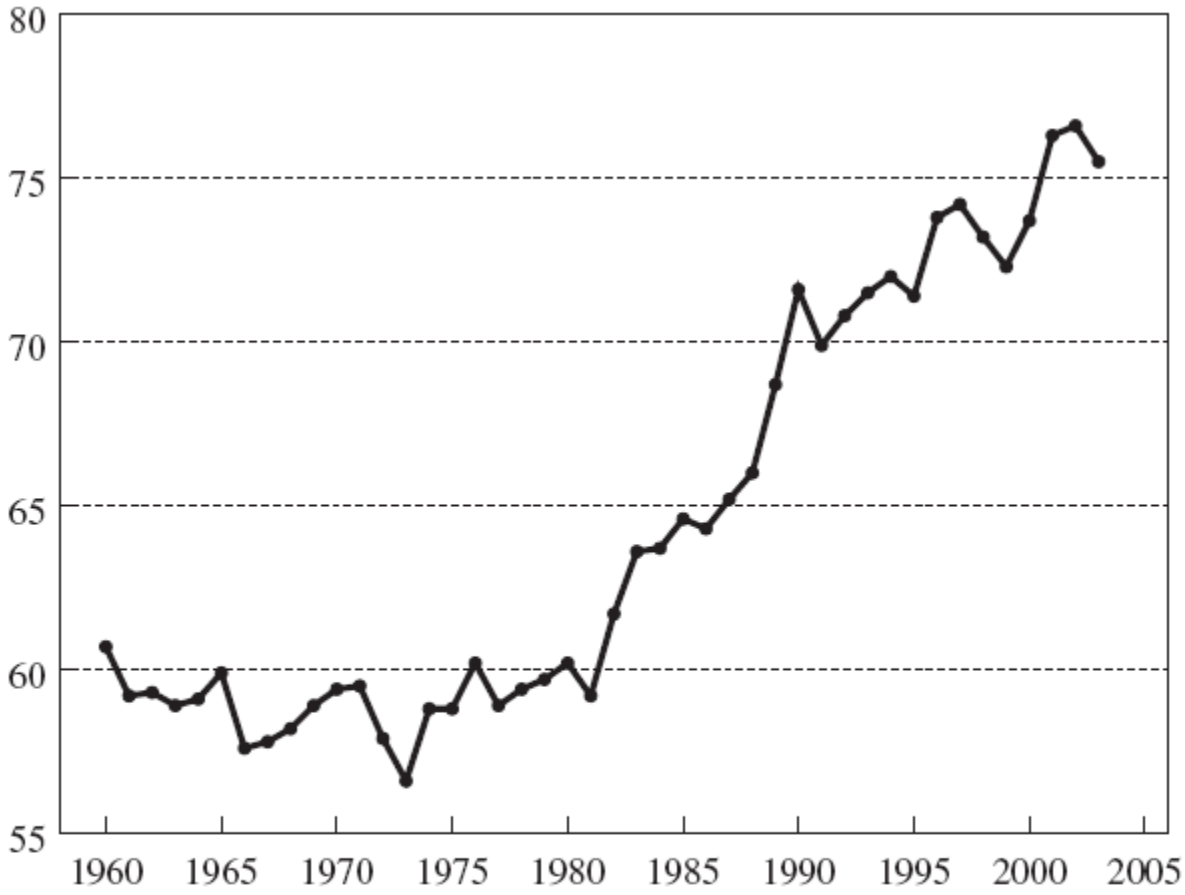


FIGURE 7. WOMEN'S EARNINGS AS A PERCENTAGE OF MEN'S EARNINGS: 1960 TO 2003

Goldin, 2006

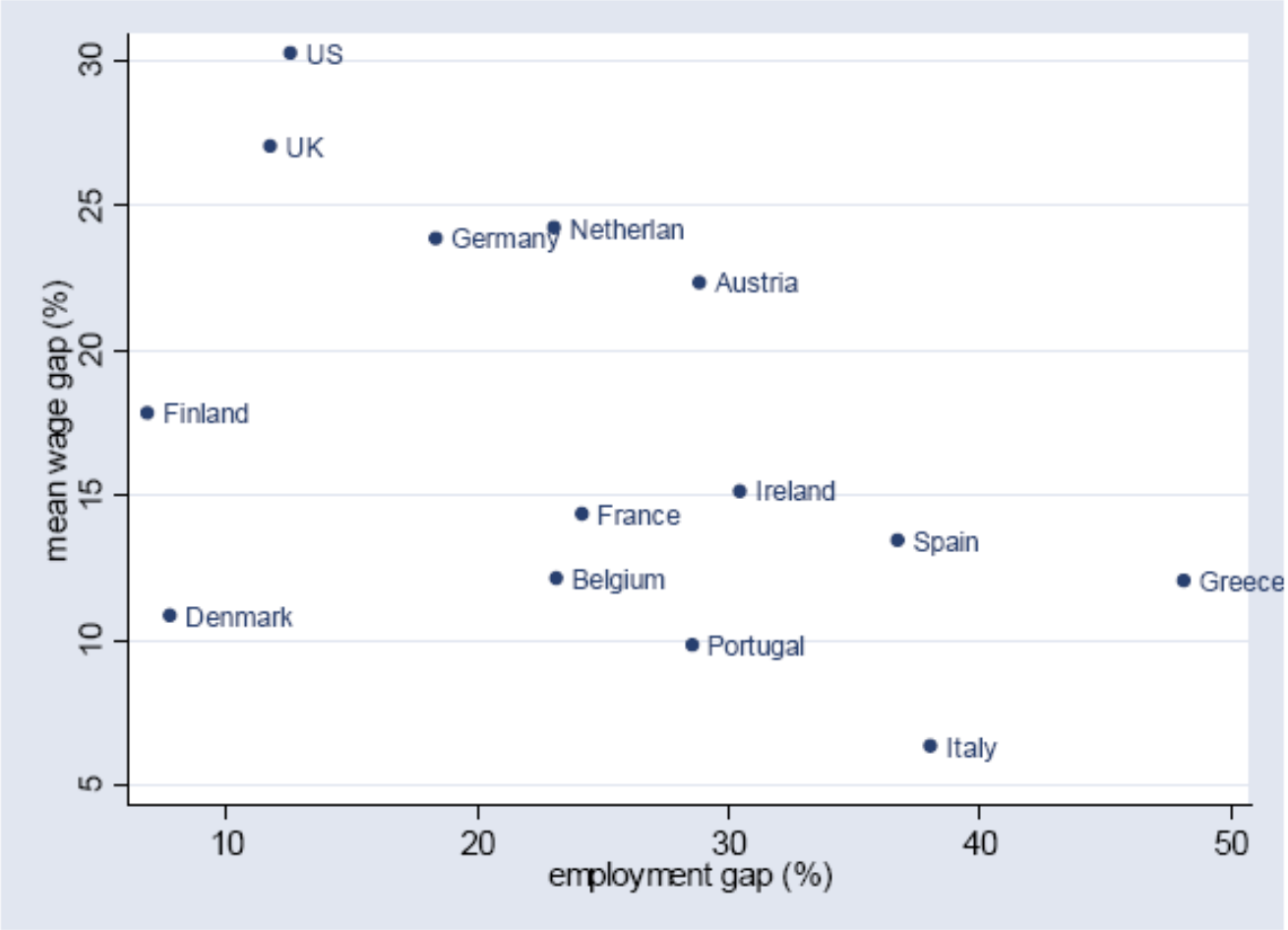


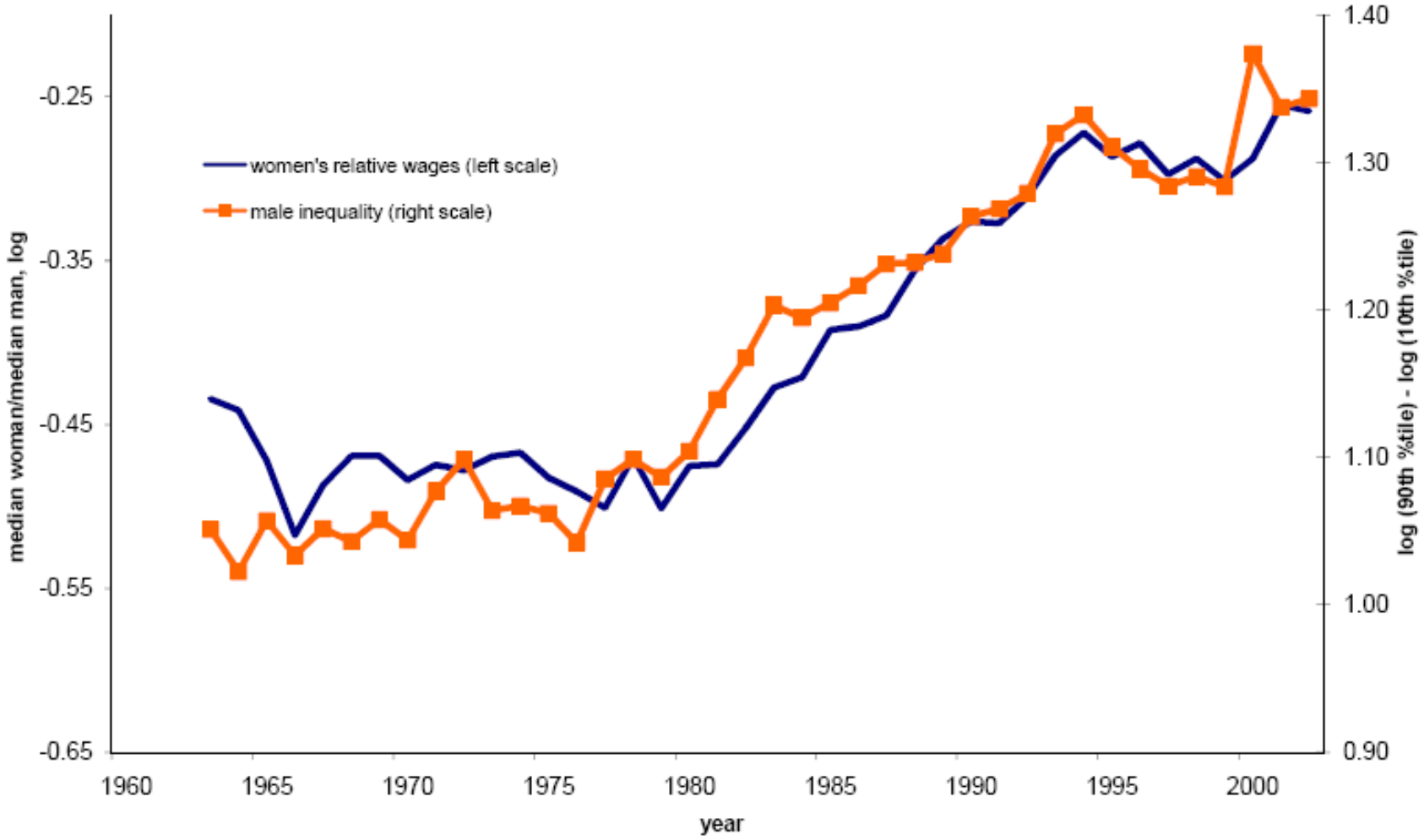
Figure 1: Gender gaps in mean (log) hourly wages and in employment, 1994-2001

Olivetti and Petrongolo, 2007

Puzzle: Male Wage Inequality and F/M Gender Gap

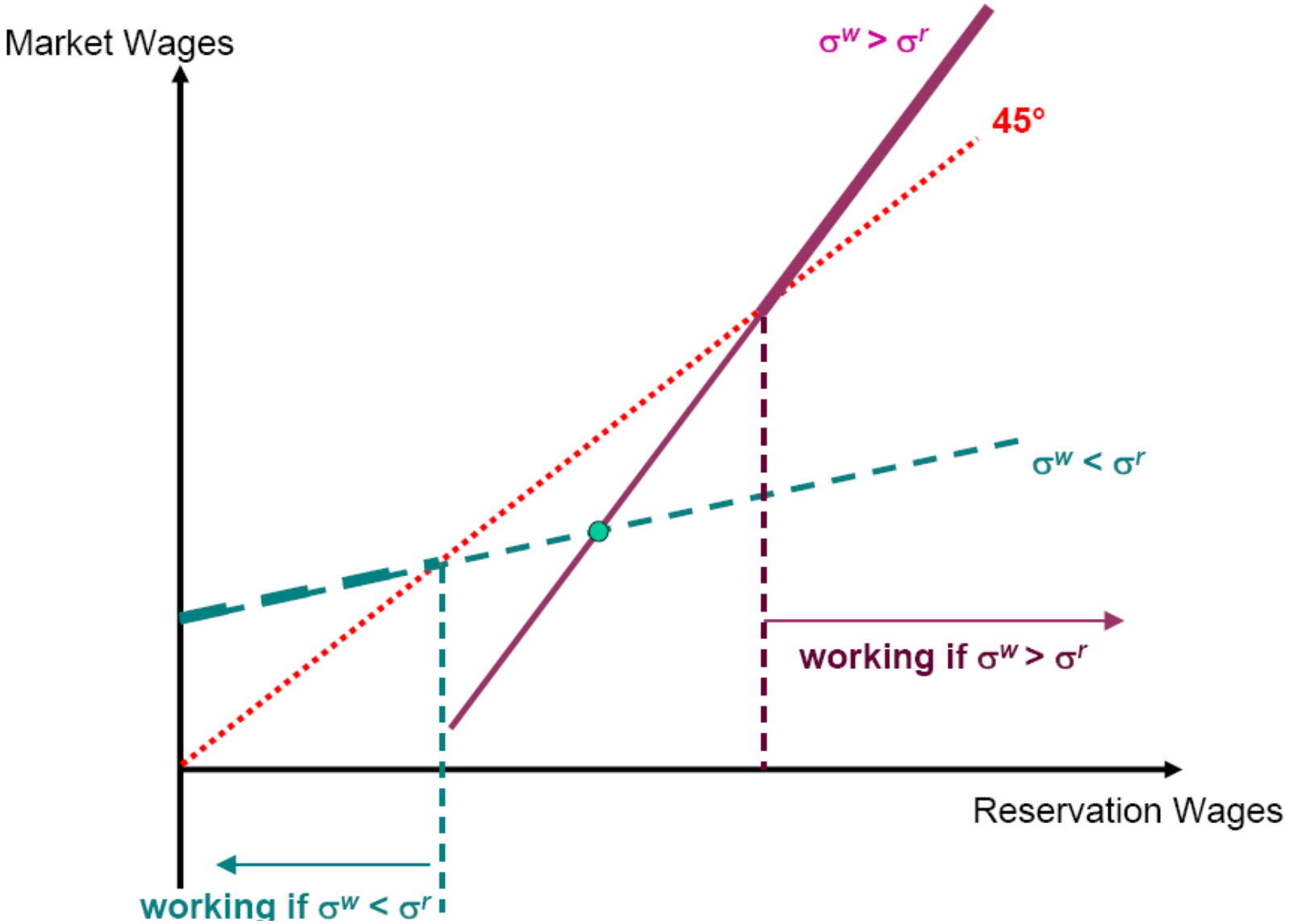
Figure 1. Wage Inequality within and between Genders

The Figure graphs time series of (a) the log of the ratio of the wage of the median working woman to that of the median working man (left scale, no markers), and (b) the log of the ratio of the wage of a man at the 90th percentile of the male wage distribution to that of a man at the 10th percentile (right scale, square markers). The calculations use our CPS wage sample of white persons aged 25-54, without trimming of outliers or adjusting top-codes.



