

The Math Gender Gap and Women's
Career Outcomes
&
Family, Values, and Women in Finance

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CFA Research Institute

- Question: Why are less than 20% of CFAs women?

What is required to be a CFA?

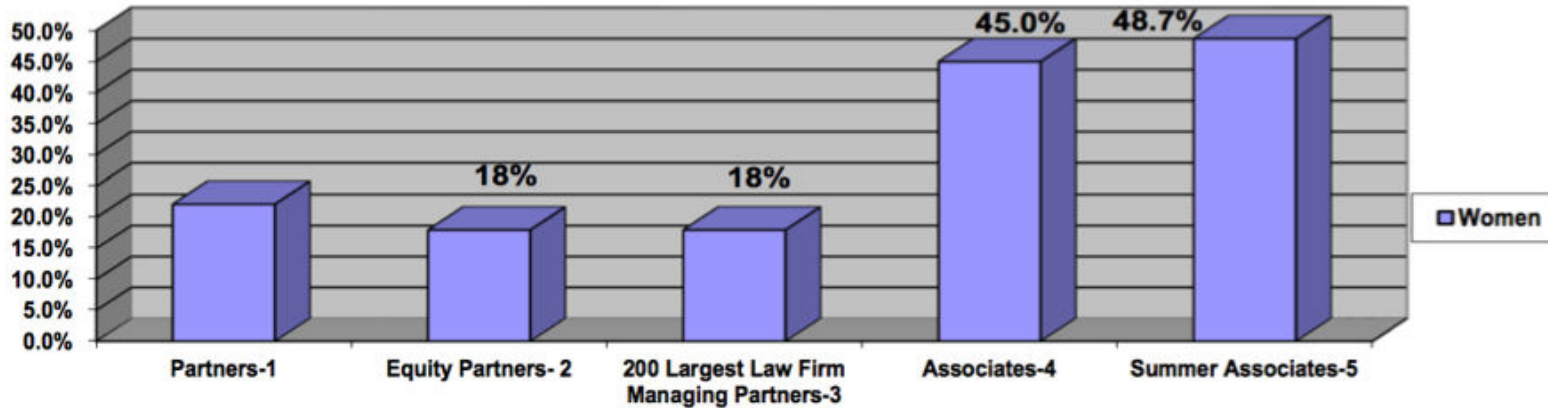
- Regular Member
 - Bachelor's Degree
 - Pass CFA Level I exam (40% pass rate)
 - Possess 4 years of professional work experience
 - 3 Professional References
- Charterholder
 - Pass Level II (43% pass rate).
 - Pass Level III (51% pass rate).

Women

- 57% of college graduates
- 48% of graduating business majors
- 50% of CPAs
- 48% of medical students
- 47% of law school students
- 30% of finance majors
- 18% of CFA charterholders

Law

Women in Private Practice



Women in Corporations

Fortune 500 General Counsel



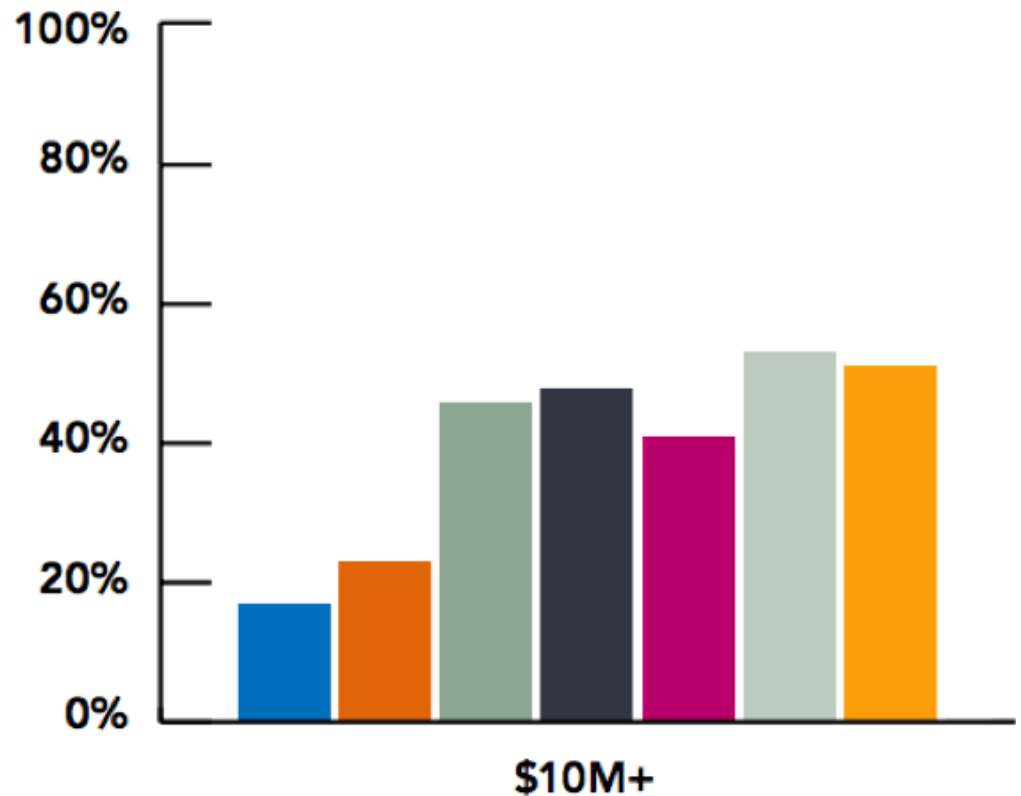
Fortune 501-1000 General Counsel



CPAs

How Many Women at Different Levels?

- Partner
- Director/non-equity partner
- Senior manager
- Manager
- Senior associate
- Associate
- New professional



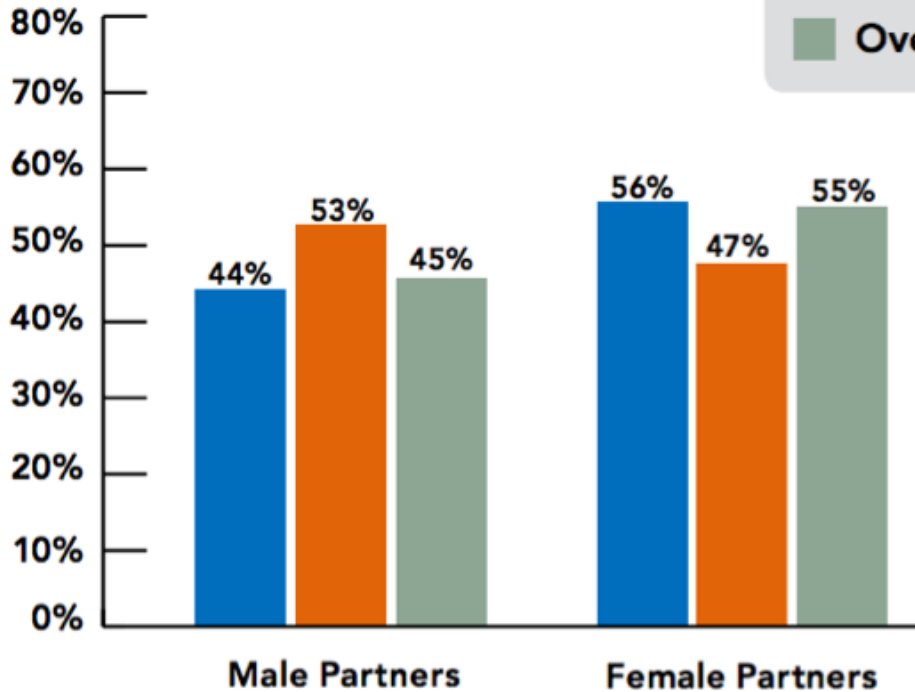
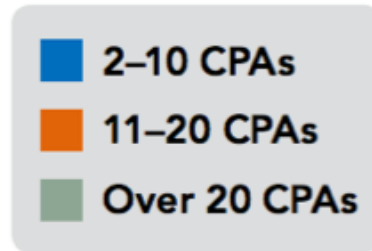
CPAs

