Differences in pay by gender among McGill Faculty

The background

- A study of gender differences in pay in 2000
- Used statistical procedures to generate the following within-Faculty estimates of female disadvantage:

Arts:	$5,654
Medicine:	$4,230
Music:	$7,013

- Salary policy was modified to eliminate this gap
- It was agreed that the study would be repeated later to determine whether or not the gap had re-emerged.

How the gap was estimated in 2000

Within faculties, enter the following variables into a regression equation to predict dollar differences in earnings:

- gender
- work experience
- department *grouping*
- rank

Female earnings disadvantage:

- was the difference in pay by gender, after the effects of differences in work experience, department of employment, and rank were ‘controlled’;
- providing the difference was statistically ‘significant’ (large enough and precisely estimated enough to warrant attention).

Why the controls?

- Pay rises with experience, and males on average have been employed at McGill for longer than females.
- Market effects cause average pay levels to vary across departments; males *may* be overrepresented in departments with higher average pay.
- Pay tends to rise with rank. Since males have been employed longer at McGill, they're more likely to have been promoted.

The 2000 model applied to more recent data

Female disadvantage in dollars

	2006		2007	
	Coeff.	P-value	Coeff.	P-value
Arts	$2,913	0.0839	$2,402	0.1472
Science	$2,070	0.3895	$2,769	0.2779
Medicine	$4,112	0.0379	$3,305	0.0818

Controls for experience, department, rank

The 2000 study was of great value, *but*

- It didn't tell us much about the *sources* of gender differences in earnings.
- There may have been biases in the 2000 analyses leading to either an *underestimate* or *overestimate* of the gender disadvantage.
- This sort of analysis usually examines log earnings (for reasons I return to).
- CRCs and related awards have become more important since 2000.
- A premise: a single coefficient is unlikely to suitably inform us on pay differences by gender.

McGill pay policy is likely to influence outcomes ….

- Entry-level pay varies substantially, matching market processes common across North American research universities.
- Annual pay increases are substantially tied to merit judgments.
- Pay may be increased to *retain* a faculty member who has received an offer from another university.
- Pay has (erratically) increased with promotion to full professor.
- Pay is further increased through the award of federal and McGill chairs.

Possible sources of bias

- The potential arbitrariness of departmental groupings. (Do they adequately reflect different market conditions? Do they *over*control for market conditions?)
- *If* the promotion of women to full professor takes longer than the promotion of men then statistically eliminating the effect of rank would lead to an underestimate of the effect of gender on pay – *if mechanisms disadvantage women in pay determination one might expect the same mechanisms to disadvantage them in access to promotions*.

Choosing how to describe the data

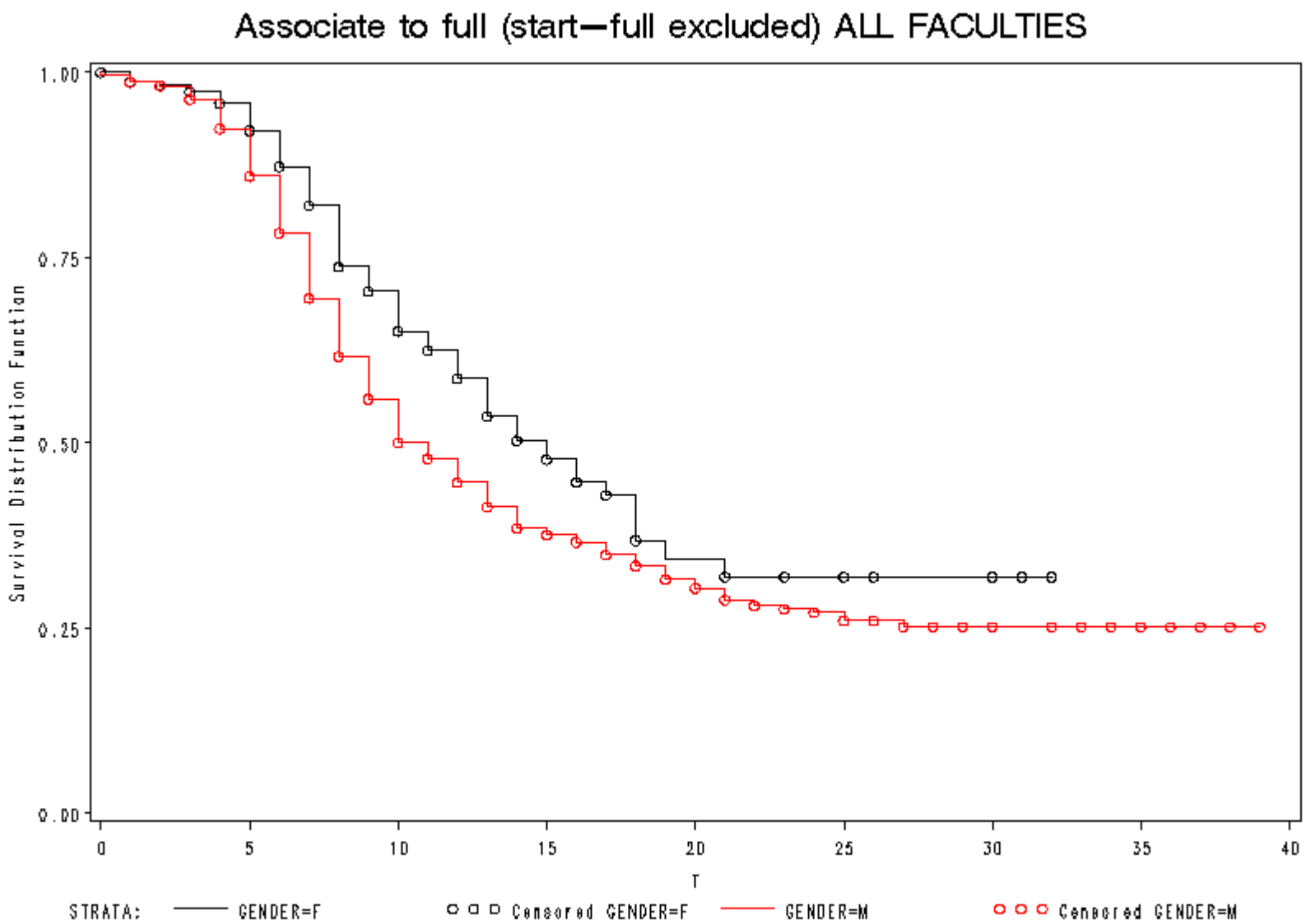
- Avoid complicated ways of incorporating indirect effects – e.g., that gender may have a direct effect on earnings but also an indirect effect through time to promotion.
- Instead, look at some descriptive information on parts of the McGill pay determination process that might account for differences in earnings by gender.
- Then examine the process in a more complicated way, controlling for things like experience and department, bearing in mind what the descriptive information shows.
- Focus on the logarithm of pay – which produces percentage differences rather than dollar amounts.
- Exclude administrative stipends.

Some pay-relevant differences described

- Time to promotion
- Merit pay
- External awards
- The dispersal of pay
- Retention payments – will comment but not present data.

➢ This and all subsequent analyses apply to all McGill faculty members with a professorial rank, excluding GFTUs.