Mulligan and Rubinstein, 2008

The Intuition of the Mulligan-Rubinstein Model/Paper



Mulligan and Rubinstein, 2008

Selection 'Corrected' Gender Wage Gaps

TABLE I

CORRECTING THE GENDER WAGE GAP USING THE HECKMAN TWO-STEP ESTIMATOR

Period	Method: OLS	Method: Two-Step	Bias
	Panel A: Variable Weights		
1975–1979	−0.414	−0.337	−0.077
	(0.003)	(0.014)	(0.015)
1995–1999	−0.254	−0.339	0.085
	(0.003)	(0.014)	(0.015)
Change	0.160	−0.002	0.162
	(0.005)	(0.020)	(0.021)
	Panel B: Fixed Weights		
1975–1979	−0.404	−0.330	−0.075
	(0.003)	(0.014)	(0.014)
1995–1999	−0.264	−0.353	0.089
	(0.004)	(0.015)	(0.016)
Change	0.140	−0.024	0.164
	(0.005)	(0.021)	(0.021)

Notes. Each table entry summarizes regression results (reported in full in Appendix II). The entries are female minus male log wages, which differ from each other in terms of (a) rows, i.e., time period used for estimation (1975–1979 vs. 1995–1999); (b) columns, i.e., whether the regression includes the inverse Mills ratio (OLS does not include it, two-step does); and (c) panels, i.e., the weighting used to average the regression results across demographic groups (variable vs. fixed weights). The "Bias" column is the difference between the OLS and two-step columns. The "change" row is the difference between the 1995–1999 and 1975–1979 rows. Weights are factions of working women in each demographic group and are time-specific (variable) or pool both time periods (fixed).

The regressions control for demographics interacted with gender and use our CPS wage sample of white persons aged 25–54, trimming outliers and adjusting topcodes as described in Appendix I.

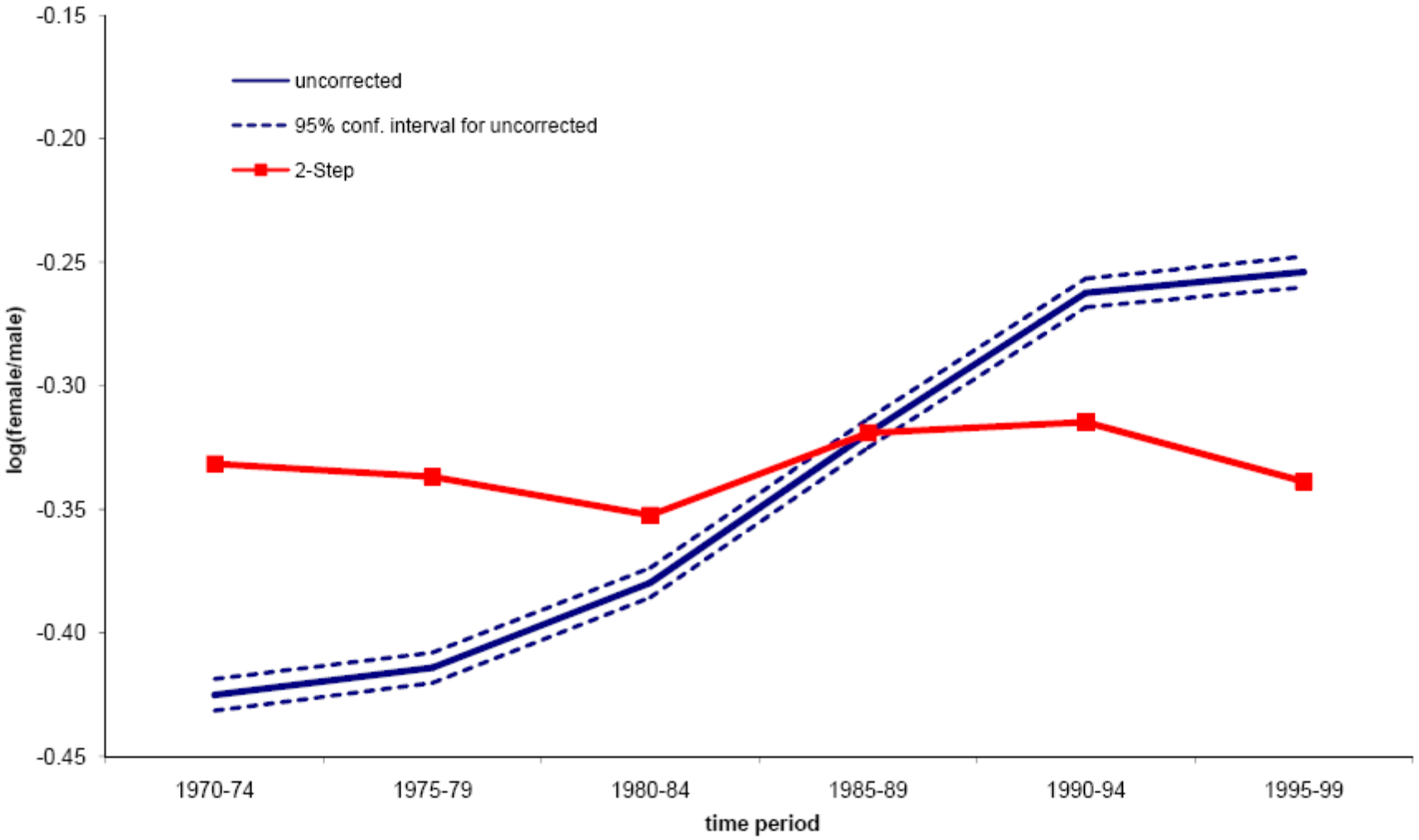
Bootstrap standard errors are in parentheses.

Mulligan and Rubinstein, 2008

Selection 'Corrected' Gender Wage Gaps

Figure 3. Correcting the Gender Wage Gap: the Heckman Two-step Estimator

The Figure graphs two time series of women's log wages relative to men's (unmarked and square-marked), plus a 95% confidence interval for one of them (dashed). Both relative wage series are net of measured demographic characteristics, and averaged across demographic groups using time-specific female workforce weights. Only the 2-step series (square-marked) is net of the inverse Mills ratio. The calculations use our CPS sample of white persons aged 25-54, trimming outliers and adjusting top-codes as described in Appendix I.



Mulligan and Rubinstein, 2008

Selection 'Corrected' Gender Wage Gaps

TABLE II

GENDER-GAP CHANGES BY MARITAL STATUS AND SCHOOLING

	OLS			Two-Step	Bias
	1975–1979	1995–1999	Change	Change	Change
Panel C: By Education					
0 to 8 years	−0.378	−0.322	0.056	−0.206	0.262
	(0.035)	(0.091)	(0.098)	(0.103)	(0.142)
High school, not grad.	−0.429	−0.243	0.185	−0.373	0.222
	(0.018)	(0.032)	(0.037)	(0.046)	(0.059)
High school graduates	−0.427	−0.297	0.130	−0.037	0.167
	(0.007)	(0.009)	(0.011)	(0.023)	(0.026)
Some college	−0.409	−0.258	0.151	−0.008	0.159
	(0.010)	(0.010)	(0.014)	(0.024)	(0.028)
College	−0.400	−0.237	0.163	0.012	0.151
	(0.013)	(0.011)	(0.017)	(0.025)	(0.030)
Advanced degrees	−0.276	−0.179	0.096	−0.018	0.115
	(0.023)	(0.017)	(0.028)	(0.032)	(0.043)

Notes. Each table entry summarizes regression results (reported in full in Appendix II). The entries are female minus male log wages and differ from each other in terms of (a) rows, that is, demographic groups; (b) columns, that is, time period used for estimation and whether the regression includes the inverse Mills ratio (OLS does not include it, two-step does); and (c) panels, i.e., the types of demographic groups summarized. Time-invariant female workforce weights are used to average the regression results across demographic subgroups. The "Bias" column is the difference between the OLS and two-step columns.