55%

of firms have partners with FWAs

Flexible Work Arrangements

Partners Using FWAs by Gender and Firm Size



% Female, CFA Members

20
15
10
5
0

21-29

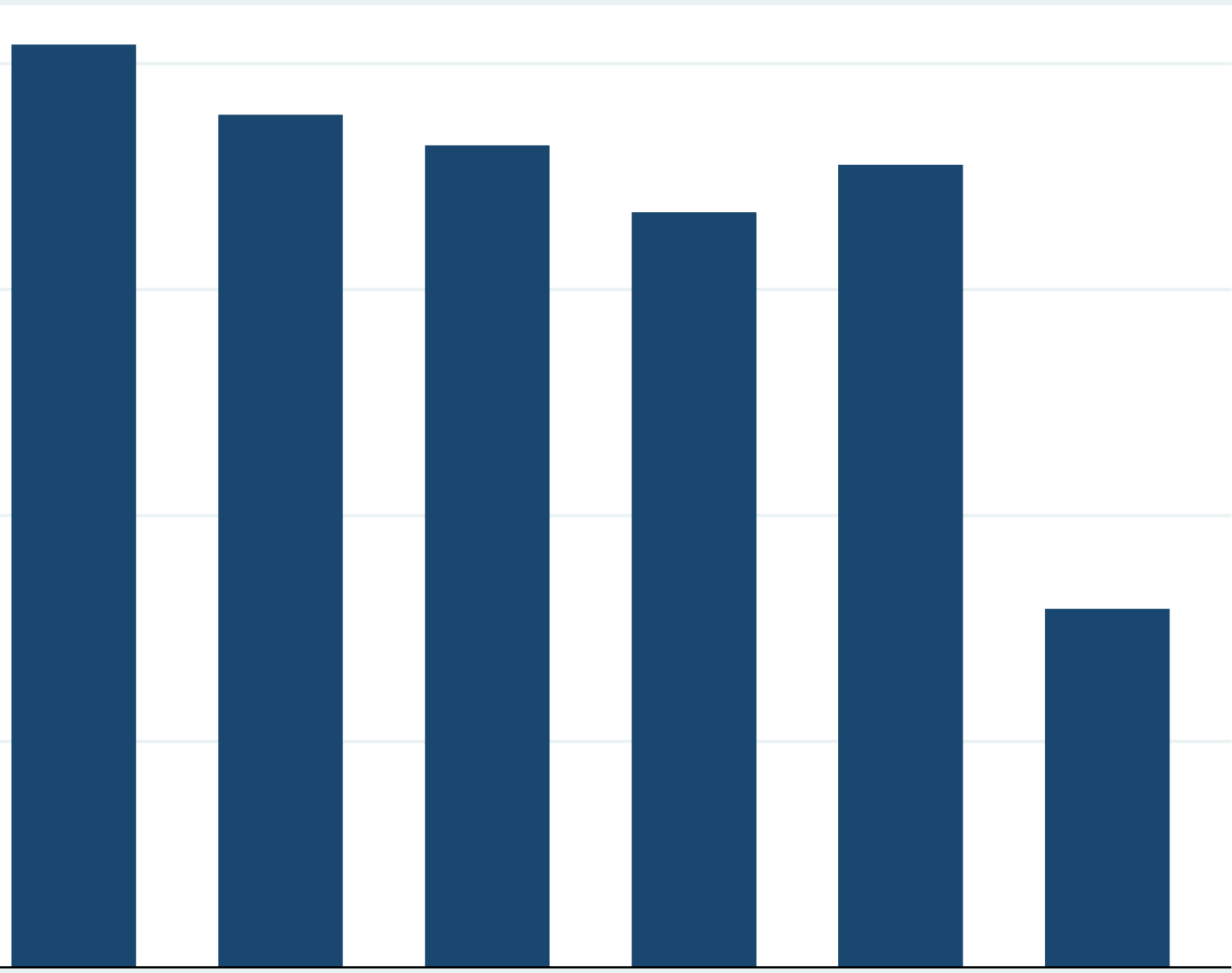
30-39

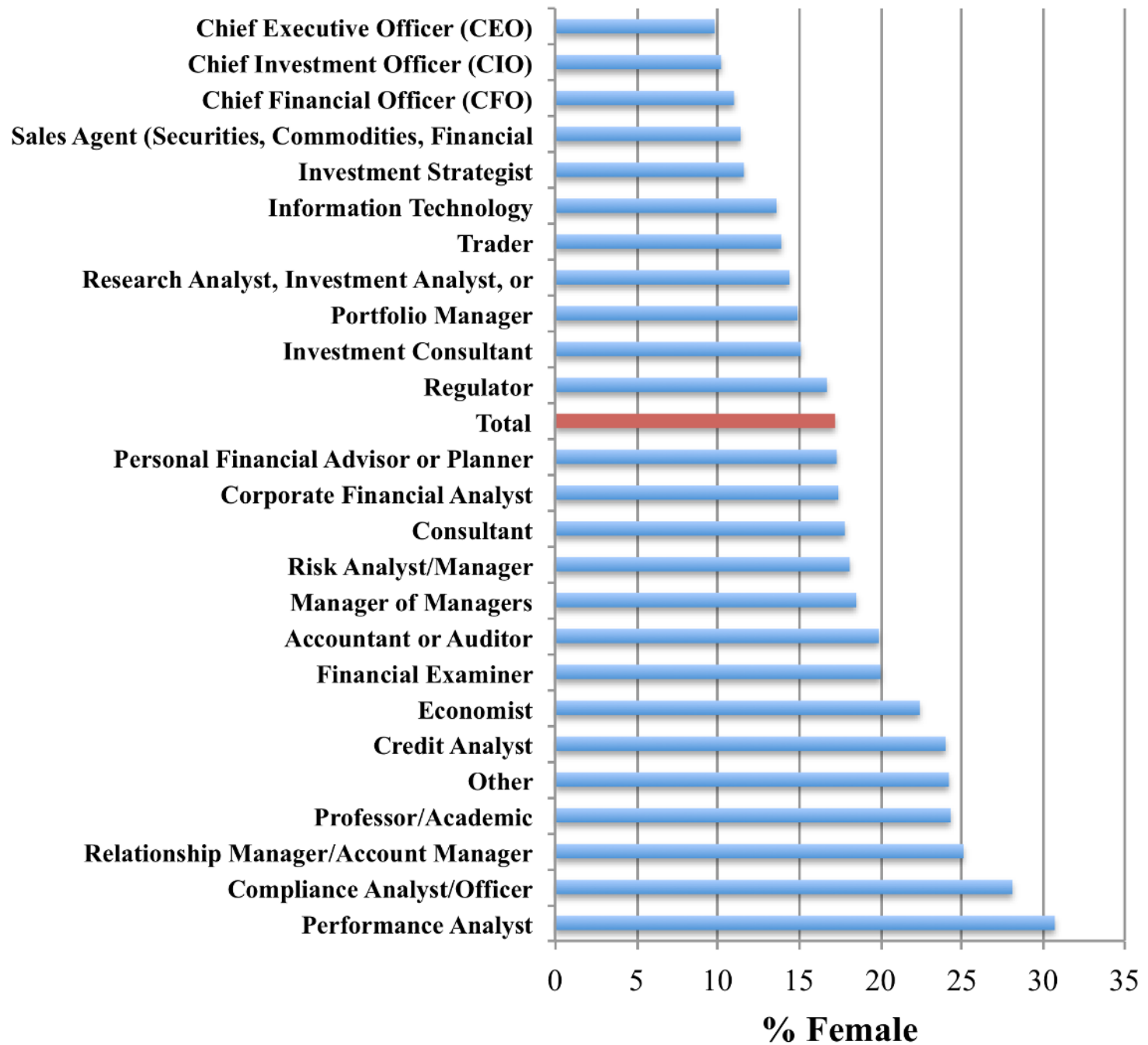
40-49

50-59

60-69

> 70





Mutual Fund Managers

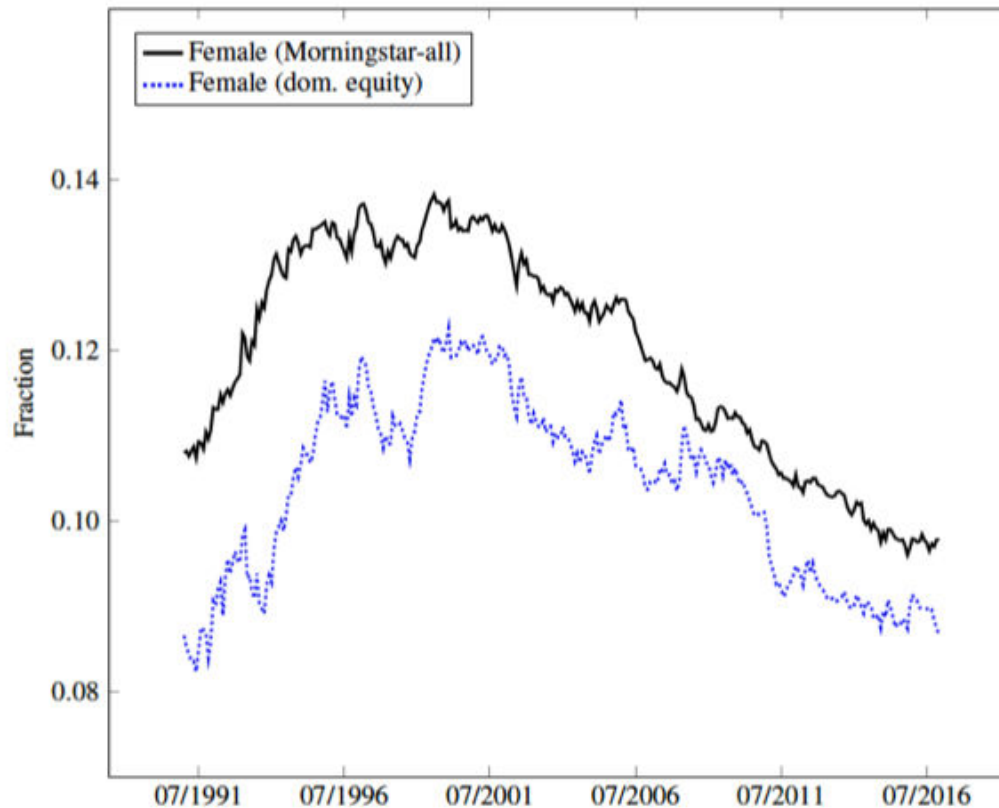


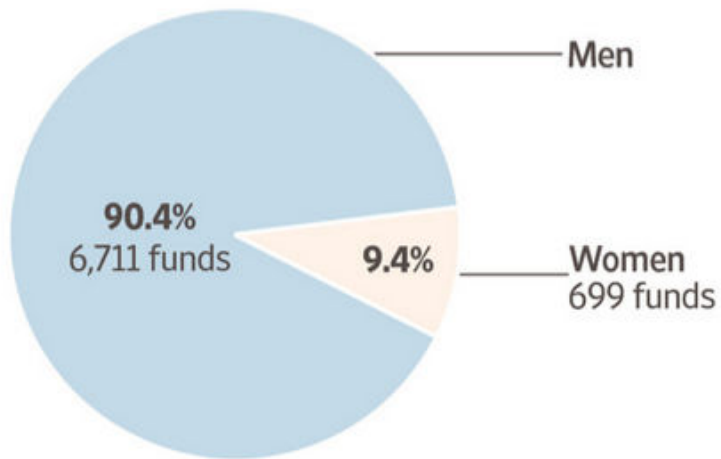
Figure 1. Fraction of female managers. The figure plots the fraction of female fund managers by month. The solid line plots the fraction for all managers in the Morningstar dataset and the dotted line plots the fraction for managers of mainstream active domestic equity funds.

Mutual Fund Managers

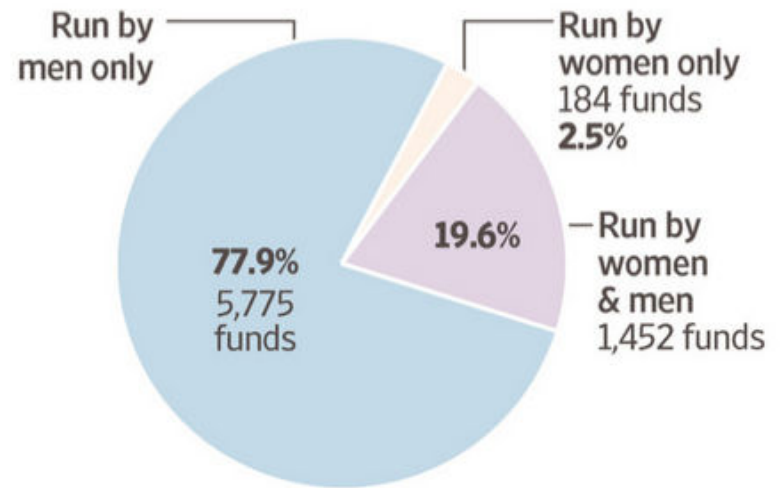
You've Got Males

Gender breakdown of 7,410 portfolio managers of U.S. mutual funds

FUND MANAGERS BY GENDER



FUNDS BY GENDER



Note: As of March 31, U.S. mutual funds only. Some percentages don't add to 100% due to rounding.

Source: Morningstar

THE WALL STREET JOURNAL.

Why are women underrepresented?