➢ In these descriptive analyses there are no controls. We introduce controls later.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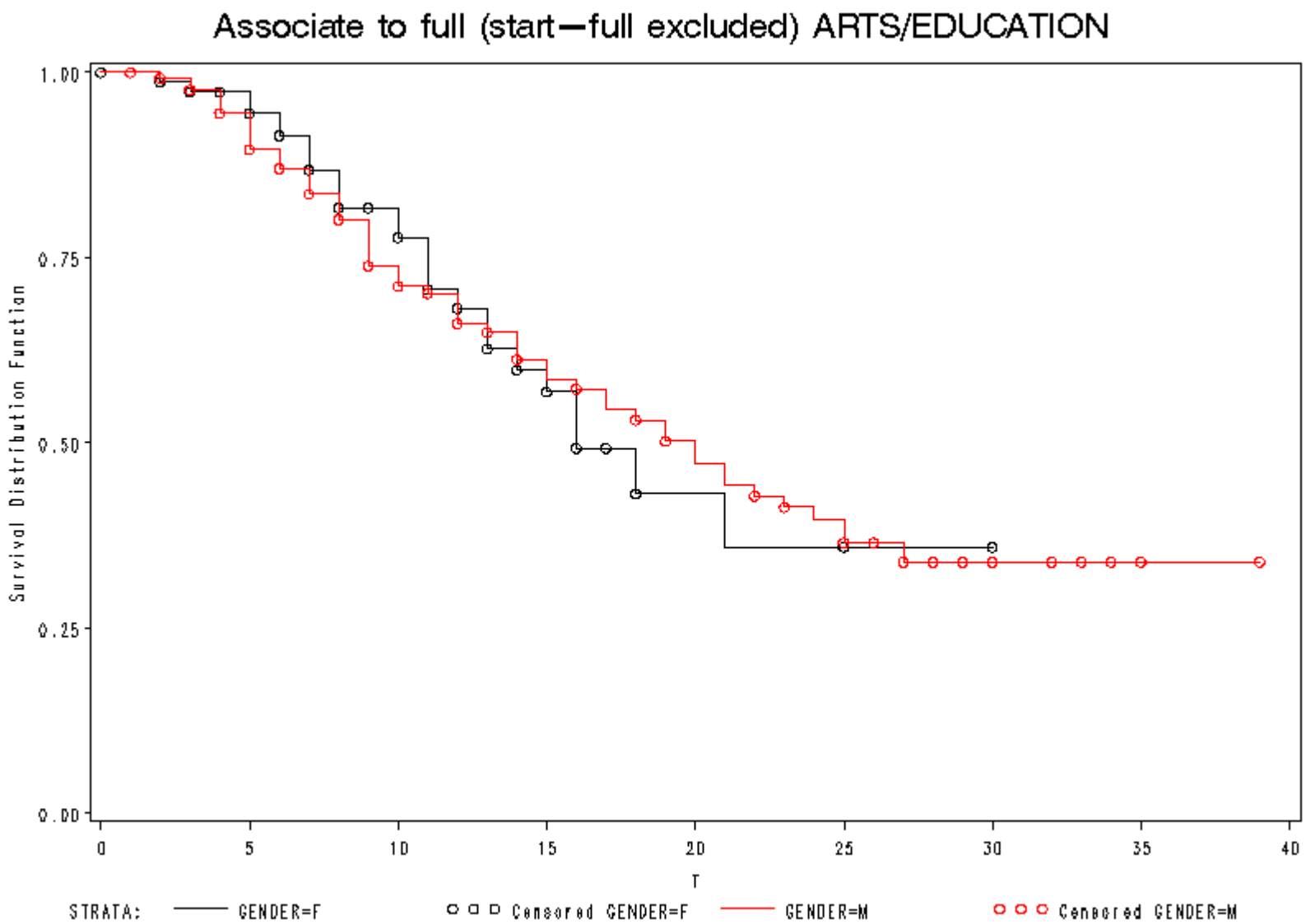
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Survival Distribution Function