The regressions control for demographics (which include marital status unless indicated otherwise) interacted with gender, and use our CPS wage sample of white persons aged 25–54, trimming outliers and adjusting topcodes as described in Appendix I.

Bootstrap standard errors are in parentheses.

Mulligan and Rubinstein, 2008

'Evidence' on Changing Female Self-Selection into LF

TABLE III

EFFECT OF IQ ON A WOMAN'S LIKELIHOOD TO BE A FULL-TIME FULL-YEAR WORKER

		Probit	
Variables	OLS (1)	coeff. (2)	dF/dX (3)
IQ above 100	−0.006	−0.023	−0.009
(1968–1979)	(0.019)	(0.063)	(0.024)
IQ above 100* 1980s	0.040	0.119	0.046
	(0.021)	(0.065)	(0.026)
IQ above 100* 1990s	0.062	0.168	0.065
	(0.026)*	(0.076)*	(0.030)*
Observations	21,308	21,308	21,308
Number of individuals	2,135	2,135	2,135

Notes. The table reports some of the coefficients from a linear regression (column (1)) and a probit equation (columns (2) and (3)), each with binary dependent variable equal to 1 for those reporting working 35 hours per week and at least 50 weeks of the year. IQ is a composite of various test scores measured by the Census Bureau's school survey (see Appendix I). In addition to the three regressors shown in the table (by row), the equations include demographic variables interacted with decade. Column (3) reports the marginal effects for the column (2) probit, evaluated at the sample mean.

Person-years are the unit of observation. The calculations use our NLSW sample of white women aged 25–54, for the calendar years 1969–2000 (all of these women were 14–24 years of age in 1968).

Robust standard errors are in parentheses.

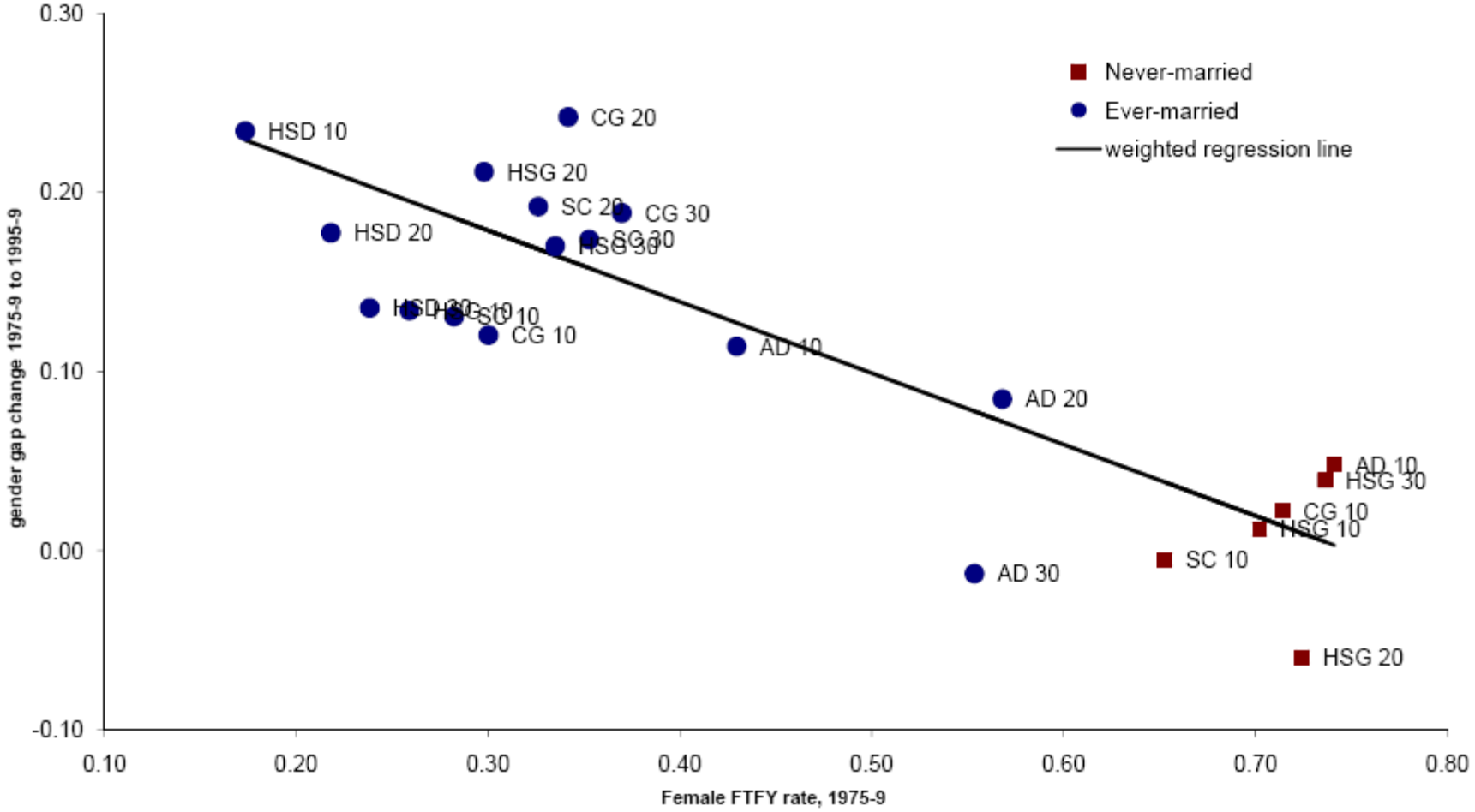
* significant at 5% for two-sided hypothesis.

Mulligan and Rubinstein, 2008

Identification at Infinity: The Intuition

Figure 4. Measured Wage Growth Declines with Labor Supply

The scatter diagram shows the gender gap change 1975-9 to 1995-9 against the FTFY employment rate 1975-9 for the 21 demographic groups with at least 40 observations of female FTFY workers per year in the 1970's. The demographic groups are the cross-product of marital status (never-married vs. ever-married), schooling (high school dropout HSD, high school grad HSG, some college SC, college grad CG, and advanced degree AD), and potential experience (10 denotes 5-14 years, 20 denotes 15-24 years, and 30 denotes 25-34 years). The calculations use our CPS sample of white persons aged 25-54, trimming outliers and adjusting top-codes as described in Appendix I.