- Discrimination
- Aversion to Competition
- Gender Norms (Gender Essentialism)
 - Structure of Work
- Math Training
 - The math gender gap

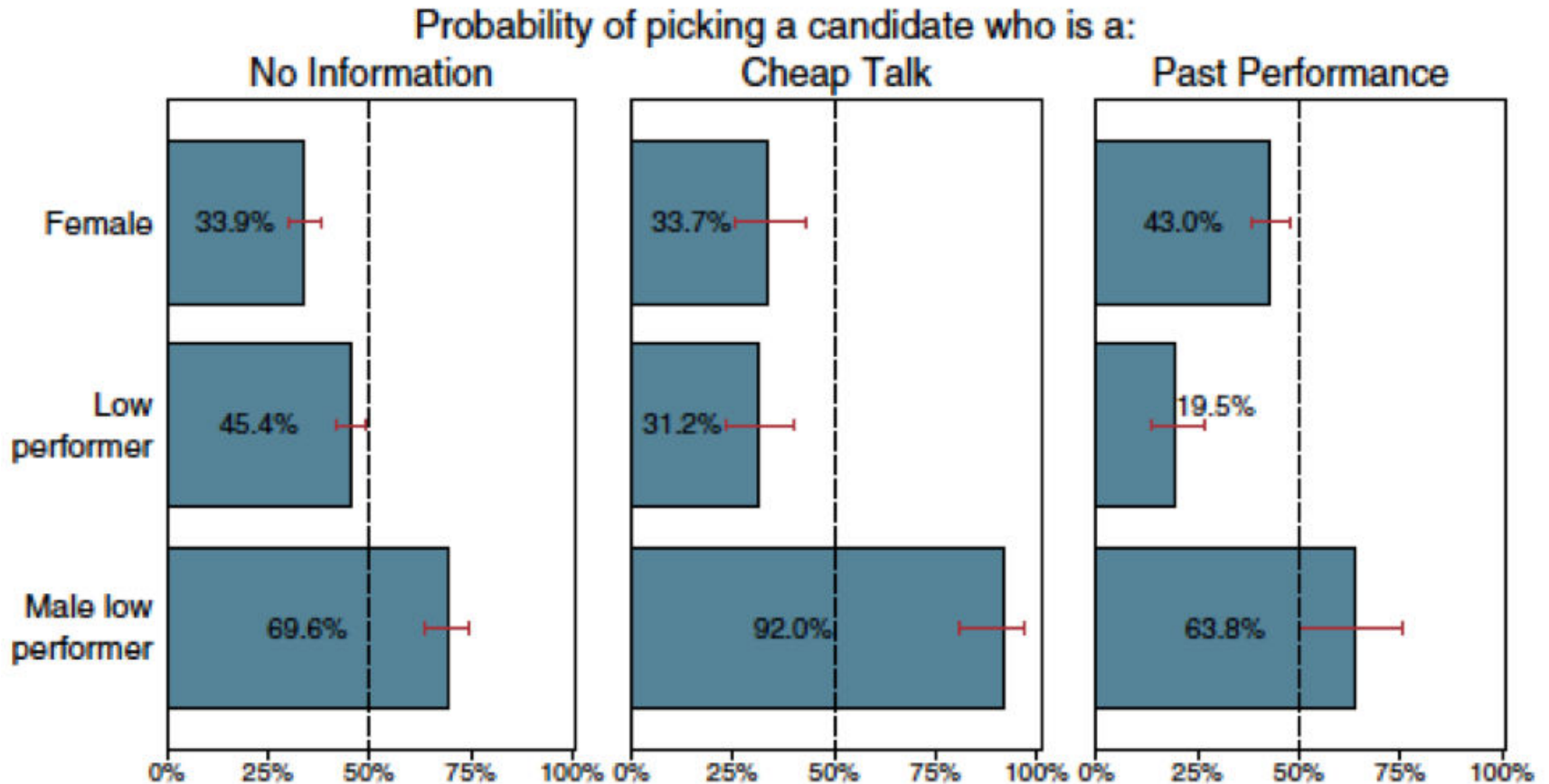
Gender-Science Implicit Association Test

Category	Items
Male	Man, Son, Father, Boy, Uncle, Grandpa, Husband, Male
Female	Mother, Wife, Aunt, Woman, Girl, Female, Grandma, Daughter
Science	Astronomy, Math, Chemistry, Physics, Biology, Geology, Engineering
Liberal Arts	History, Arts, Humanities, English, Philosophy, Music, Literature

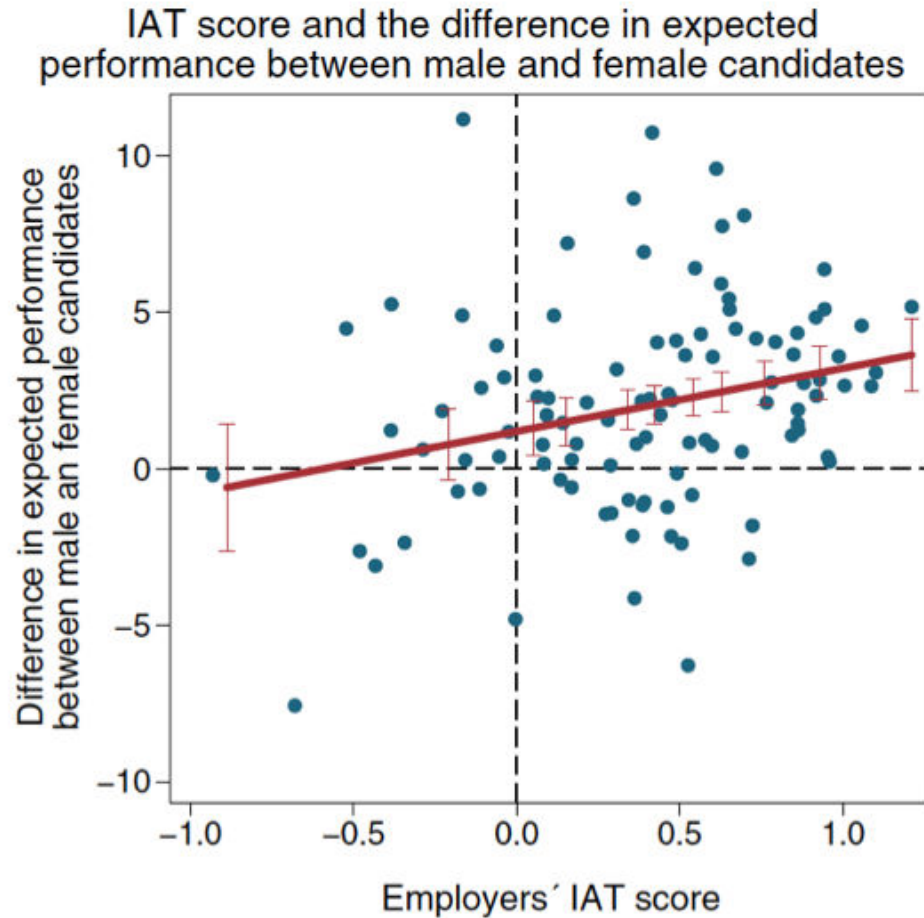
Reuben, Sapienza, Zingales (2014)

- Subjects sum sets of four two-digit numbers over 4 minutes
- Two subjects randomly selected as candidates
- The remainder were employers asked to hire one of the two candidates for a math test.
- Treatments
 - Cheap talk: Candidates talk
 - Past Performance: Scores revealed

Reuben, Sapienza, Zingales (2014)



Reuben, Sapienza, Zingales (2014)



Double Standards in Penalties?

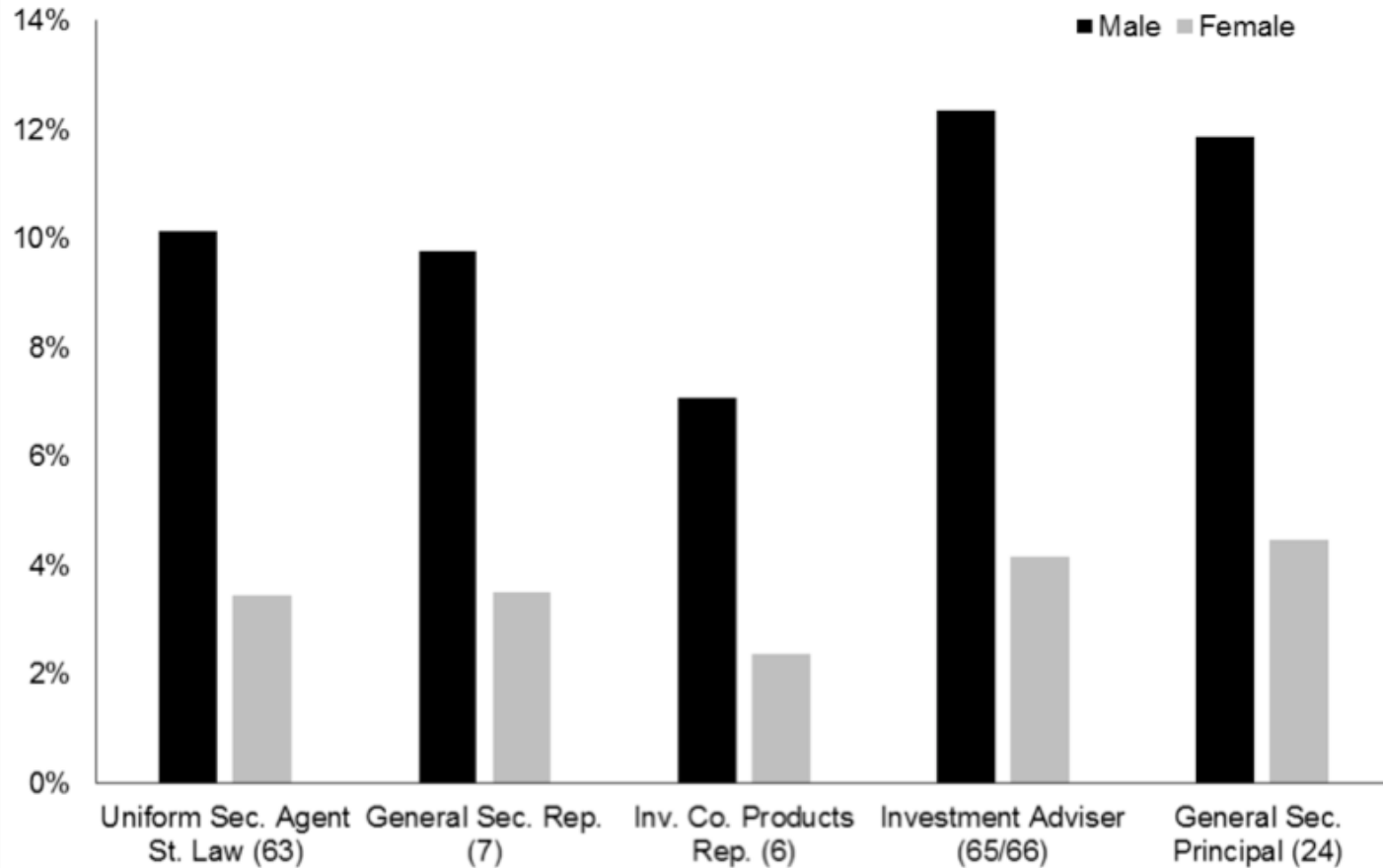
Egan, Matvos, Seru (WP, 2017)

- Analyze misconduct in Financial Advisers
- Women engage in less misconduct than men.
- Conditional on misconduct, women are penalized more than men.