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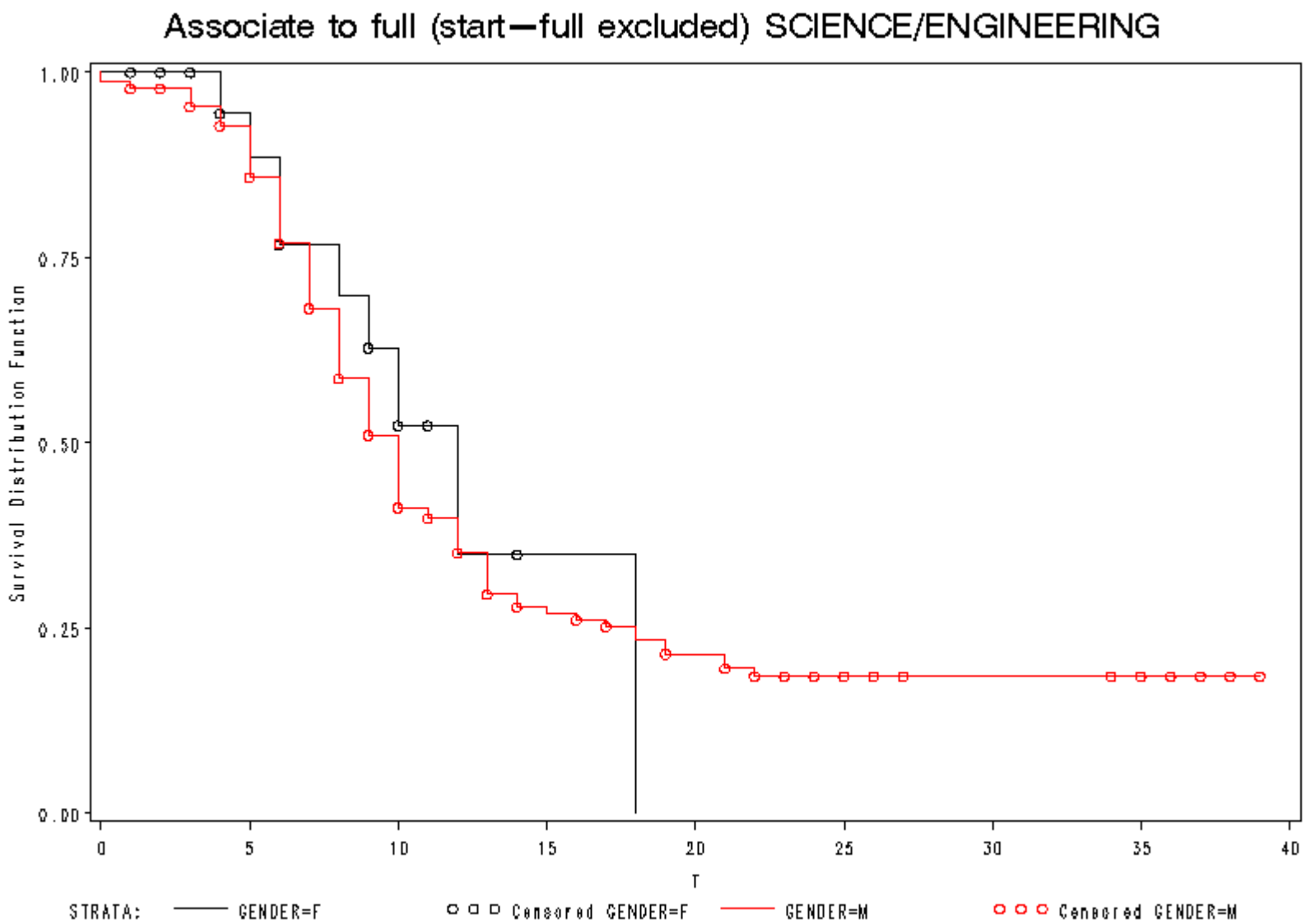
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Survival Distribution Function
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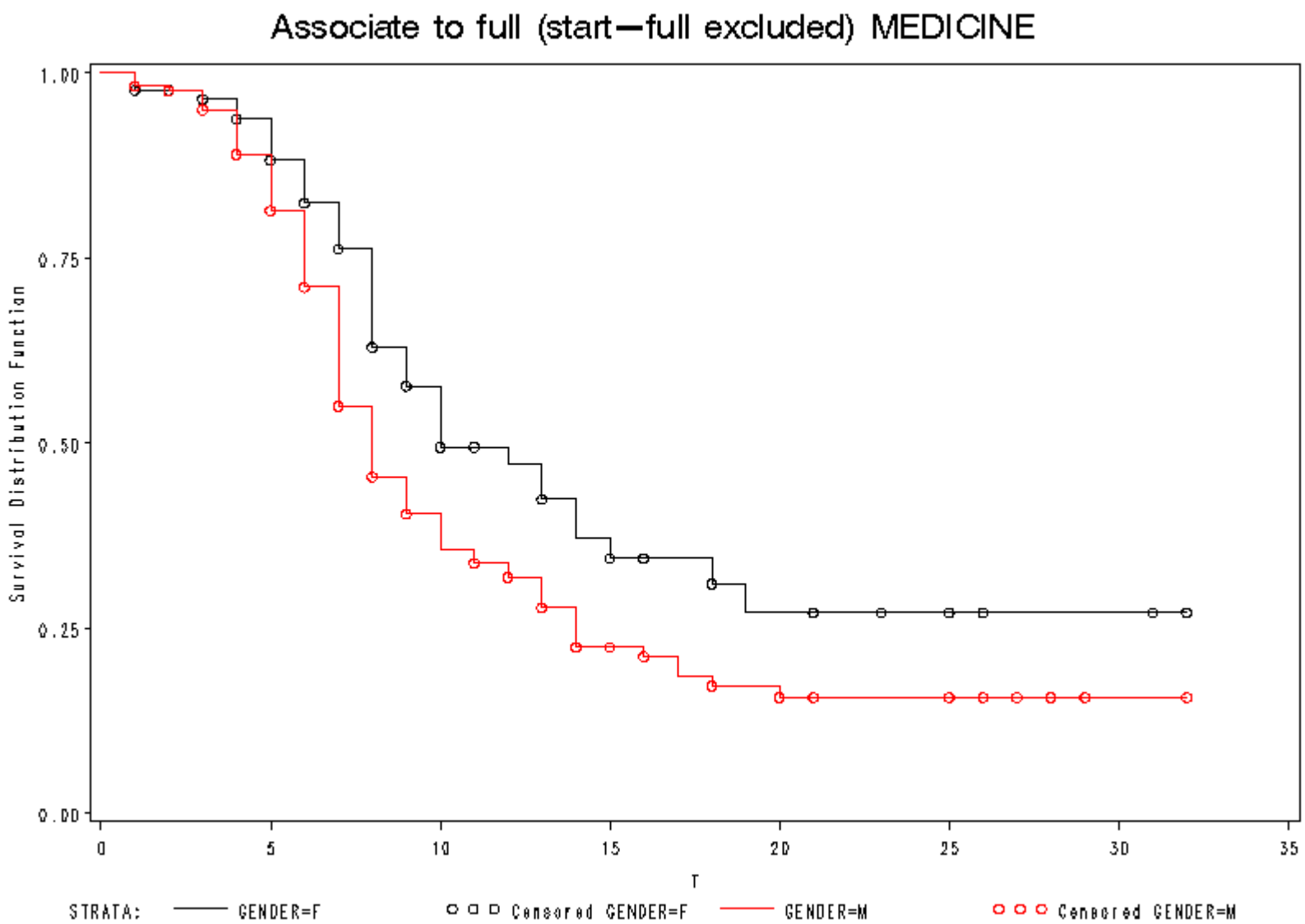