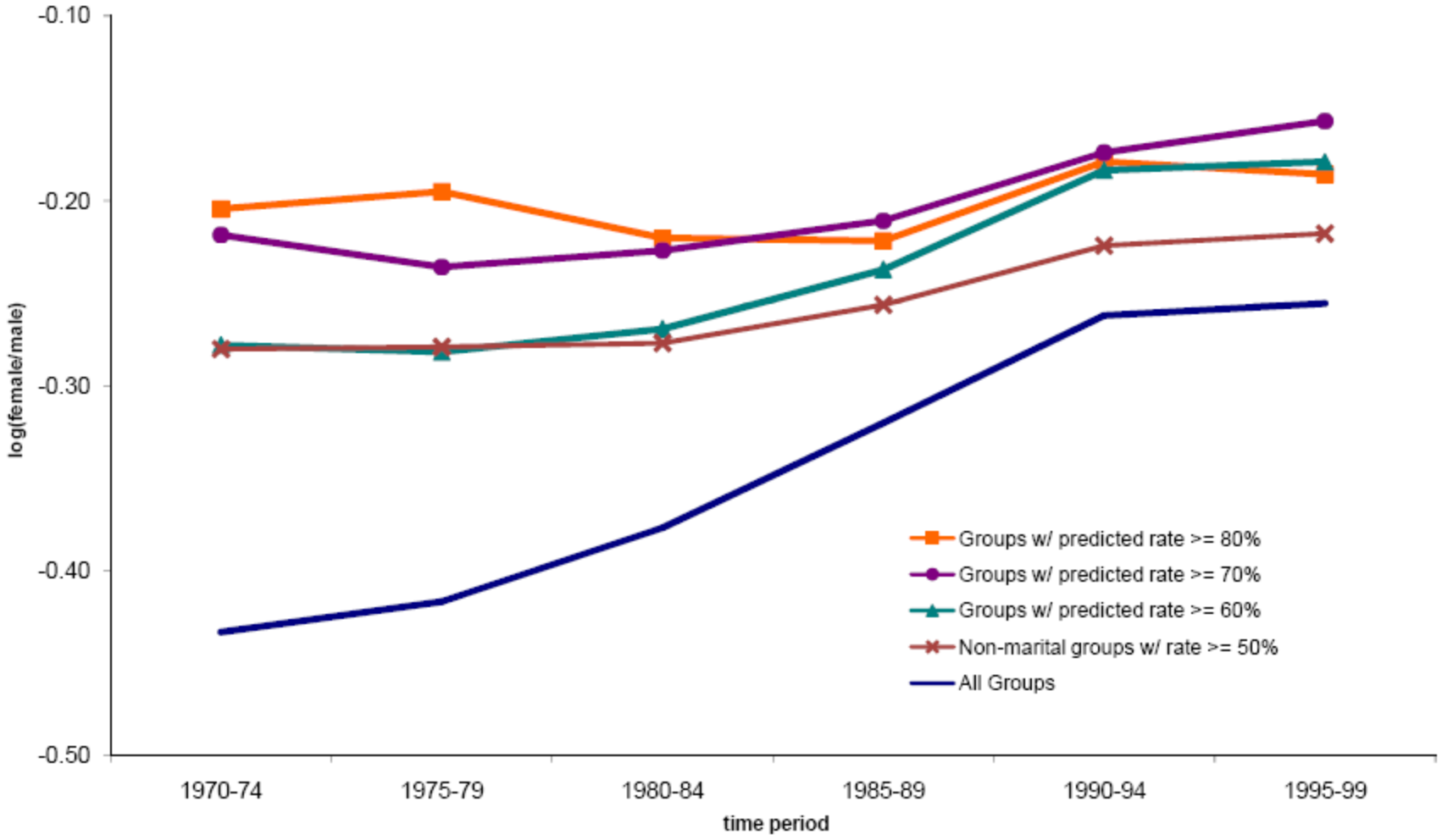


Mulligan and Rubinstein, 2008

Identification at Infinity: High vs. Low LF Attachment

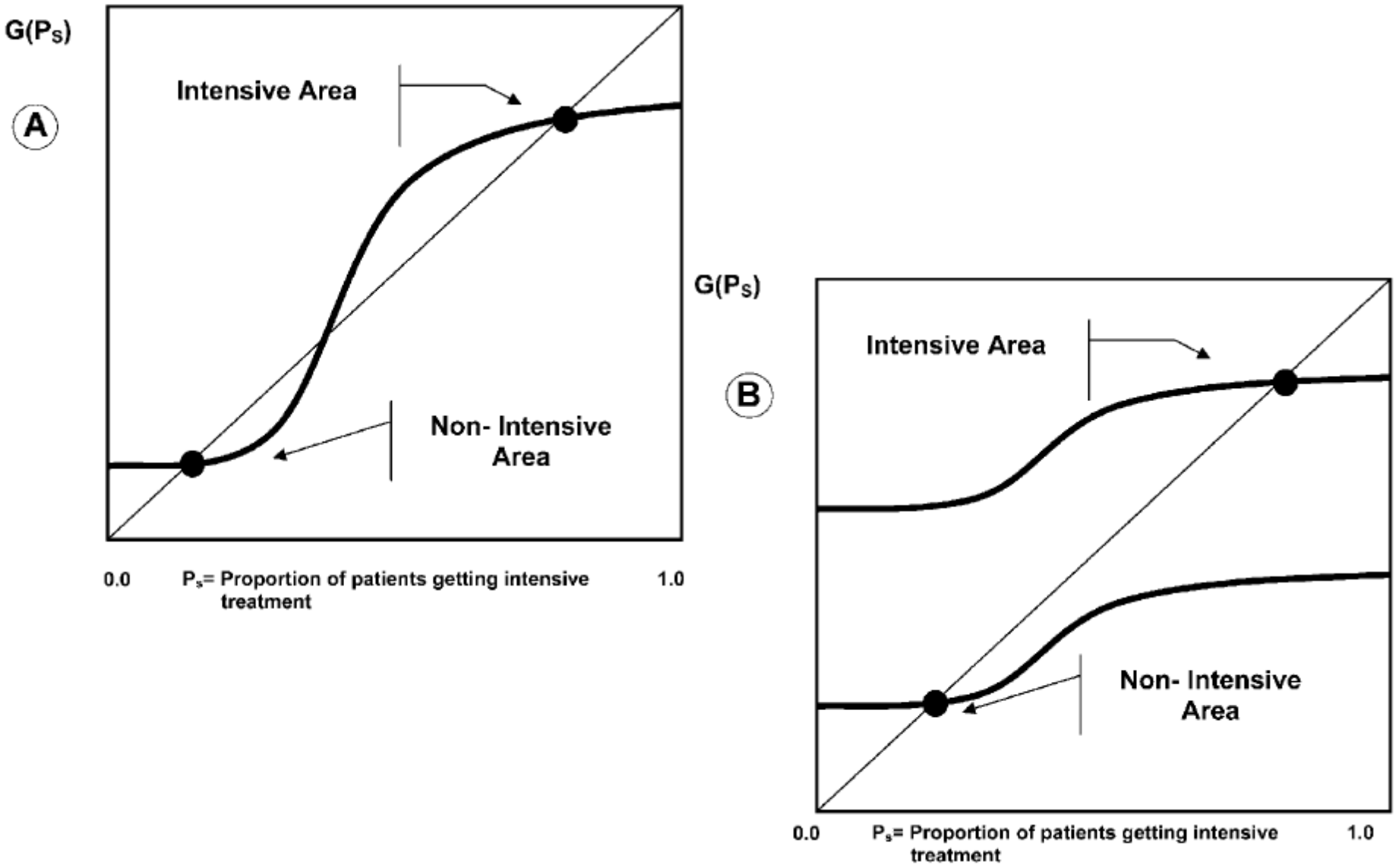
Figure 5. Gender Wage Gaps Among Strongly Attached Groups, Various Thresholds

The Figure graphs five times series of women's log wages relative to men's, net of demographic characteristics. The series differ according to the demographic groups (defined according to gender, schooling, marital status, and potential experience, except for the x-marked series that does not use marital status) included in the estimation. The unmarked series includes all demographic groups. For the other series, demographic groups are selected based on their FTFY employment rate for the years 1975-79. The calculations use our CPS sample of white persons aged 25-54, trimming outliers and adjusting top-codes as described in Appendix I.