Misconduct Rates

Egos, Matvos, Seru (WP 2017)

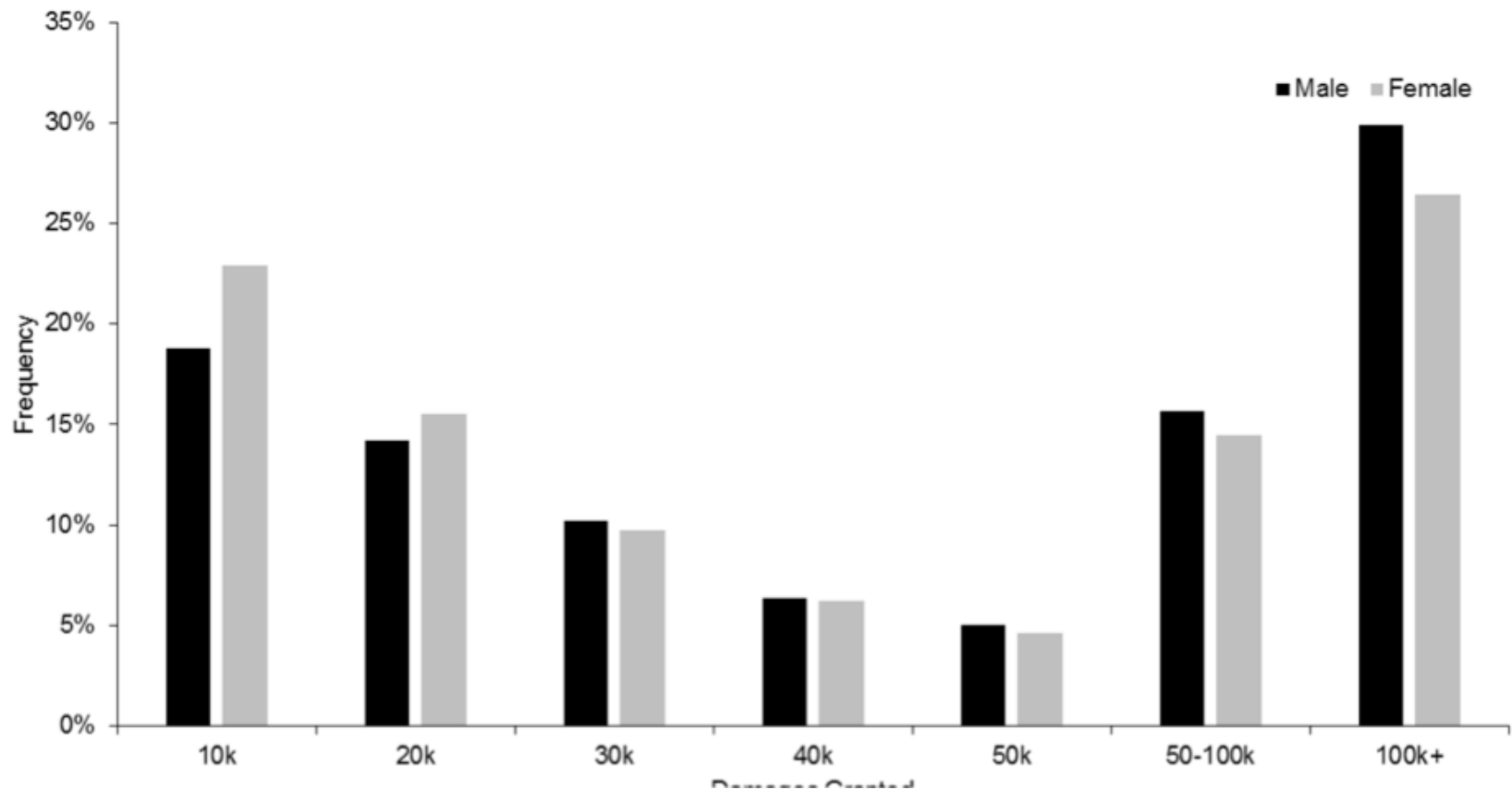
(a) Frequency of Misconduct by Qualification Exam



Misconduct Rates

Egos, Matvos, Seru (WP 2017)

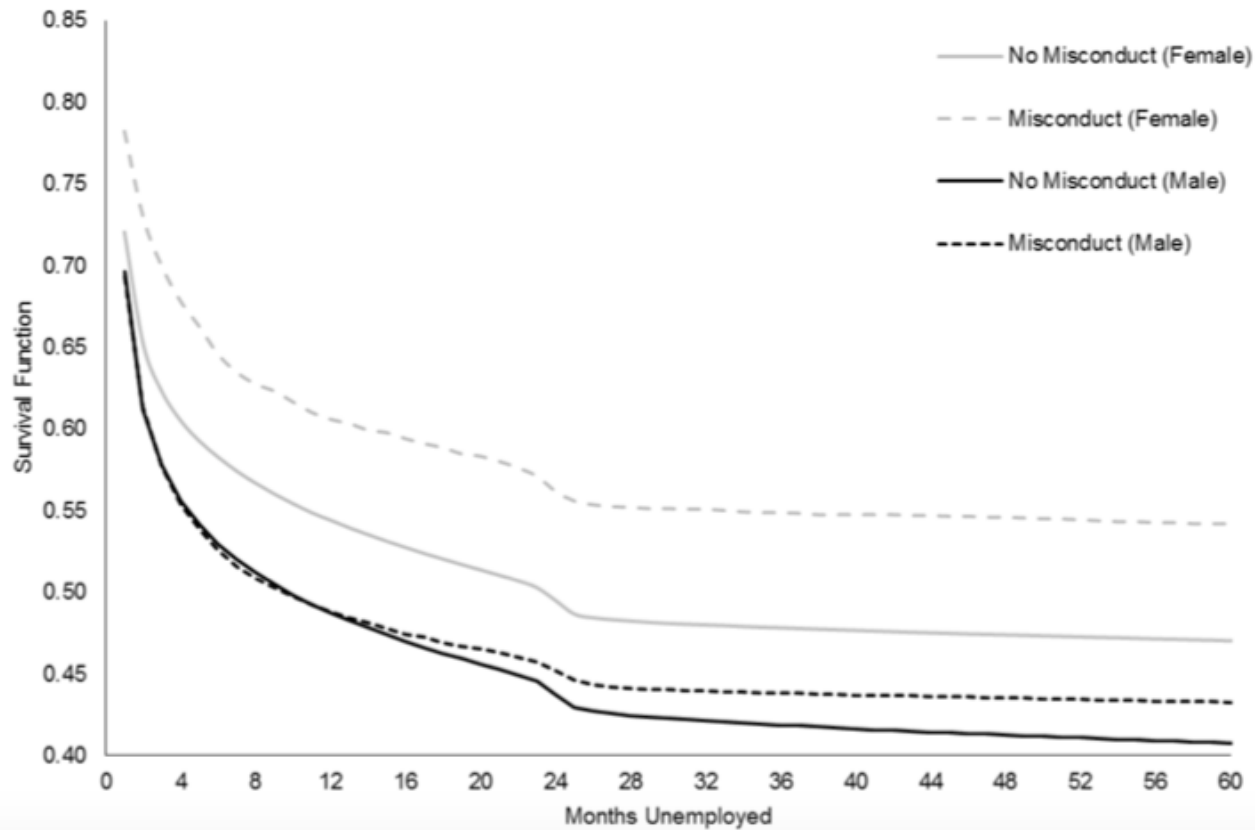
Figure 7: Distribution of Settlements/Damages



Misconduct Consequences

Egos, Matvos, Seru (WP 2017)

Figure 5: Unemployment and Misconduct



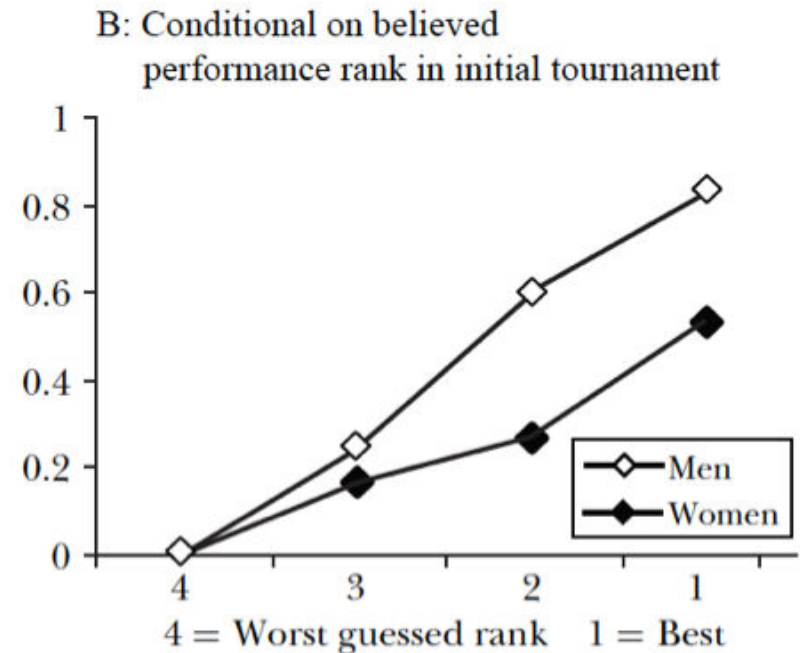
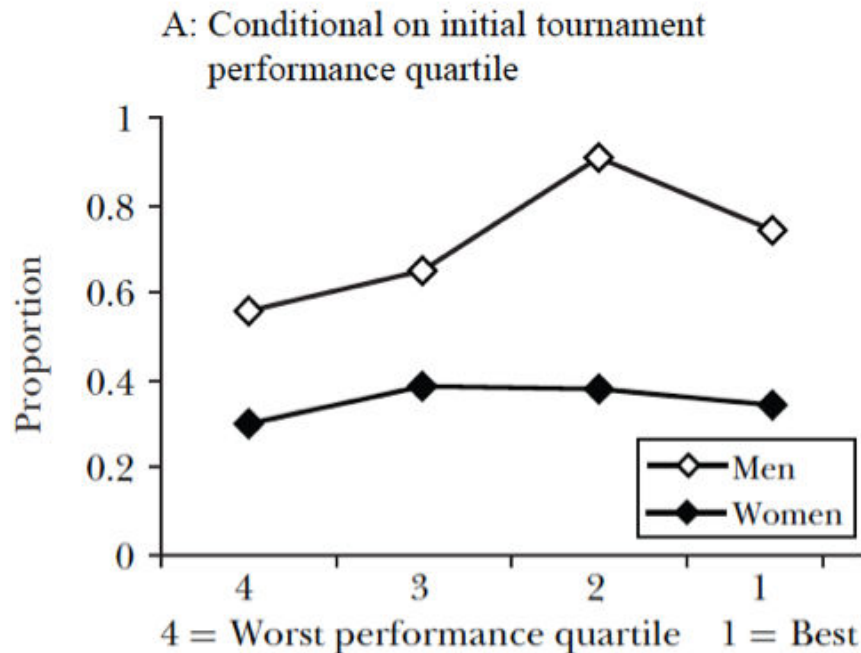
Competition Preferences

Niederle and Vesterlund (QJE, 2007)

- Women are less attracted to competitive environments
- Subjects asked to add set of five two-digit numbers
- Compensation
 - Piece rate: 50 cents per correct answer.
 - Tournament of four people:
 - Winner in group receives \$2 per correct.
 - 73% of Men Select Tournament
 - 35% of Women Select Tournament