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Survival Distribution Function
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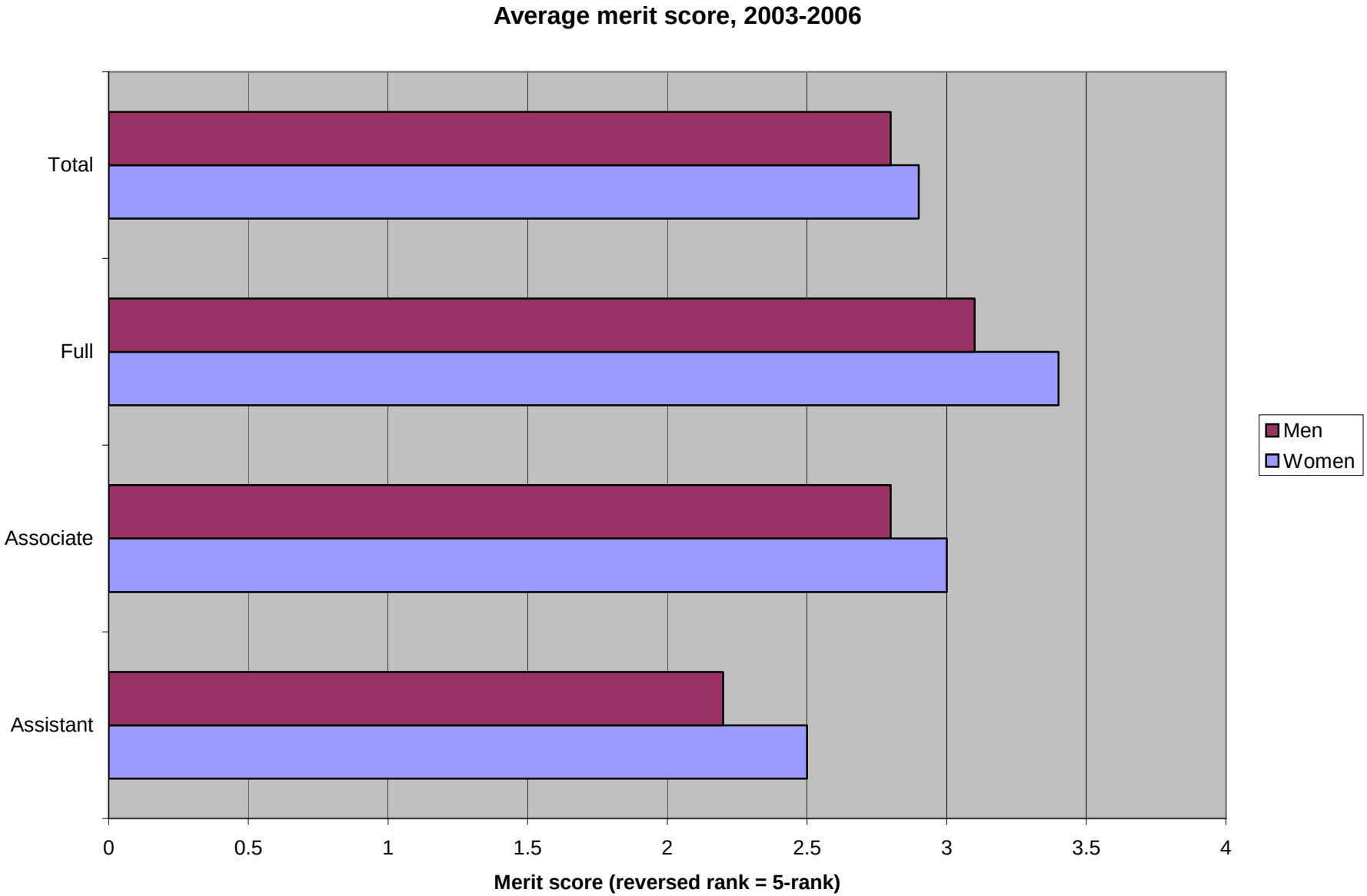
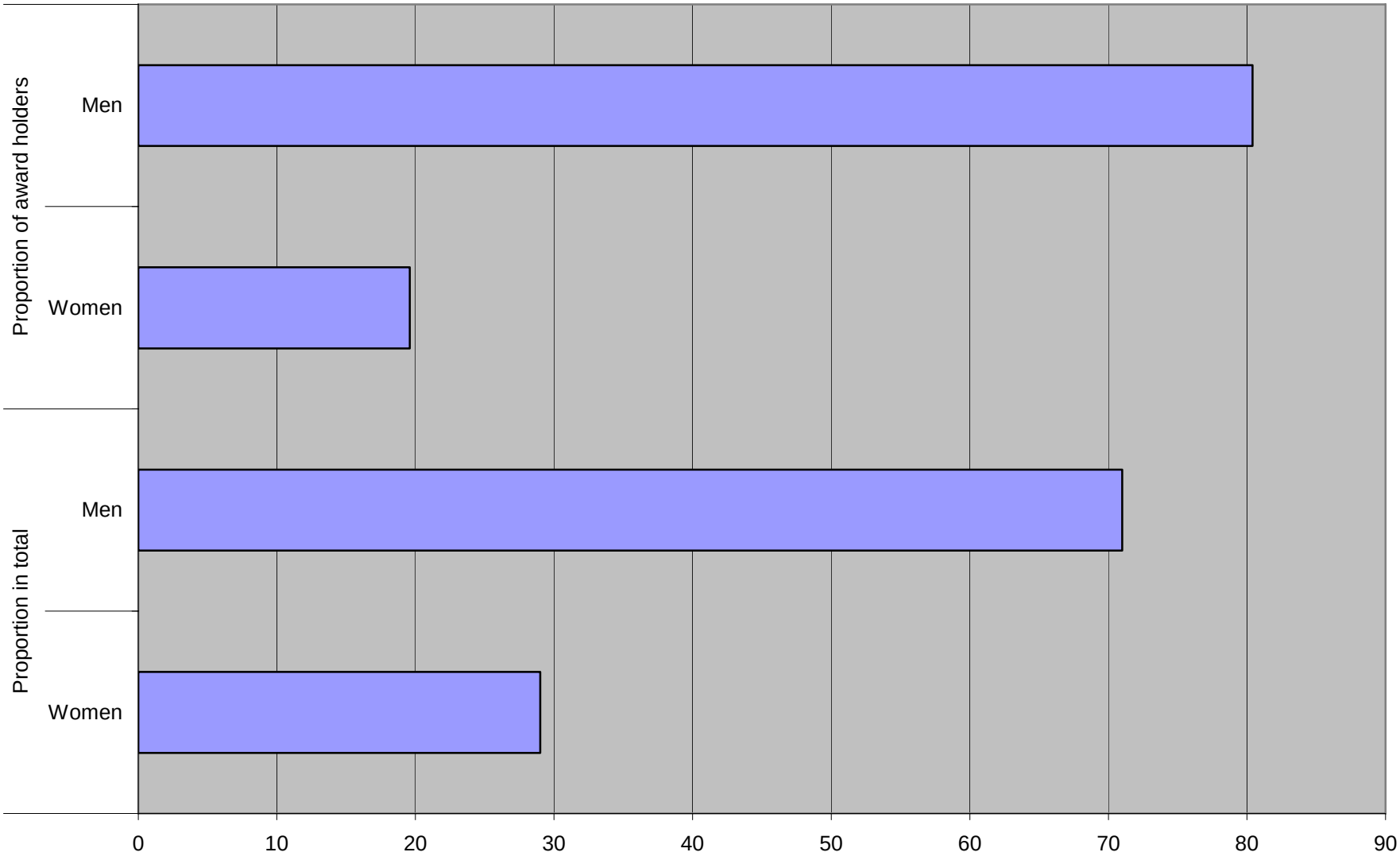
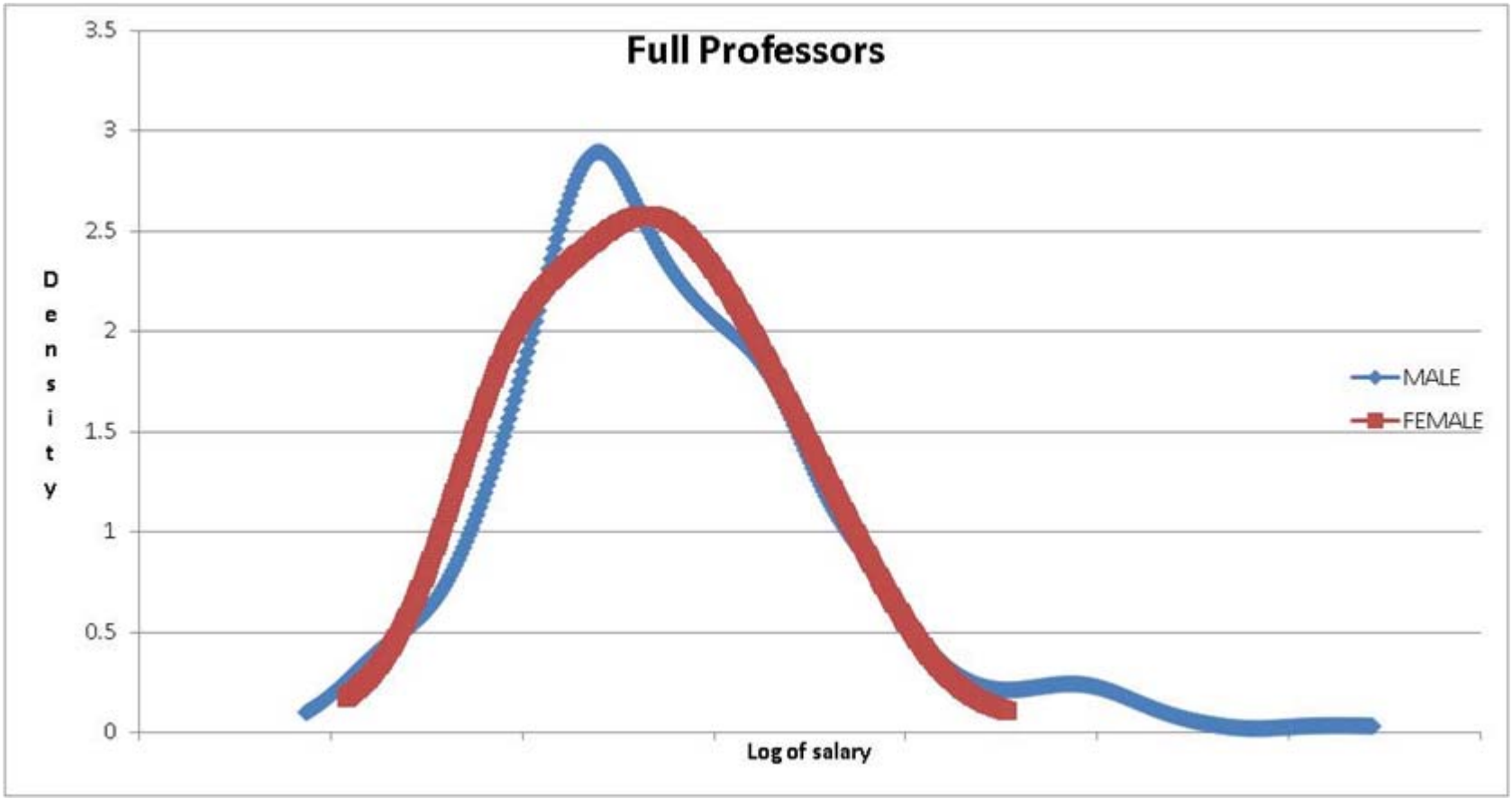