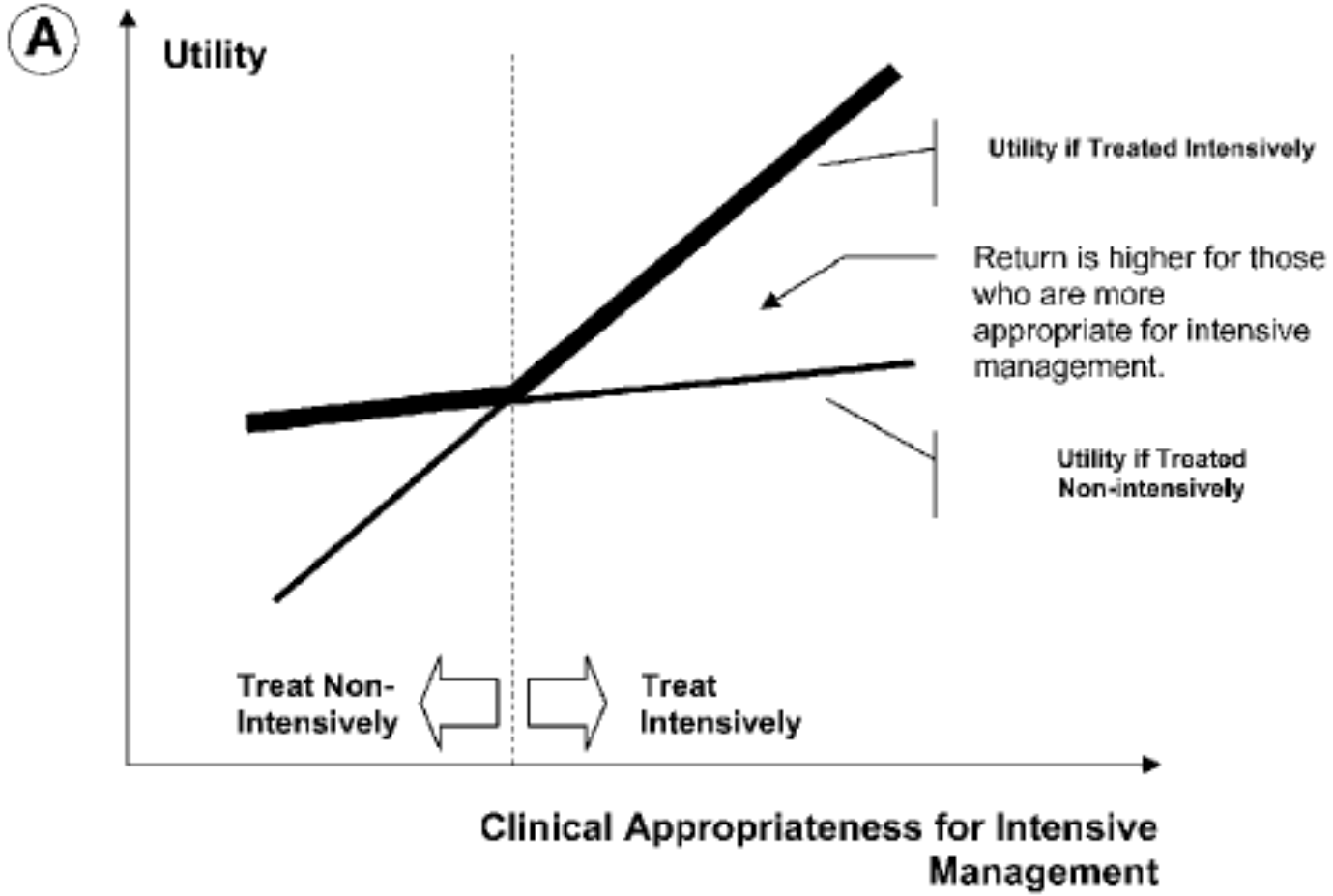


Mulligan and Rubinstein, 2008

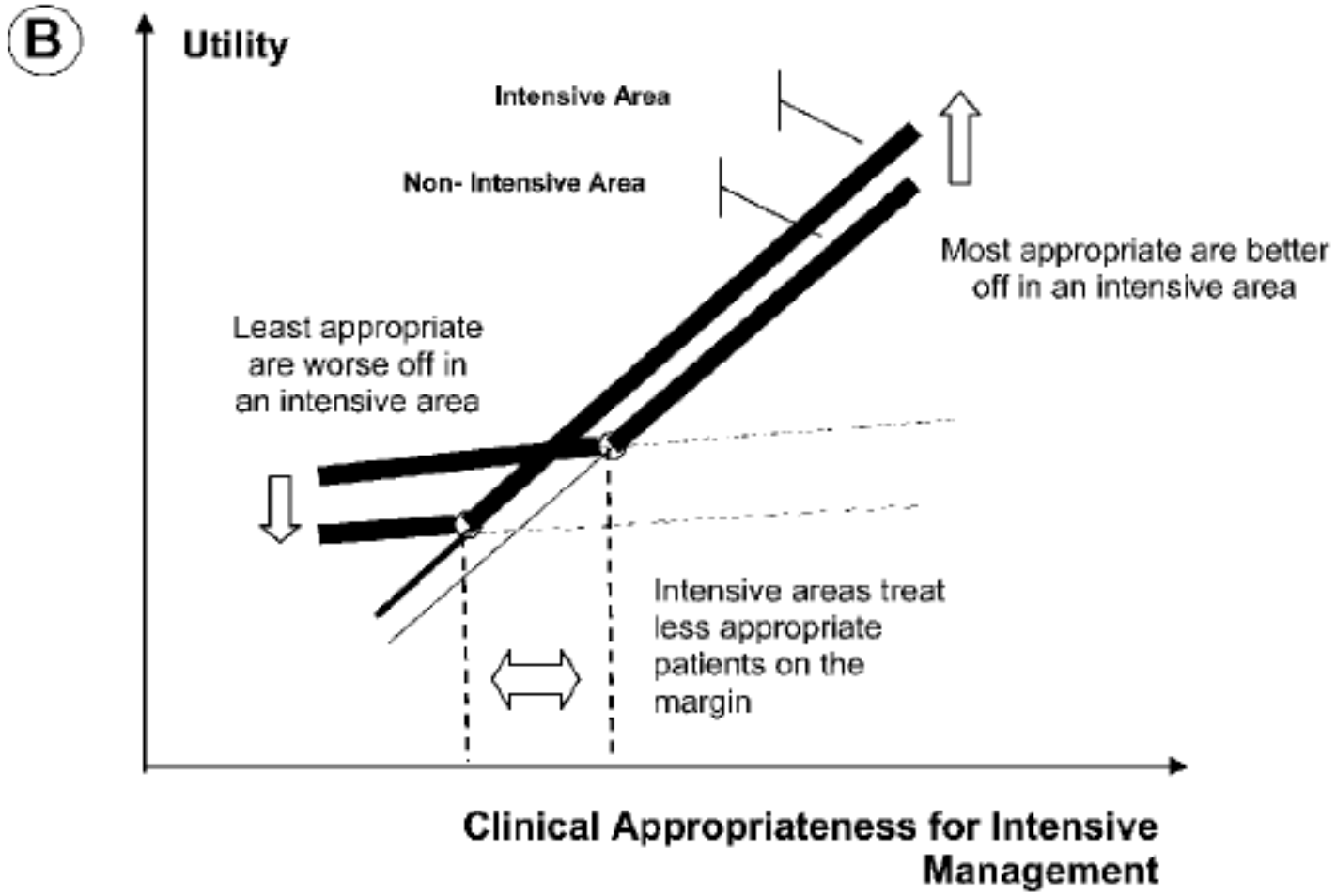
Chandra and Staiger 2007 (*JPE*)