Competition Preferences

Proportion Selecting Tournament

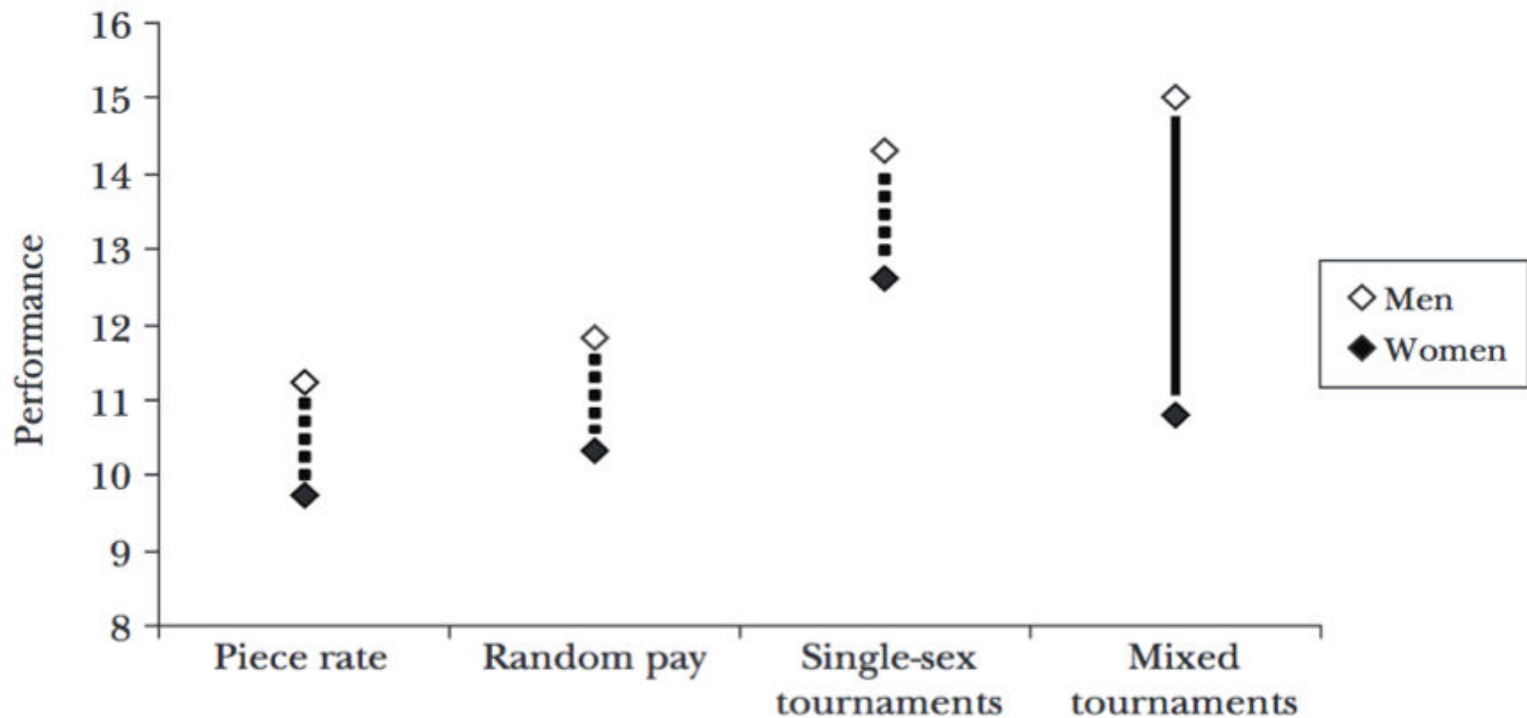


Source: Niederle and Vesterlund (2007).

Competition and Gender Gap

Gneezy, Niederle, and Rustichini (2003)

Average Performance of 30 Men and 30 Women in Each Treatment



Source: Gneezy, Niederle, and Rustichini (2003).

Gender Norms

- Women with traditional views of women's roles may not consider a career in finance.
- In marriages in which wife earns more than husband (Bertrand, Kamenica, Pan, QJE, 2016)
 - Greater likelihood of divorce
 - Women are more likely to quit their jobs
 - Women do more housework than if they earned less than husband

Convex Compensation for Time

- Women are at a disadvantage in professions, such as finance, that disproportionately reward those who work long and specific hours
 - Goldin (AER, 2014)

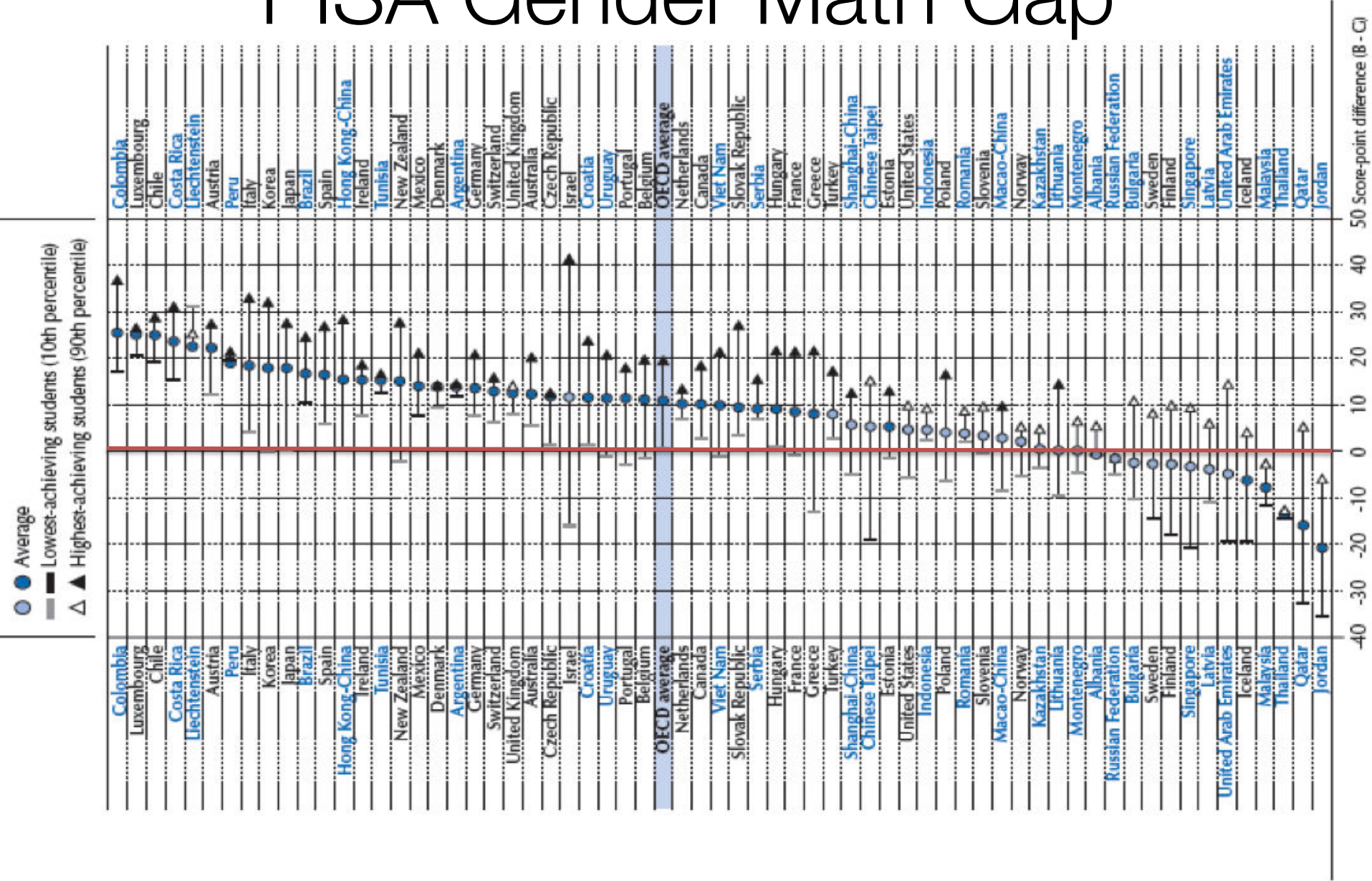
Summary—Math Gap

- Gender Representation of CFA Members is Correlated with the Gender Math Gap at age 15
 - Across Countries
 - Across States within the US
- Why? Is it because women:
 - Don't have needed math training
 - Have needed math skills, but lack confidence
 - Traditional views of women's roles correlated with traditional views about women & math
 - Discrimination against women in finance higher in areas with higher math gaps