Average merit score, 2003-2006
Total
Full
Associate
Assistant
Men
Women
0
0.5
1
1.5
2
2.5
3
3.5
4
Merit score (reversed rank = 5-rank)

Proportions of female and male faculty members and of female and male award holders




Full Professors
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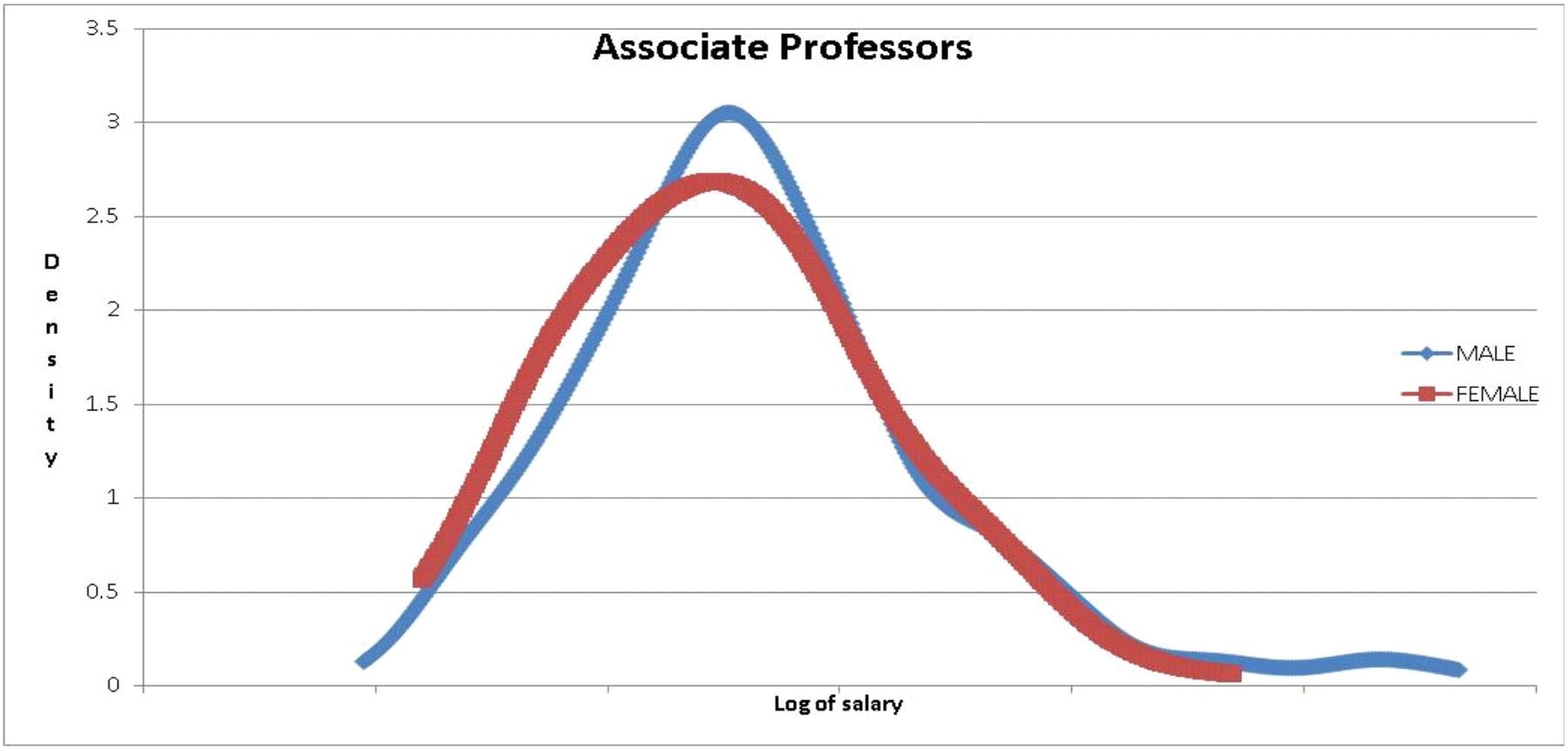
3
2.5
2
1.5
1
0.5
0
Density
Log of salary
MALE
FEMALE


Associate Professors
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3
2.5
2
1.5
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0.5
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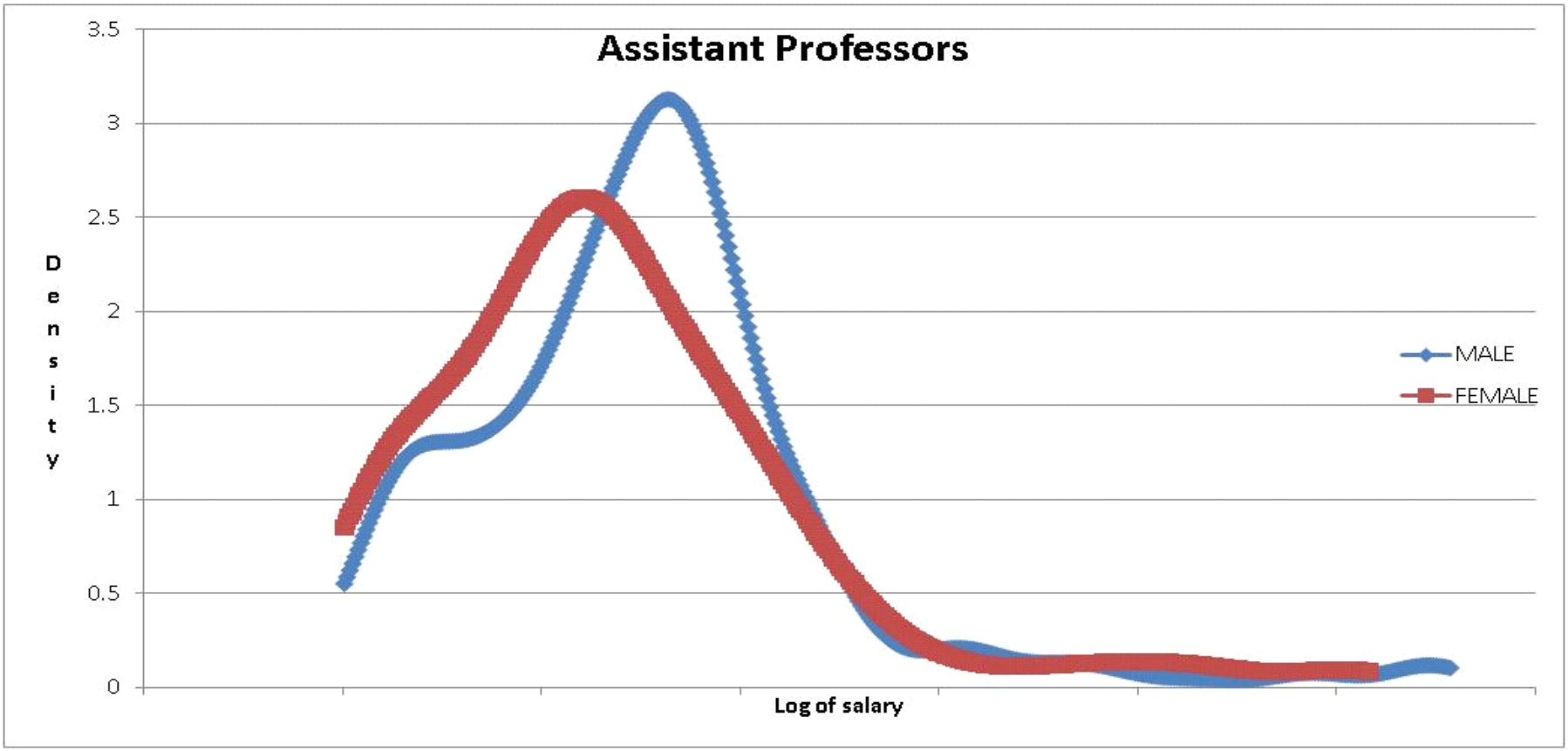
Density
Log of salary
MALE
FEMALE


Assistant Professors
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1.5
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0.5
0
Density
Log of salary
MALE
FEMALE

What do these slides tell us?

(Remember, the slides include no controls!)

- Longer time to promotion may contribute to lower female pay: i) the proportion of women in Arts and Education is higher than it is in Engineering, Science, and Medicine and the time to promotion is longer in Arts and Education; ii) women in Medicine take longer to be promoted than men.
- Merit pay appears not to be a cause of lower pay for female faculty.
- Men are more likely to have their pay increased with an external award.
- Much of the average difference in pay between males and females is produced by the very high pay received by a small number of male faculty members.

Anomaly and retention: 2003-2008

Other evidence suggests:

- women have not been disadvantaged in numbers having access to the *anomaly and retention* pools;
- women have not been disadvantaged in the dollar amounts received from the pool.

➢ But this needs looking at more closely.

No controls in the charts – so move on to regression analysis

- Log salary: i) that's what most analyses of earnings do; ii) there are some technical statistical advantages to working with logs, where earnings are being analyzed. But, using log pay has a consequence – it reduces large values by more than small values and so reduces the effect of those large values in an OLS regression.
- Experience - consistently measured as years since Ph.D. – both number of years, and the square of number of years.
- Enter the variables of interest consecutively to see what happens to the gender effect, as consecutive controls are added.
- Two regression techniques: OLS and median regression. The first is sensitive to extreme values, the second isn't.
- Maximum control for department.