Chandra and Staiger, 2007



Chandra and Staiger, 2007



Chandra and Staiger, 2007

TABLE 1

INSTRUMENTAL VARIABLE ESTIMATES OF INTENSIVE MANAGEMENT AND SPENDING ON ONE-YEAR SURVIVAL BY CLINICAL APPROPRIATENESS OF PATIENT

	INSTRUMENTAL VARIABLE ESTIMATES OF		
	Impact of Cath		
SAMPLE	On One-Year Survival (1)	On One-Year Cost ($1,000s) (2)	Impact of $1,000 on One-Year Survival (3)
A. All patients (N = 129,895)	.142	9.086	.016
	(.036)	(1.810)	(.005)
B. By cath propensity:			
Above the median (N = 64,799)	.184	4.793	.038
	(.034)	(1.997)	(.017)
Below the median (N = 65,096)	.035	17.183	.002
	(.083)	(3.204)	(.005)
Difference	.149	−12.39	.036
	(.090)	(3.775)	(.018)
C. By age:			
65–80 (N = 89,947)	.171	6.993	.024
	(.037)	(1.993)	(.009)
Over 80 (N = 39,948)	.016	16.026	.001
	(.108)	(2.967)	(.007)
Difference	.155	−9.033	.023
	(.114)	(3.574)	(.011)

NOTE.—Cath propensity is an empirical measure of patient appropriateness for intensive treatments. We define this measure by using fitted values from a logit model of the receipt of cardiac catheterization on all the CCP risk adjusters. Differential distance (measured as the distance between the patient's zip code of residence and the nearest catheterization hospital minus the distance to the nearest hospital) is the instrument. Each model includes all the CCP risk adjusters, and the standard errors are clustered at the level of each HRR.

Chandra and Staiger, 2007

TABLE 2

RELATIONSHIP BETWEEN DIFFERENTIAL DISTANCE (DD) AND PROBABILITY OF CATHETERIZATION AND SURVIVAL, AND DIFFERENTIAL DISTANCE AND OBSERVABLE CHARACTERISTICS (%)

	30-DAY CATH RATE		ONE-YEAR SURVIVAL		ONE-YEAR PREDICTED SURVIVAL		30-DAY PREDICTED CATH RATE FOR PATIENTS GETTING CATH	
SAMPLE	DD Below Median (1)	DD Above Median (2)	DD Below Median (3)	DD Above Median (4)	DD Below Median (5)	DD Above Median (6)	DD Below Median (7)	DD Above Median (8)
All patients (N = 129,997)	48.9	42.8	67.6	66.7	67.5	67.2	63.3	63.2
By cath propensity:								
Above the median (N = 64,733)	74.0	67.1	84.6	83.8	83.4	83.5	72.6	72.6
Below the median (N = 65,244)	22.9	19.5	50.1	50.4	51.1	51.6	32.3	32.5
By age:								
65–80 (N = 90,016)	61.1	54.9	74.3	73.5	73.9	73.9	67.4	67.3
Over 80 (N = 39,961)	20.3	16.5	52.1	52.1	52.6	52.7	34.6	34.1

NOTE.—Cath propensity is an empirical measure of patient appropriateness for intensive treatments. We define this measure by using fitted values from a logit model of the receipt of cardiac catheterization on all the CCP risk adjusters. Differential distance is measured as the distance between the patient's zip code of residence and the nearest catheterization hospital minus the distance to the nearest hospital.

Chandra and Staiger, 2007

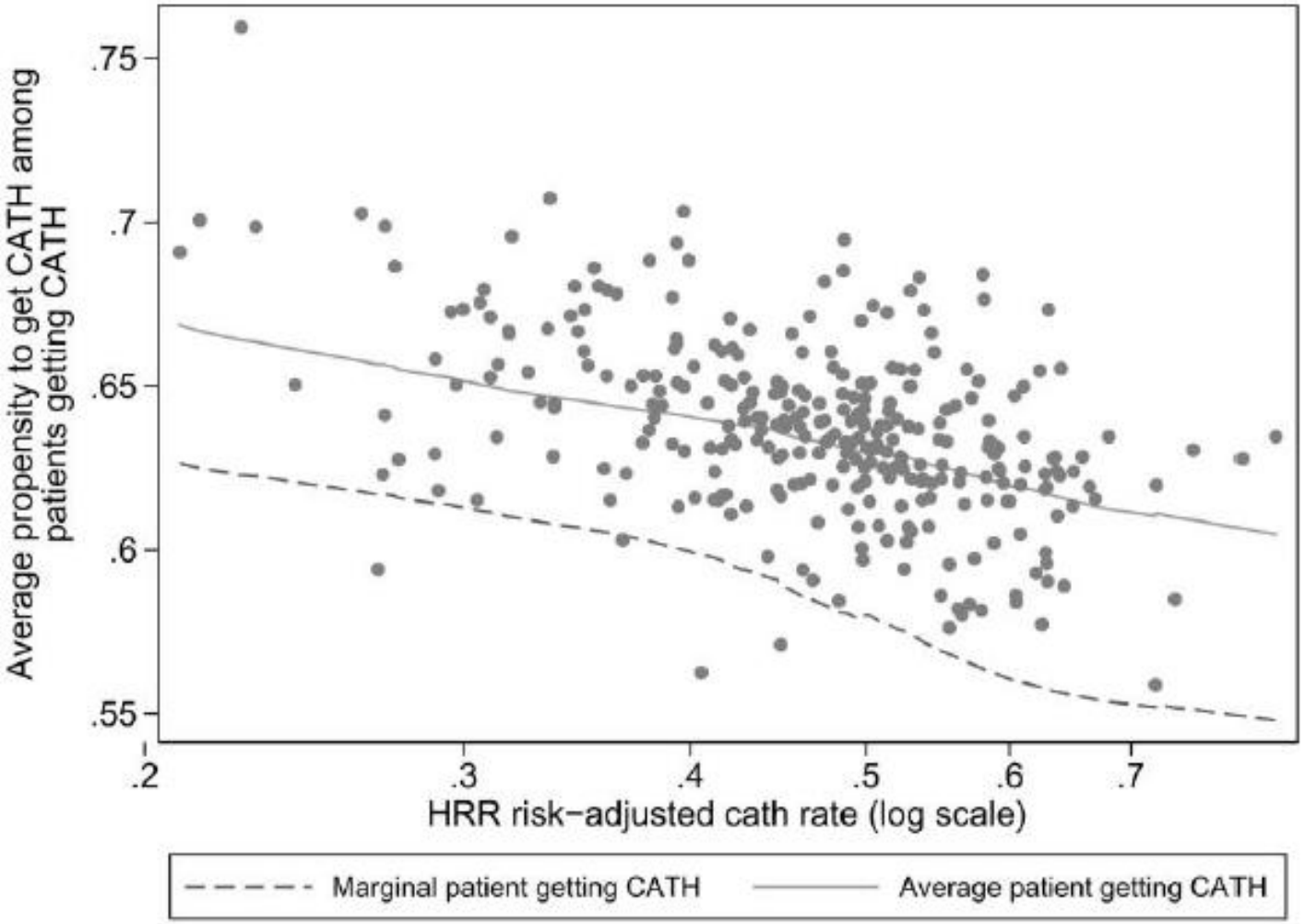
TABLE 3

RELATIONSHIP BETWEEN THE AVERAGE AND MARGINAL PATIENT RECEIVING CARDIAC CATHETERIZATION ($N = 303$)

Patient Characteristic	Characteristic of Average Patient Getting Cath across All Areas (1)	Difference between Marginal Patient and Average Patient Getting Cath in Higher-Cath HRRs (2)
Cath propensity	.633	−.045
	(.002)	(.008)
Over age 80	.125	.063
	(.002)	(.012)
Not eligible for cath using ACC/AHA guidelines	.028	.010
	(.001)	(.003)

NOTE.—Cath propensity is an empirical measure of patient appropriateness for intensive treatments. We define this measure by using fitted values from a logit model of the receipt of cardiac catheterization on all the CCP risk adjusters. The sample is restricted to patients receiving cardiac catheterization within 30 days of an AMI. ACC/AHA guidelines reflect a binary variable assigned to each patient in the CCP that measures whether the patient is ideal, appropriate, or not eligible for catheterization on the basis of a review of the patient's chart.