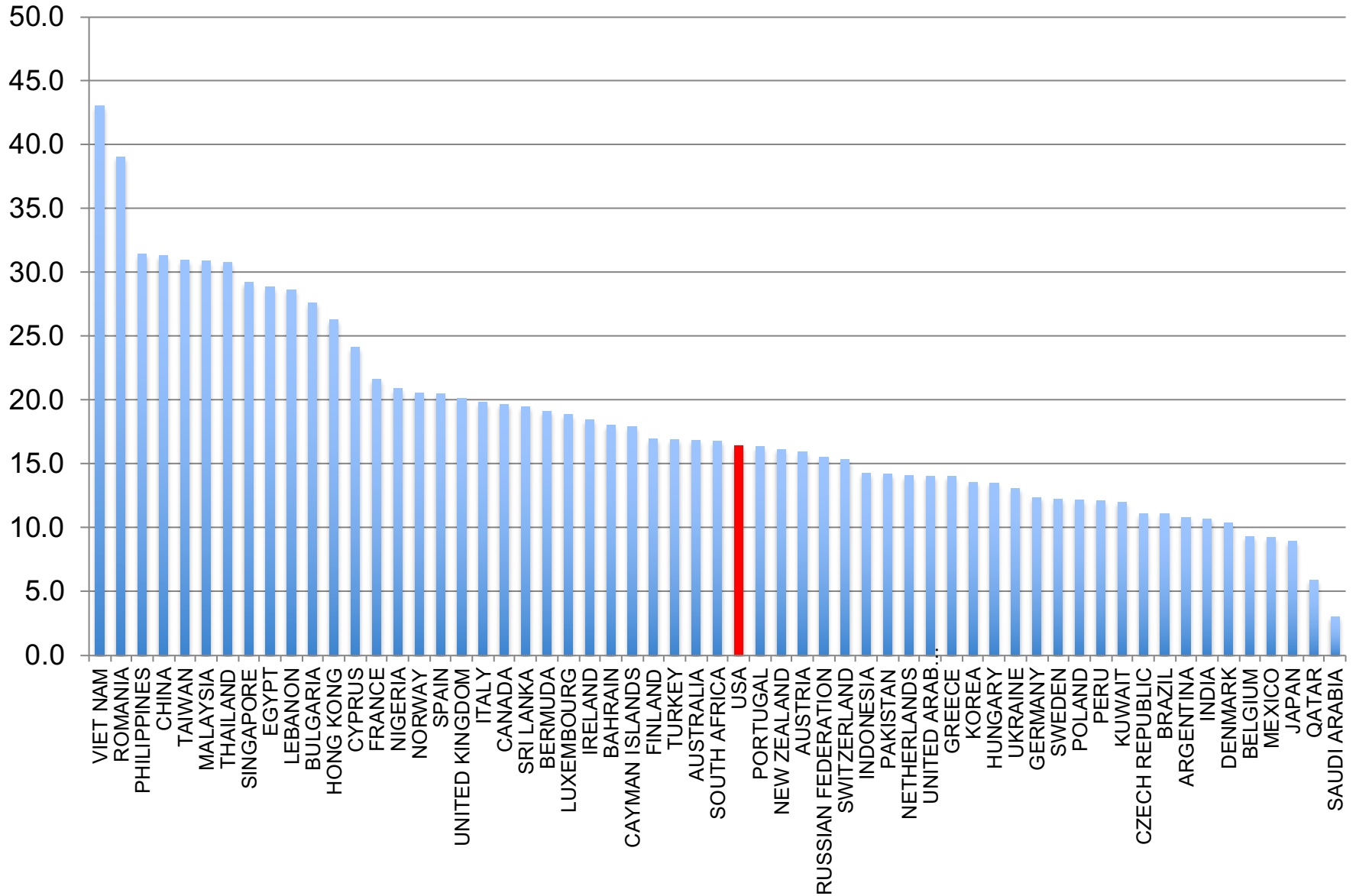
Math Gap

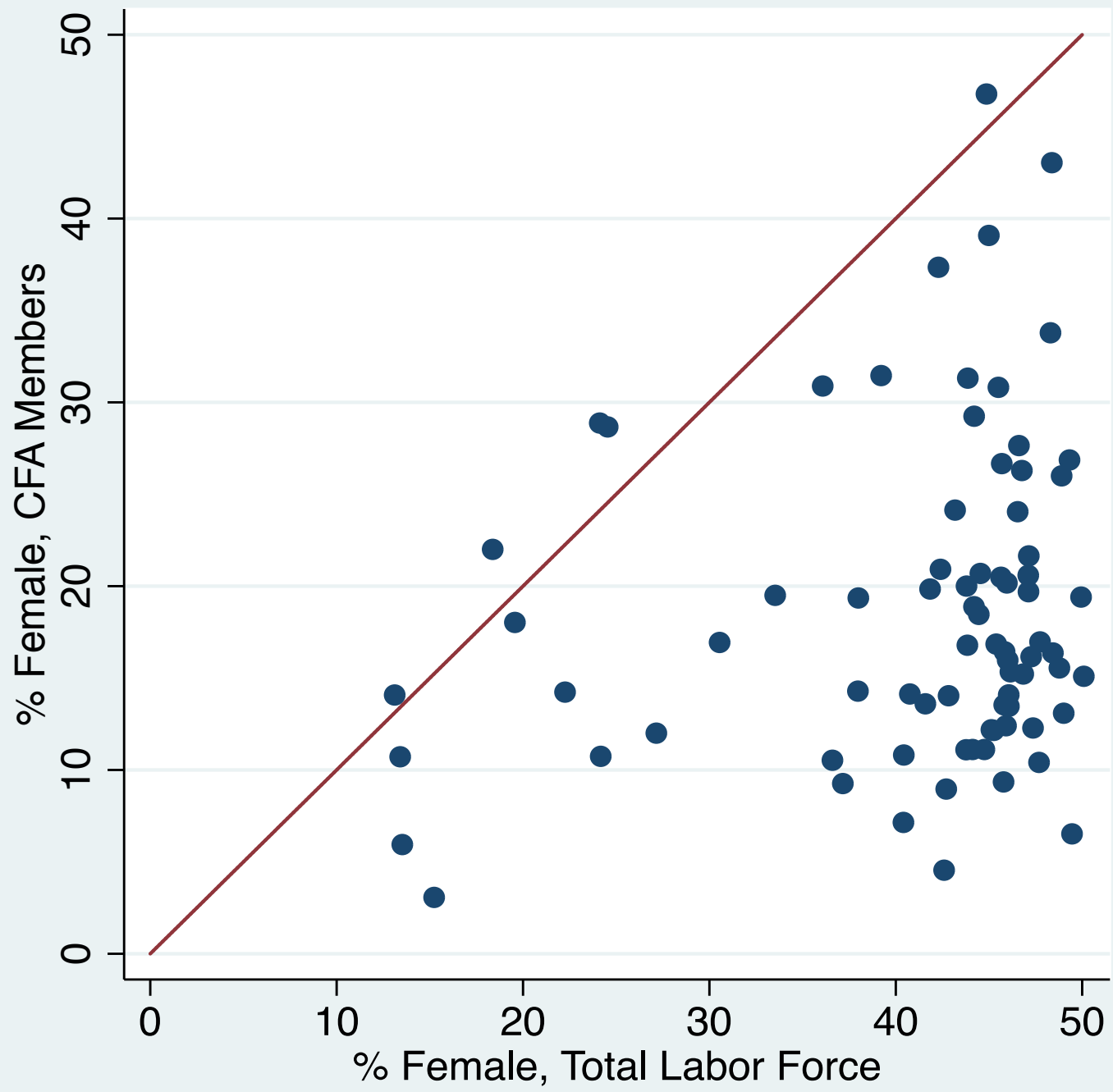
- Women lack (or believe they lack) math skills necessary for quantitative careers
 - Ellison and Swanson, 2010; Wai et al., 2010; Reuben, Sapienza and Zingales, 2014, Philippon and Reshef, 2012; Adams and Kirchmaier, 2016

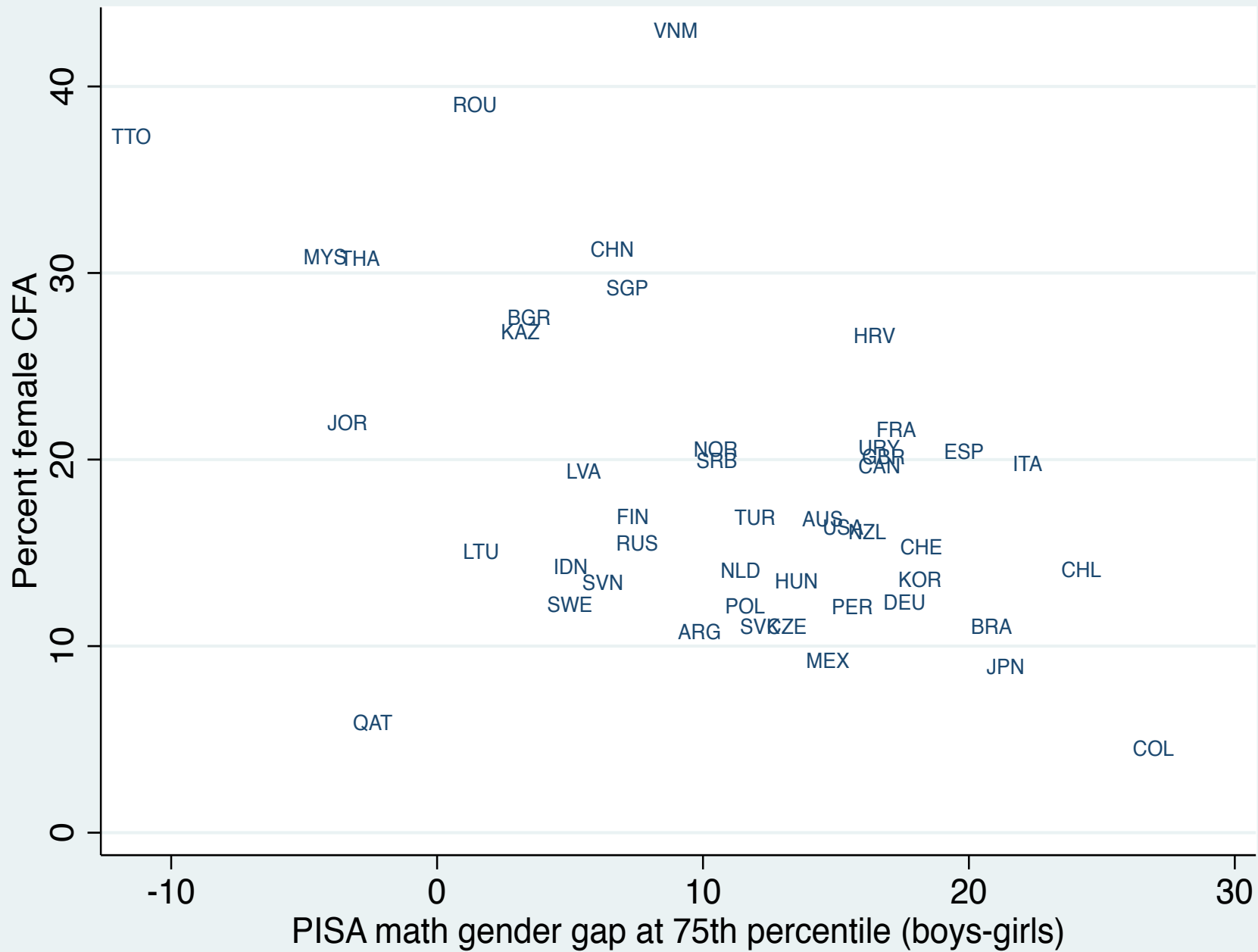
PISA Gender Math Gap



Fraction of CFA members who are female by Country

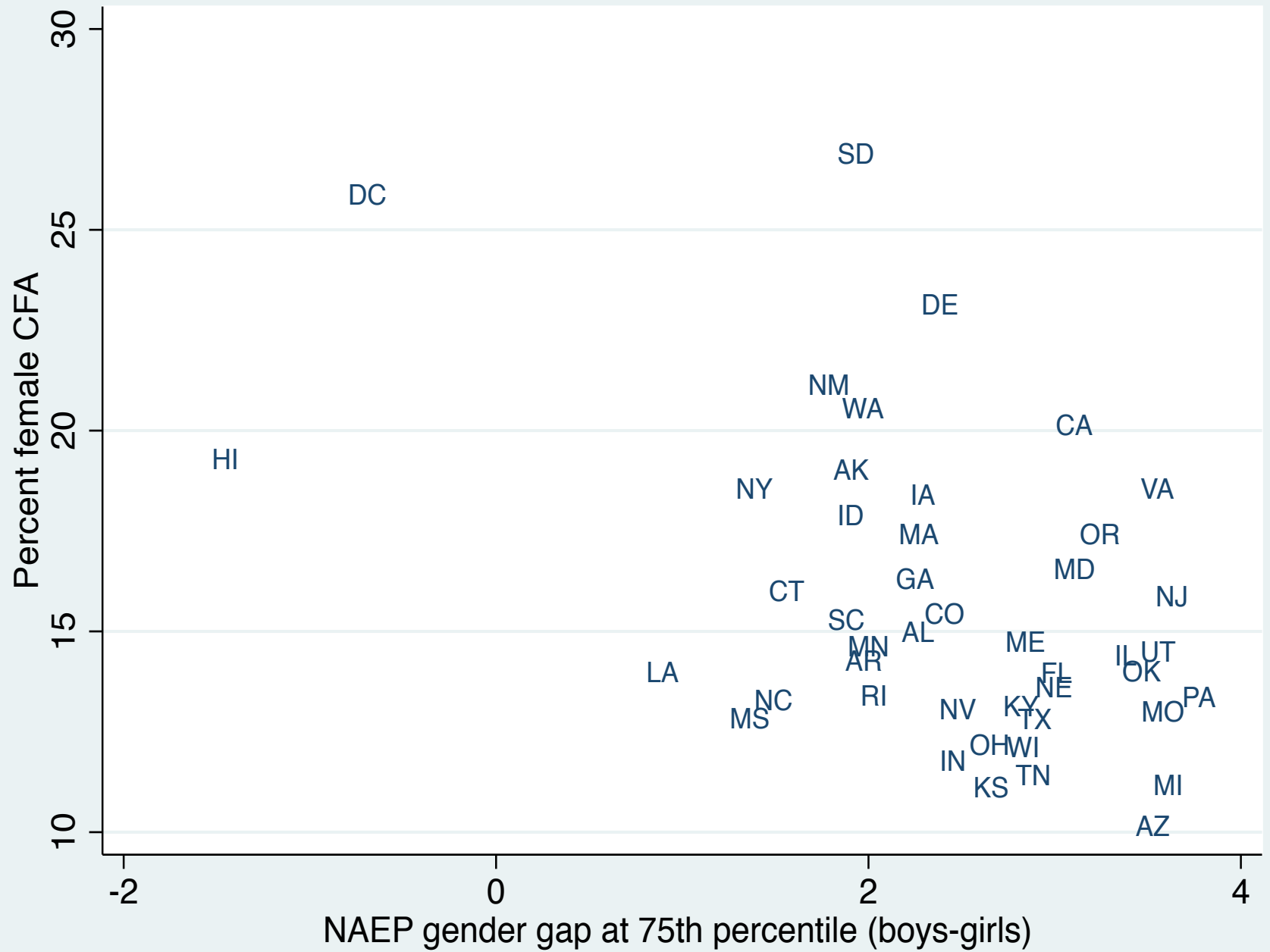






Country Level Determinants of Percent Female CFA Members

	(1)	(2)	(3)	(4)	(5)
Gender Gap in Math	-6.944***				-7.305***
	[1.692]				[1.522]
% Women - Total Labor Force		-1.801			4.386**
		[3.624]			[2.001]
Gender Inequality Index (UN)			-2.203		-2.210*
			[1.643]		[1.190]
Gender Gap in Competition				-4.682**	-1.037
				[1.857]	[1.641]
Constant	20.953***	18.819***	16.798***	20.733***	18.578***
	[1.176]	[2.096]	[1.056]	[1.463]	[0.981]
Observations	46	46	46	46	46
R-squared	0.446	0.008	0.062	0.284	0.575
Robust standard errors in brackets					
*** p<0.01, ** p<0.05, * p<0.1					