Percentage earnings *disadvantage* of women, with consecutive controls, 2007*

University Level

	OLS		Median	
	Coeff.	P-value	Coeff.	P-value
Gender	9.62	0.0001	9.50	0.0001
Experience	4.27	0.0003	3.23	0.0026
Departments	3.20	0.0021	1.78	0.0669
Rank	1.84	0.0315	0.63	0.4283
Start Full Professor (without award)	1.47	0.0783	0.41	0.5974
Award (without start Full Professor)	1.09	0.1536	0.00	0.9716

*When added, the control for departments includes *all* departments.

What does the university level analysis show?

Using OLS, controlling for *all* departments:

- women earn 3% less than men before controlling for rank;
- Women still earn almost 2% less than men after rank is controlled;
- The difference becomes weaker or insignificant after *either* 'appointed as full professor' or 'holds award' is added;

Using median regression, controlling for all departments:

- the pay disadvantage of women becomes clearly insignificant once rank is added.

➢ The differences between the OLS and median regression results show that the extreme values we saw in the density functions are influencing the OLS results.

Which of the two analyses is correct – OLS or median regression?

- Neither! The result differences reflect the large effect of extreme values in the OLS and the reduced effect of extreme values in the median regression.
- The extreme values, however exist.

What about within (large) faculty results?

In the previous study and in the reanalysis using the same model, disadvantage was concentrated in the faculties of Arts and Medicine. Our analysis modifies the method used in the previous study in potentially significant ways. In particular:

- we use the log of salaries rather than salary in dollars;
- So far we've reported results that have controlled for *all* departments.

Percentage earnings *disadvantage* of women within faculties, with consecutive controls (including detailed departments), 2007

Arts

	OLS		Median	
	Coeff.	P-value	Coeff.	P-value
Gender	14.61	0.0001	16.13	0.0001
Experience	4.45	0.0257	3.62	0.0622
Departments	4.00	0.0402	2.47	0.1918
Rank	2.36	0.1153	1.59	0.2653
Start Full Professor (without award)	1.53	0.2861	1.01	0.4720
Award (without start Full Professor)	1.72	0.2099	0.04	0.7715

Science

	OLS		Median	
	Coeff.	P-value	Coeff.	P-value
Gender	8.95	0.0076	8.89	0.0104
Experience	1.77	0.4982	0.00	0.9360
Departments	1.55	0.5452	0.00	0.8699
Rank	1.44	0.5087	1.09	0.5944
Start Full Professor (without award)	1.69	0.4330	1.61	0.4221
Award (without start Full Professor)	0.93	0.6413	0.74	0.6401

	Medicine			
	OLS		Median	
	Coeff.	P-value	Coeff.	P-value
Gender	6.50	0.0117	5.92	0.0265
Experience	3.24	0.0763	2.18	0.2151
Departments	2.78	0.1591	0.76	0.6891
Rank	1.53	0.3407	0.65	0.6553
Start Full Professor (without award)	1.42	0.3727	0.63	0.6617
Award (without start Full Professor)	1.47	0.3411	0.80	0.5404

What do these tables show?

- Median regressions eliminate disadvantage in all three faculties.
- OLS suggests female disadvantage in Arts, up to addition of rank. *But* remember, years to promotion does not seem to be longer for women in Arts and Education.
- There is no evidence of a female earnings disadvantage in Science.
- In Medicine, after controlling for departments, the OLS result becomes insignificant. This is surprising given that, using the 2000 model, there were significant or approximately significant differences in Medicine in 2006 and 2007, in which the controls were: experience, departments, *and* rank. Possible explanations: i) the department dummies used; ii) the switch from raw to log dollars.

Earnings disadvantage of women *in dollars* , Medicine, 2007
(with different department controls, and controlling for work experience)

	OLS		Median	
	Coeff.	P-value	Coeff.	P-value
Departments 1	-4,220	0.0656	-978	0.6119
Departments 2	-4,691	0.0354	-2,003	0.2900
Departments 5	-3,996	0.0973	-107	0.9579
Departments 6*	-4,281	0.0769	-236	0.9091

*This version controls for each department

The previous table replaces log earnings with dollar earnings …

Using OLS, with the following variables in the model: gender, experience, various department controls.

- Women are disadvantaged – they earn about $4,000 less - in all models.
- The different department specifications do not substantially change the conclusion.