Chandra and Staiger, 2007



Chandra and Staiger, 2007

TABLE 4

HRR-Level Measures of Intensive Treatment, Medical Management, Support of Medical Treatment, and Demographic Characteristics

HRR Indicator	Mean	Standard Deviation	10th Percentile	90th Percentile	Correlation with HRR Cath Rate
Measures of intensive treatment:					
Risk-adjusted 30-day cath rate	46.3%	9.1%	34.5%	58.3%	1.00
Risk-adjusted 30-day PTCA rate	17.7%	5.1%	11.3%	23.6%	.81
Risk-adjusted 30-day CABG rate	13.4%	2.9%	10.2%	16.9%	.51
Risk-adjusted 12-hour PTCA rate	2.7%	2.6%	.6%	5.8%	.52
Measures of quality of medical management:					
Risk-adjusted beta-blocker rate	45.6%	9.5%	34.2%	58.3%	−.31
Support for intensive treatment:					
Cardiovascular surgeons per 100,000	1.06	.27	.70	1.40	.33
Cath labs per 10,000	2.40	.76	1.50	3.30	.39
Demographic characteristics:					
Log of resident population	13.96	.89	12.72	15.18	−.05
Log of per capita income	9.55	.20	9.31	9.85	.02
Percent college graduates	19.3%	5.5%	13.1%	26.6%	−.05

Note.—HRR surgical and medical intensity rates are computed as the risk-adjusted fixed effects from a patient-level regression of the receipt of cath or beta-blockers on HRR fixed effects and CCP risk adjusters.

Chandra and Staiger, 2007

TABLE 5

OLS Restimates of the Relationship between Probability of Receiving Catheterization and HRR Patient Characteristics (N = 138,873)

HRR-Level Independent Variable	Probability of Receiving Catheterization	
	(1)	(2)
Average propensity to get cath	.529	.575
	(.172)	(.167)
Percent under age 65		.150
		(.135)
Log of resident population		−.003
		(.005)
Log of per capita income		.024
		(.024)

Note.—The table reports OLS estimates of the relationship between a patient receiving catheterization and the average appropriateness for catheterization in an HRR. Regressions control for patient risk adjusters, and standard errors are clustered at the level of HRRs.

Chandra and Staiger, 2007

TABLE 6

INSTRUMENTAL VARIABLE ESTIMATES OF INTENSIVE MANAGEMENT AND SPENDING ON SURVIVAL, BY SURGICAL INTENSITY OF HOSPITAL REFERRAL REGION

	INSTRUMENTAL VARIABLE ESTIMATES OF		
	Impact of Cath		
SAMPLE	On One-Year Survival (1)	On One-Year Cost ($1,000s) (2)	Impact of $1,000 on One-Year Survival (3)
A. All patients:			
HRR risk-adjusted cath rate:			
Above the median (N = 63,771)	.256	6.691	.038
	(.061)	(3.510)	(.021)
Below the median (N = 66,124)	.09	9.835	.009
	(.059)	(3.155)	(.007)
Difference	.166	−3.144	.029
	(.085)	(4.720)	(.022)
B. Patients above the median cath propensity:			
HRR risk-adjusted cath rate:			
Above the median (N = 32,388)	.271	.347	.78
	(.064)	(4.370)	(9.820)
Below the median (N = 32,411)	.168	4.962	.034
	(.046)	(2.890)	(.021)
C. Patients below the median cath propensity:			
HRR risk-adjusted cath rate:			
Above the median (N = 31,383)	.206	16.21	.013
	(.129)	(5.130)	(.009)
Below the median (N = 33,713)	−.139	22.064	−.006
	(.165)	(6.870)	(.007)

NOTE.—HRR intensity rates are computed as the risk-adjusted fixed effects from a patient-level regression of the receipt of cath on HRR fixed effects and CCP risk adjusters. Differential distance (measured as the distance between the patient's zip code of residence and the nearest catheterization hospital minus the distance to the nearest hospital) is the instrument. Each model includes all the CCP risk adjusters, and the standard errors are clustered at the level of each HRR.

Chandra and Staiger, 2007

TABLE 7

RELATIONSHIP BETWEEN HRR CATHETERIZATION RATE, SURVIVAL, AND COSTS, BY CLINICAL APPROPRIATENESS FOR INTENSIVE MANAGEMENT

	OLS ESTIMATES OF THE RELATIONSHIP BETWEEN HRR RISK-ADJUSTED CATH RATE AND			
SAMPLE	One-Year Survival (1)	One-Year Cost ($1,000s) (2)	Beta-Blocker in Hospital (3)	Catheterization within 30 Days (4)
A. All patients (N = 138,873)	.007	8.093	−.28	.702
	(.019)	(1.410)	(.073)	(.004)
B. By cath propensity:				
Top tercile (N = 46,287)	.052	10.012	−.366	.802
	(.019)	(1.439)	(.073)	(.032)
Middle tercile (N = 46,295)	.03	11.154	−.271	.906
	(.030)	(1.784)	(.082)	(.021)
Bottom tercile (N = 46,291)	−.075	2.763	−.209	.369
	(.028)	(1.612)	(.073)	(.021)
Difference (top − bottom)	.127	7.249	−.157	.433
	(.034)	(2.161)	(.103)	(.038)
C. By age:				
65–80 (N = 96,093)	.023	9.616	−.311	.775
	(.021)	(1.448)	(.072)	(.012)
Over 80 (N = 42,780)	−.031	4.738	−.215	.531
	(.028)	(1.603)	(.080)	(.022)
Difference (top − bottom)	.054	4.878	−.096	.244
	(.035)	(2.160)	(.108)	(.025)
D. By AHA/ACC criterion:				
Ideal (N = 89,569)	.027	9.845	−.302	.769
	(.023)	(1.599)	(.076)	(.010)
Appropriate (N = 31,800)	−.002	6.174	−.282	.752
	(.024)	(1.537)	(.080)	(.026)
Not appropriate (N = 17,504)	−.08	2.958	−.177	.264
	(.040)	(1.511)	(.065)	(.021)
Difference (top − bottom)	.107	6.887	−.125	.505
	(.046)	(2.200)	(.100)	(.023)

NOTE.—Cath propensity is an empirical measure of patient appropriateness for intensive treatments. We define this measure by using fitted values from a logit model of the receipt of cardiac catheterization on all the CCP risk adjusters. HRR surgical and medical intensity rates are computed as the risk-adjusted fixed effects from a patient-level regression of the receipt of cath or beta-blockers on HRR fixed effects and CCP risk adjusters.

Chandra and Staiger, 2007