State Level Determinants of Percent Female CFA Members

	(1)	(2)	(3)	(4)
Gender Gap in Math	-1.255** [0.560]			-1.596*** [0.382]
% Women - Total Labor Force		-0.163 [1.042]		0.106 [0.772]
% Women - Finance Majors			1.473 [1.064]	2.135** [0.974]
Constant	16.621*** [0.609]	16.441*** [0.818]	16.093*** [0.642]	16.199*** [0.632]
Observations	45	45	45	45
R-squared	0.146	0.002	0.099	0.327
Robust standard errors in brackets				
*** p<0.01, ** p<0.05, * p<0.1				

Mechanism

- Not general Female Labor Force Participation
- Not general measures of inequality
 - UN Gender Inequality Index
 - WEF Gender Gap Index
 - WEF Political Empowerment Index
 - Women's empowerment index
 - Differences in Competition Attitudes

Summary—STEM Parents

- STEM Parents (especially a mother) influence women to go into finance more than men.
- Why?
 - Heredity
 - but would require asymmetric heredity
 - Pre-school and at home math training
 - Perhaps girls receive better math training from STEM parents
 - Parents view of appropriate careers
 - Perhaps girls learn of appropriate careers from parents, but does not predict differences by mom/dad
 - Parents as role models
 - Might lead to differences by mom/dad

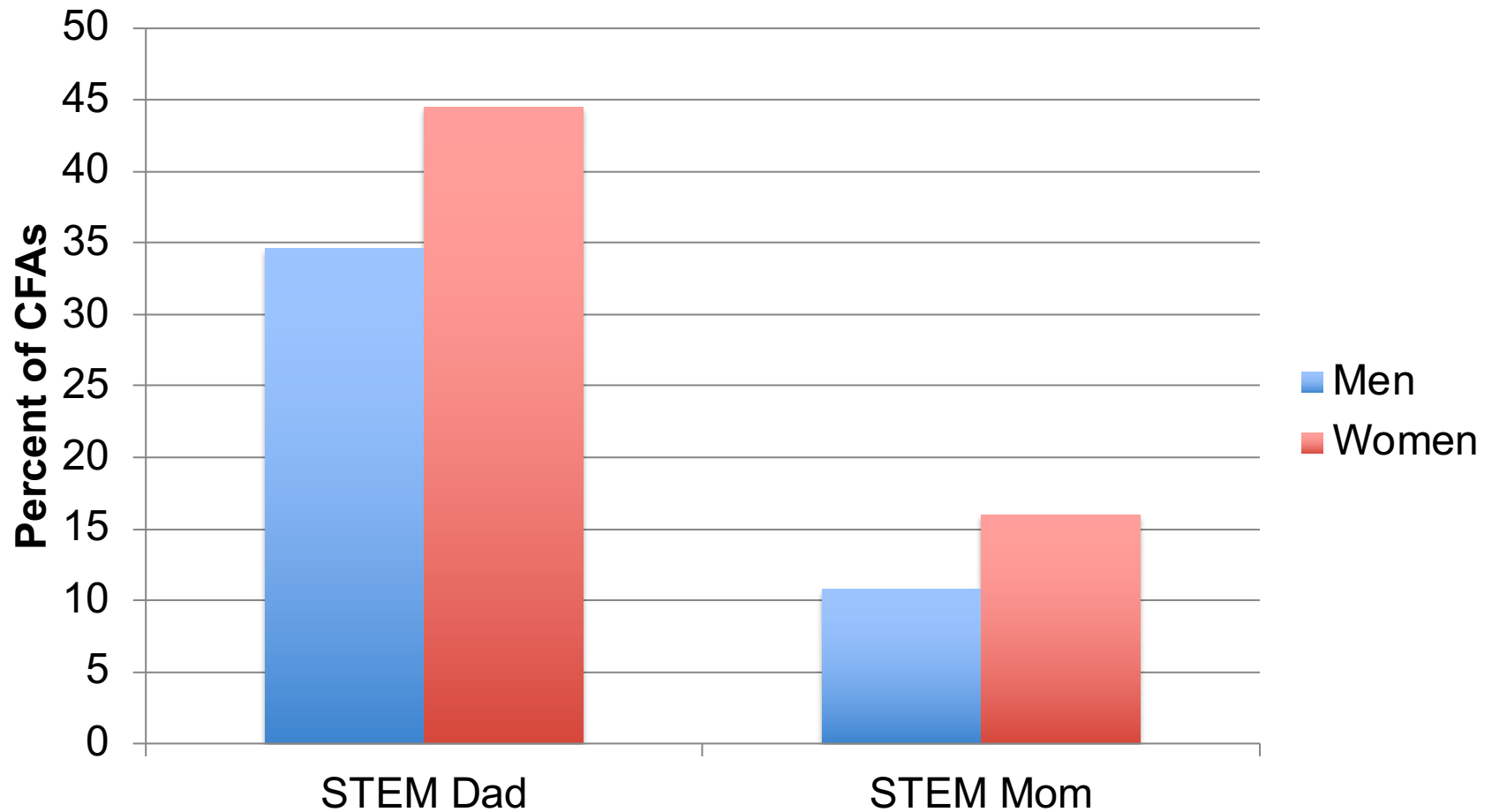
STEM Parents

Conjecture:

Parents affect the career choices of children

- Do STEM parents close the gender gap in finance?
- If so, what is the mechanism?
 - Role model
 - Math training

CFAs with STEM Parents



CFA Member Parents and Siblings with STEM Careers differ by Gender

The "Probability Impact" of 28.6% for STEM fathers means: Having a STEM father raises the probability that a daughter becomes a CFA member by 28.6% more than that of a son.

	Male		Female		Probability Impact
	Mean	N	Mean	N	
% Father in STEM	34.6	3,954	44.5	1,020	28.6
% Mother in STEM	10.8	3,993	16.0	1,031	47.6
% Sister in STEM	15.2	3,582	23.1	888	51.7
% Brother in STEM	27.9	3,534	33.4	885	19.8

$$\begin{aligned}
 \text{Probability Impact} &= \frac{P(\text{Female CFA} \mid \text{STEM Dad}) / P(\text{Female CFA})}{P(\text{Male CFA} \mid \text{STEM Dad}) / P(\text{Male CFA})} \\
 &= \frac{P(\text{STEM Dad} \mid \text{Female CFA})}{P(\text{STEM Dad} \mid \text{Male CFA})}
 \end{aligned}$$

Math Channel?

- PISA Individual Math Score Data
- Code Parents in STEM Occupations
- Triple Interaction Model
 - Father STEM
 - Mother STEM
 - Girl
 - Country Fixed Effects

Table 4: The Effect of STEM Parents on Math Scores of Girls and Boys

The dependent variable is a student's score on the PISA math test. The independent variables include the triple interaction of *Girl*, *DAD_STEM*, and *MOM_STEM*, which are dummy variables that take a value of one if the student is a girl, has a STEM father, or has a STEM mother (respectively), and country fixed effects (where the U.S. is the base country).

Variable	2012
constant	489.402*** (3.397)
<i>Girl</i>	-11.608*** (0.775)
<i>DAD_STEM</i>	48.690*** (2.442)
<i>MOM_STEM</i>	36.969*** (5.456)
<i>DAD_STEM</i> * <i>MOM_STEM</i>	-8.897 (11.184)
<i>Girl</i> * <i>DAD_STEM</i>	2.258 (3.053)
<i>Girl</i> * <i>MOM_STEM</i>	15.473*** (6.729)
<i>Girl</i> * <i>DAD_STEM</i> * <i>MOM_STEM</i>	-1.016 (12.734)
Country Fixed Effects	YES
Observations	360,229
No.of Countries	67
Adjusted R-Squared	30.6%

Standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 4: The Effect of STEM Parents on Math Scores of Girls and Boys

The dependent variable is a student's score on the PISA math test. The independent variables include the triple interaction of *Girl*, *DAD_STEM*, and *MOM_STEM*, which are dummy variables that take a value of one if the student is a girl, has a STEM father, or has a STEM mother (respectively), and country fixed effects (where the U.S. is the base country).

Variable	2000	2003	2006	2009	2012	2015
constant	491.171*** (7.404)	481.774*** (2.888)	475.074*** (2.363)	485.778*** (3.381)	489.402*** (3.397)	467.648*** (3.127)
<i>Girl</i>	-9.488*** (1.703)	-8.611*** (1.131)	-11.722*** (1.041)	-11.069*** (0.884)	-11.608*** (0.775)	-6.757*** (0.864)
<i>DAD_STEM</i>	55.287*** (4.314)	54.241*** (2.608)	46.350*** (2.363)	51.106*** (2.346)	48.690*** (2.442)	51.341*** (1.998)
<i>MOM_STEM</i>	50.067*** (7.854)	48.273*** (4.621)	36.710*** (3.250)	44.700*** (3.030)	36.969*** (5.456)	56.317*** (3.507)
<i>DAD_STEM*MOM_STEM</i>	-27.362*** (12.961)	-7.661 (10.386)	-5.297 (8.195)	-18.295*** (6.804)	-8.897 (11.184)	-29.987*** (6.854)
<i>Girl*DAD_STEM</i>	-1.894 (6.278)	-8.479*** (3.571)	-0.804 (2.950)	-3.371 (2.947)	2.258 (3.053)	-1.692 (2.679)
<i>Girl*MOM_STEM</i>	-3.132 (10.907)	-2.180 (6.321)	-2.252 (4.408)	-3.771 (3.496)	15.473*** (6.729)	-4.173 (4.673)
<i>Girl*DAD_STEM*MOM_STEM</i>	11.001 (18.976)	6.392 (15.403)	-9.355 (12.659)	7.099 (8.392)	-1.016 (12.734)	9.358 (9.244)
Country Fixed Effects	YES	YES	YES	YES	YES	YES
Observations	127,388	276,165	398,750	475,460	360,229	519,334
No.of Countries	43	41	57	65	67	73
Adjusted R-Squared	39.8%	32.7%	28.8%	32.6%	30.6%	30.8%

Standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Summary-Values

PART 1: Selection into Finance

- Female CFA members value tradition & conformity less and achievement more than:
 - Women in the general population.
 - Male CFA members
- Why is there a “values” selection effect?
 - Stereotypes about appropriate careers for women
 - More family time demands for women with traditional views
 - Discrimination against women in finance higher in areas where people more highly value tradition

Summary-Values

PART 2: Does Selection Level the Playing Field?