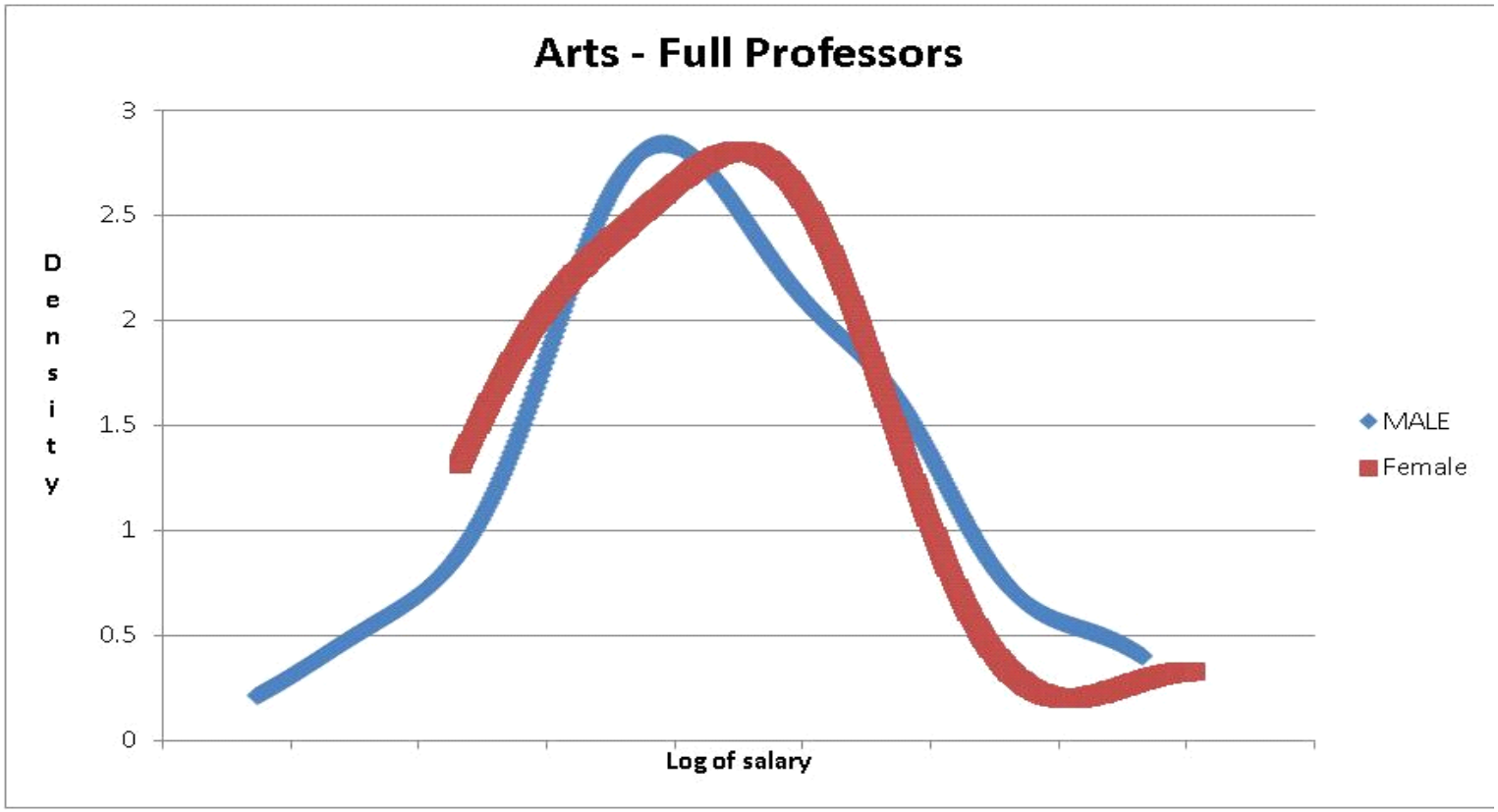
Three methodological conclusions

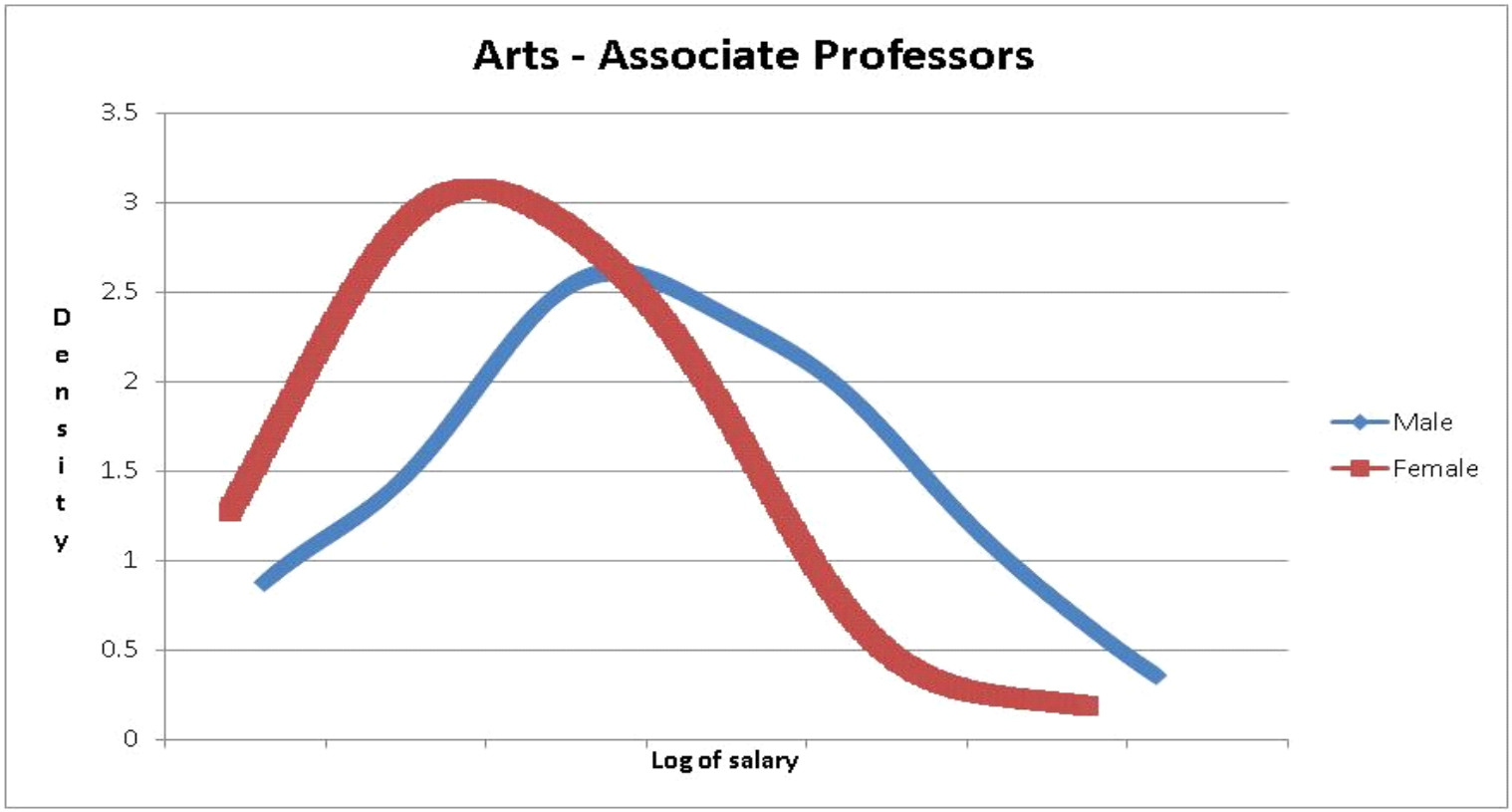
- Differences in specifying the department dummy don't make much difference – either at the University level, in the analysis of log earnings (not shown in slides) or in the Faculty of Medicine analysis of raw dollars.
- The differences in earnings at the upper end of values across genders do matter. This is shown in the fact that the results change when i) earnings are log transformed and further changed when ii) median regression is used rather than OLS.
- There is marked heterogeneity within the University.

Substantive conclusions

- At the University level, after controls for work experience and department (market), women may be said to have earned between 3.2% and 1.8% less than men, depending on whether OLS or median regression is used.
- Within the Faculty of Arts, after controls for work experience and department (market), women earned 4% less than men using OLS. The relationship more or less disappears when rank is added.
- Within the Faculty of Medicine, there was no difference in the pay of men and women using log transformed earnings. There was a difference of about 4,000 using raw dollars.
- Within the Faculty of Science, there is no evidence of a female earnings disadvantage.
- Any differences are reduced and ultimately eliminated when the effects of being recruited from outside at the full professor level and when awards (CRCs, Dawson and McGill chairs, other awards) are controlled.

APPENDIX


Arts - Full Professors
Density
3
2.5
2
1.5
1
0.5
0
Log of salary
MALE
Female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Density
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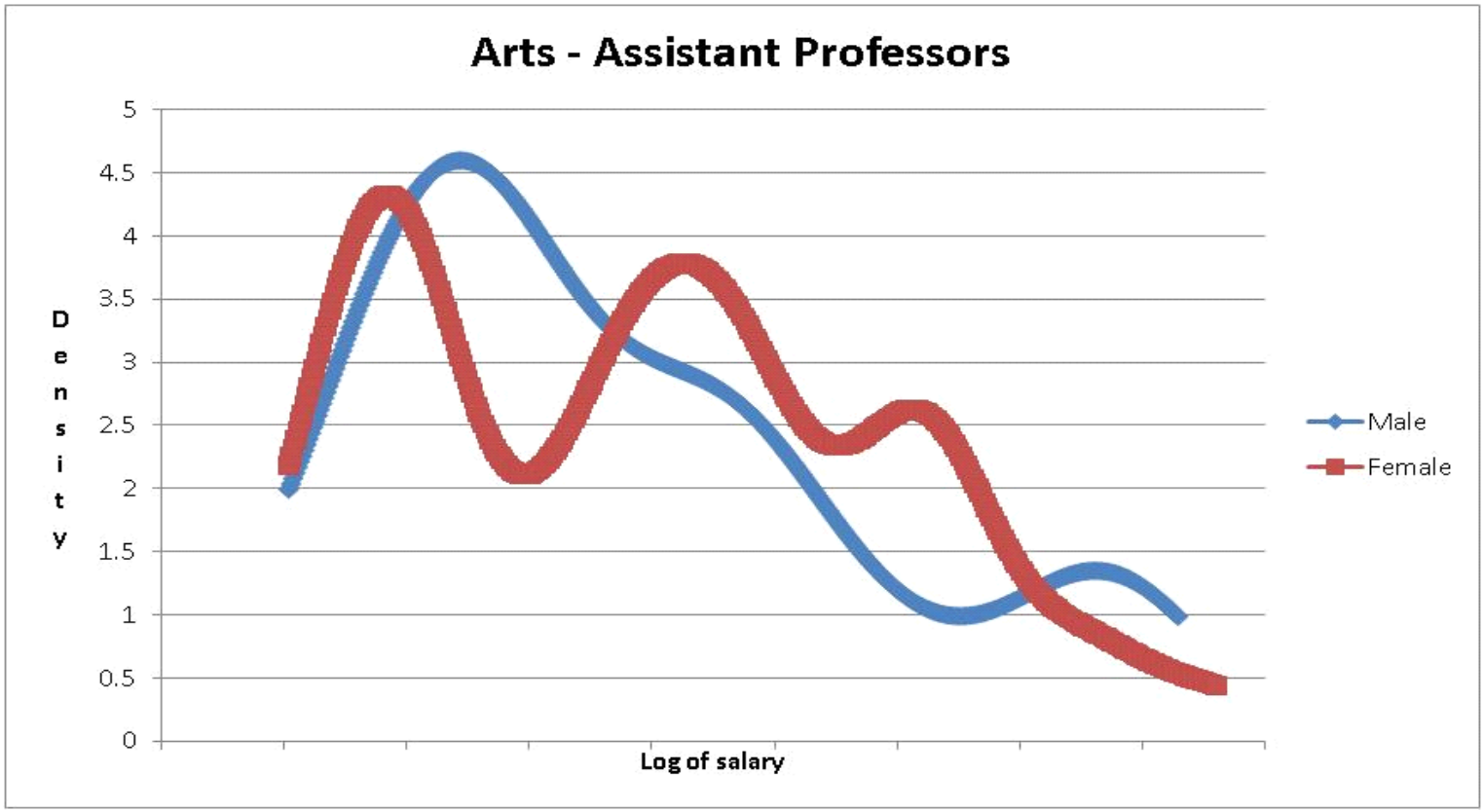
0.5
0
Log of salary
Male
Female