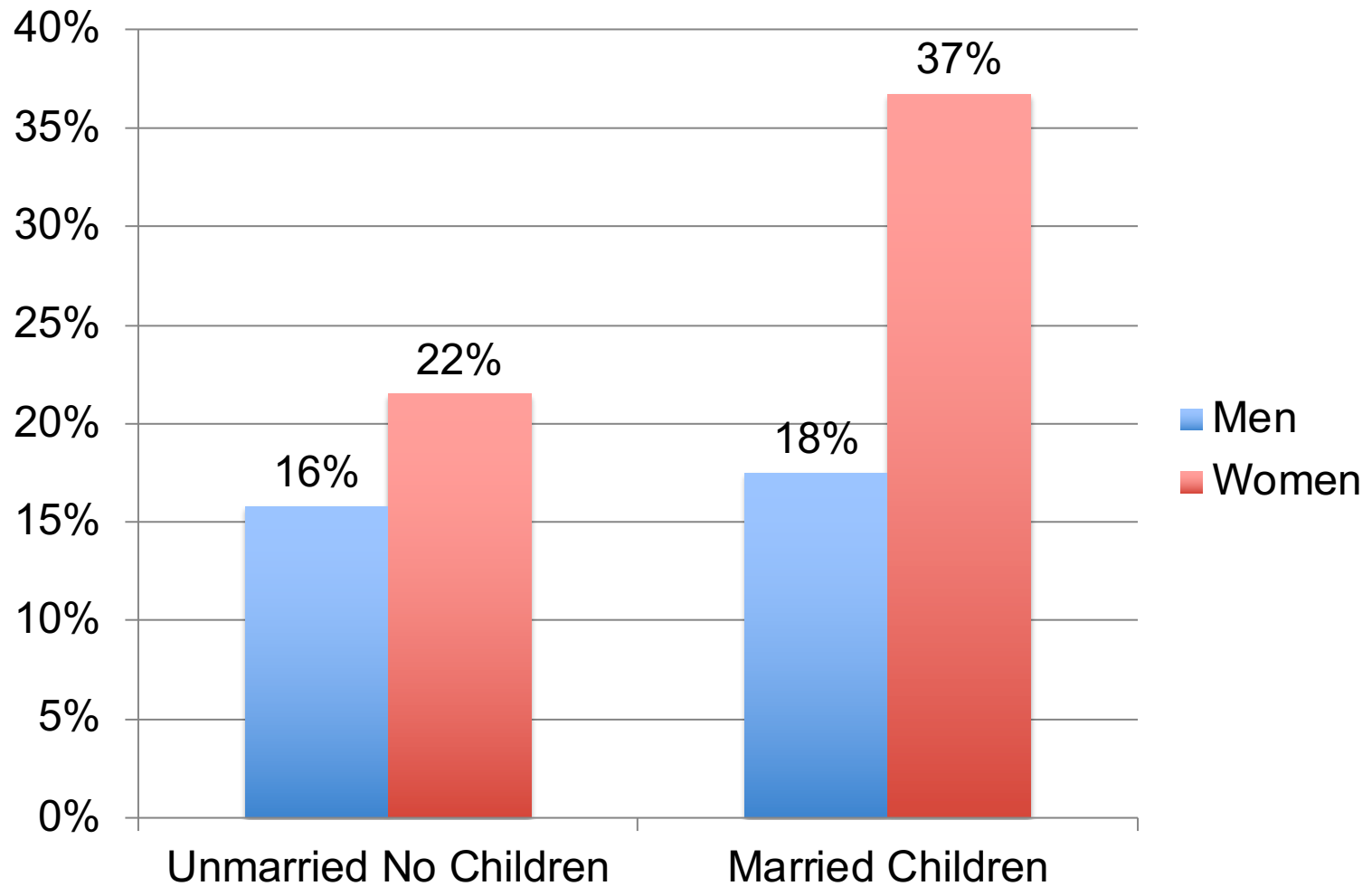
Survey Question of CFA Members: Given a linear pay scale, do you want to recapture time from work (i.e., prefer less hours and pay)

Desire to Recapture Time from Work

If you were given the following options, which would you prefer?

- a. I would work 25% more hours each week for 25% more pay.
- b. I would work 10% more hours each week for 10% more pay.
- c. I would work the same hours each week for the same pay.
- d. I would work 10% fewer hours each week for 10% less pay.
- e. I would work 25% fewer hours each week for 25% less pay.

Do you want to recapture time from work?



CFA Institute Member Survey

- Surveyed 135,000 members in 151 countries
 - 3.8% response rate
- World Values Survey (6th wave)
 - Schwartz values inventory
 - tradition, conformity, achievement, benevolence, universalism, power, security, self-direction, stimulation, and hedonism

“How much like you is this person?”

Tradition: Tradition is important to this person; to follow the customs handed down by one’s religion or family.

Conformity: It is important to this person to always behave properly; to avoid doing anything people would say is wrong.

Achievement: Being very successful is important to this person; to have people recognize one’s achievements.

CFAs: Men and Women

Variable	N	Male		Female			N	Difference	
		Mean	Std. Dev.	Mean	Std. Dev.	(F-M)		t-stat.	
Age	5,150	41.7	11.0	4,116	42.0	10.7	1,034	0.3	0.77
Years with CFA Charter	4,932	8.1	8.7	3,935	9.0	8.2	997	0.9	2.94 ***
% with Grad. Degree	5,241	61.3	48.7	4,170	55.0	49.8	1,071	-6.3	-3.77 ***
% Employed	5,259	94.2	23.4	4,183	91.1	28.5	1,076	-3.1	-3.68 ***
Income Percentile	5,021	66.1	16.8	4,002	64.6	15.9	1,019	-1.5	-2.50 **
% Married	5,014	79.4	40.5	3,982	71.7	45.1	1,032	-7.7	-5.28 ***
% Children at Home	5,035	53.2	49.9	4,001	44.0	49.7	1,034	-9.2	-5.28 ***
% Children Restrict Career	4,636	52.8	49.9	3,704	63.3	48.2	932	10.5	5.79 ***
% Childcare	2,779	40.3	24.5	2,282	57.8	23.9	497	17.5	14.50 ***
% Working Spouse	3,747	50.7	50.0	3,036	79.0	40.7	711	28.3	14.05 ***
% Recapture Time	4,625	16.7	37.3	3,696	29.0	45.4	929	12.3	8.58 ***

*** p<0.01, ** p<0.05, * p<0.1

General Population v. CFAs

Variable	Worlds Values Survey			CFA Members			Difference	
	Mean	Std. Dev.	N	Mean	Std. Dev.	N	CFA-WVS	t-stat
% Female	53.58	0.50	53889	20.56	40.42	4425	-33.02	42.90 ***
% College	19.51	0.40	53923	100	0	4425	80.49	-135.13 ***
Age	45.59	15.62	53923	42.11	10.97	4337	-3.48	14.39 ***
Income Percentile	41.80	22.10	53923	65.30	18.20	4425	23.50	-68.84 ***
% Married	60.39	48.91	53923	77.60	41.69	4425	17.22	-22.75 ***
% Children	76.03	42.69	53923	51.53	49.98	4425	-24.50	36.20 ***
Tradition	0.38	1.25	53754	-0.46	1.30	4417	-0.84	42.82 ***
Conformity	0.34	1.18	53735	0.33	1.19	4418	-0.01	0.60
Achievement	-0.15	1.14	53691	0.18	1.09	4421	0.33	-18.75 ***

*** p<0.01, ** p<0.05, * p<0.1

Table 4: Gender Differences in Tradition, Conformity, and Achievement Values

Model:	(1)	(2)	(3)
Dep. Var.:	Tradition	Conformity	Achievement
Panel A: CFA Member Sample			
Female	-0.172*** [0.025]	-0.130*** [0.034]	0.187*** [0.019]
Observations	4,417	4,418	4,421
R-squared	0.080	0.040	0.059
Panel B: CFA Member and WVS Combined Sample			
Female	0.098*** [0.014]	0.087*** [0.014]	-0.108*** [0.013]
CFA	-0.607*** [0.075]	0.129 [0.106]	0.103 [0.117]
Female*CFA	-0.262*** [0.030]	-0.216*** [0.040]	0.266*** [0.024]
Observations	58,137	58,120	58,079
R-squared	0.146	0.060	0.087
Panel C: Controls for Panel A & B Regressions			
Age Category	Yes	Yes	Yes
Country	Yes	Yes	Yes
Education ⁽¹⁾	Yes	Yes	Yes
Income Decile	Yes	Yes	Yes
Married	Yes	Yes	Yes
Children	Yes	Yes	Yes

Robust standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.1

Table 5: Gender and the Desire to Work Less when faced with Linear Pay Structure

The dependent variable is a dummy variable that takes a value of one if survey respondents indicated they would work 10% (or 25%) fewer hours for 10% (25%) less pay.

Model:	1	2	3	4
Dep. Var.:	workless	workless	workless	workless
Female	0.123*** [0.014]	0.126*** [0.015]		
Male	Base	Base		
Female Unmarried No Children			0.057* [0.030]	0.063** [0.030]
Female Unmarried Children			0.156** [0.067]	0.138** [0.068]
Female Married No Children			0.108*** [0.027]	0.093*** [0.028]
Female Married Children			0.192*** [0.025]	0.159*** [0.026]
Male Unmarried No Children			Base	Base
Male Unmarried Children			0.055 [0.047]	-0.008 [0.049]
Male Married No Children			-0.004 [0.019]	-0.012 [0.020]
Male Married Children			0.017 [0.017]	-0.015 [0.019]
Constant	0.167*** [0.006]	--	0.158*** [0.014]	--
Fixed Effects:				
Age Category	No	Yes	No	Yes
Country	No	Yes	No	Yes
Education	No	Yes	No	Yes
Occupation	No	Yes	No	Yes
Income Decile	No	Yes	No	Yes
Observations	4,625	4,625	4,625	4,625
R-squared	0.016	0.054	0.02	0.056

Married women with children
 $0.158 + 0.192 = 0.350 = 35\%$

Married men with children
 $0.158 + 0.017 = 0.175 = 17.5\%$

Standard errors in brackets; *** p<0.01, ** p<0.05, * p<0.1

Table 6: The Effect of Values on the Desire to Work Less

Model:	(1)	(2)	(3)	(4)
Female*<40*Tradition	0.007			-0.003
Female*≥40*Tradition	0.048**			0.039**
Male*<40*Tradition	-0.004			-0.009
Male*≥40*Tradition	-0.005			-0.007
Female*<40*Conformity		-0.010		-0.018
Female*≥40*Conformity		0.035*		0.026
Male*<40*Conformity		-0.007		-0.010
Male*≥40*Conformity		0.007		0.007
Female*<40*Achievement			-0.077***	-0.080***
Female*≥40*Achievement			-0.026	-0.016
Male*<40*Achievement			-0.033***	-0.036***
Male*≥40*Achievement			-0.007	-0.008
Fixed Effects:				
Gender	YES	YES	YES	YES
Marriage	YES	YES	YES	YES
Children	YES	YES	YES	YES
Age Category	YES	YES	YES	YES
Country	YES	YES	YES	YES
Education	YES	YES	YES	YES
Occupation	YES	YES	YES	YES
Income Decile	YES	YES	YES	YES
Observations	4,553	4,555	4,558	4,543
R-squared	0.055	0.054	0.060	0.062

*** p<0.01, ** p<0.05, * p<0.1

Family, Values, and Women in Finance

- Female CFA members value tradition and conformity less than other women and less than male CFA members.
- Female CFA members value achievement more than other women and more than male CFA members.
- Female CFA members, especially those who are married and have children, are more likely than male CFA members to express a preference for recapturing time from work.
- Older CFA women who value tradition are more likely to express a preference for recapturing time from work.
- One avenue to attracting more women to finance would be to structure and reward jobs in a way that supports temporal flexibility.