Arts - Assistant Professors
Density
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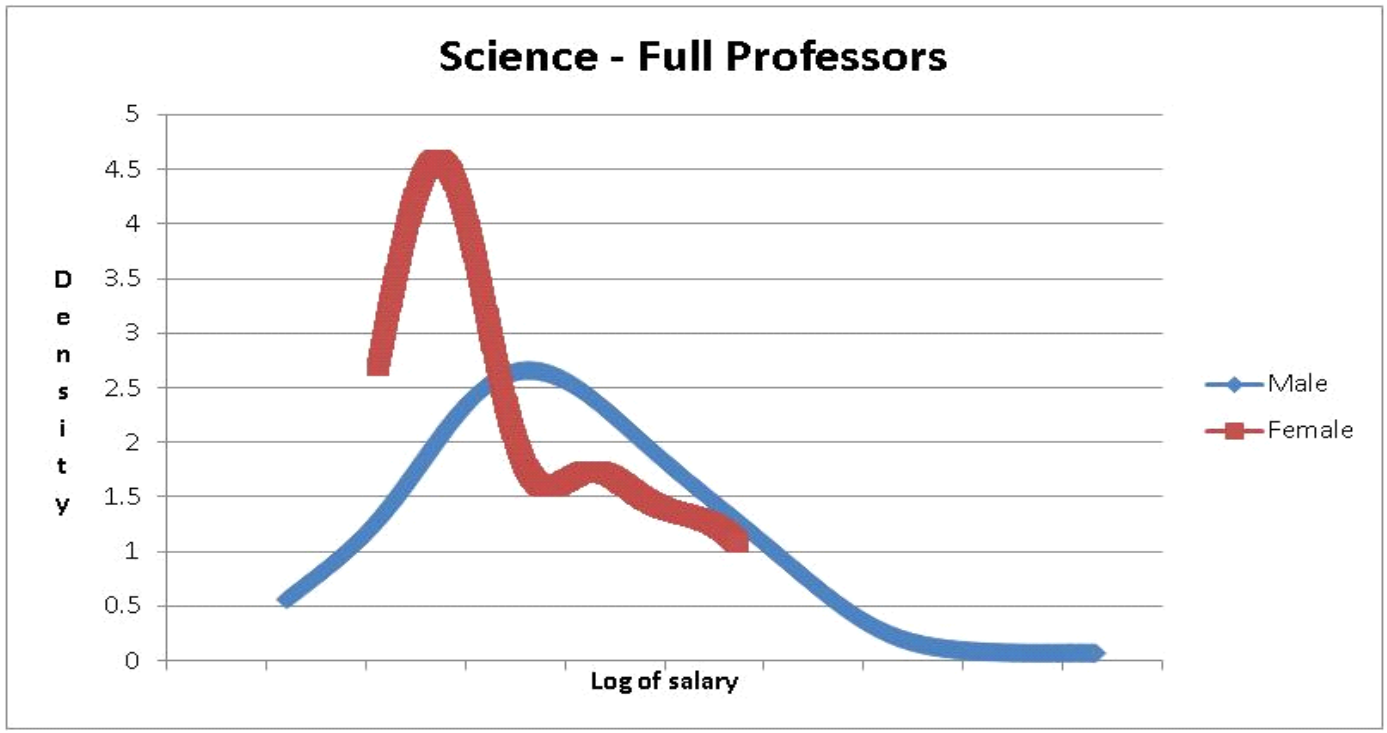
Log of salary
Male
Female


Science - Full Professors
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1
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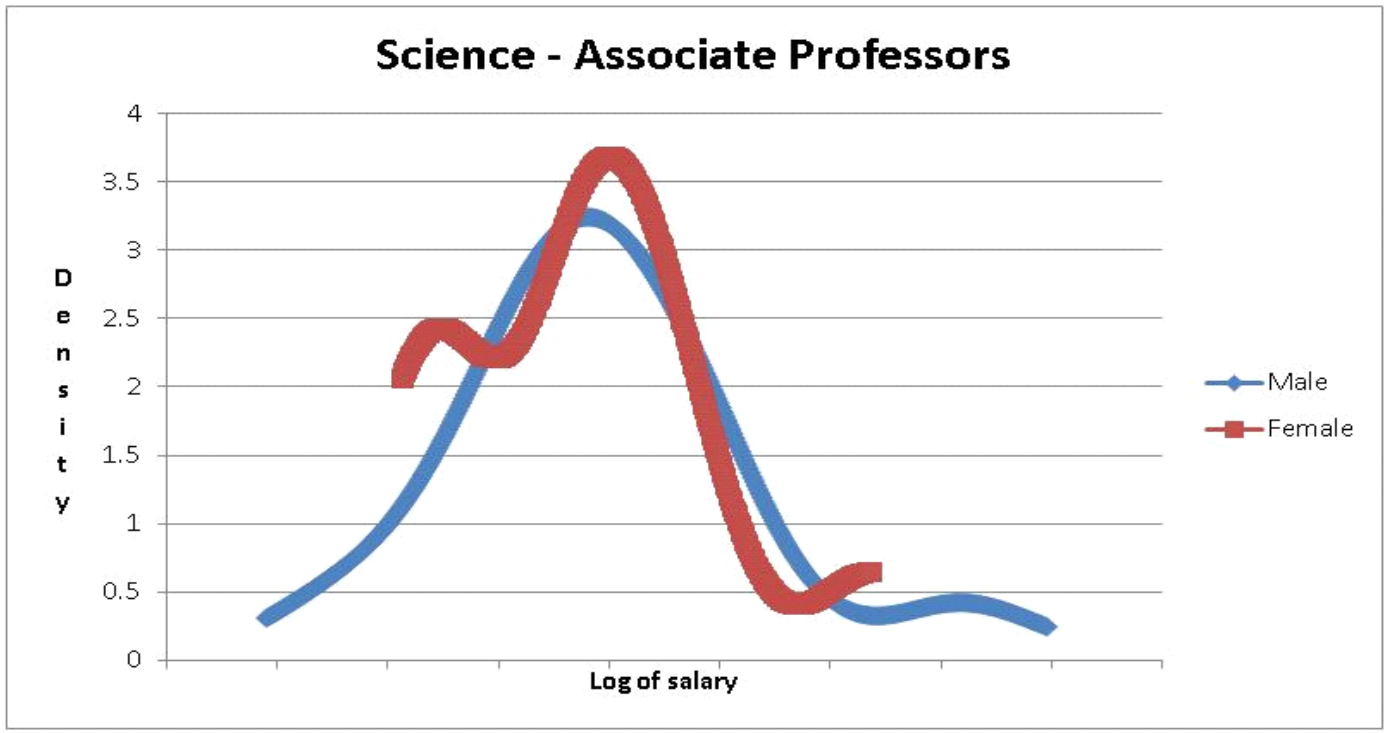
0
Log of salary
Male
Female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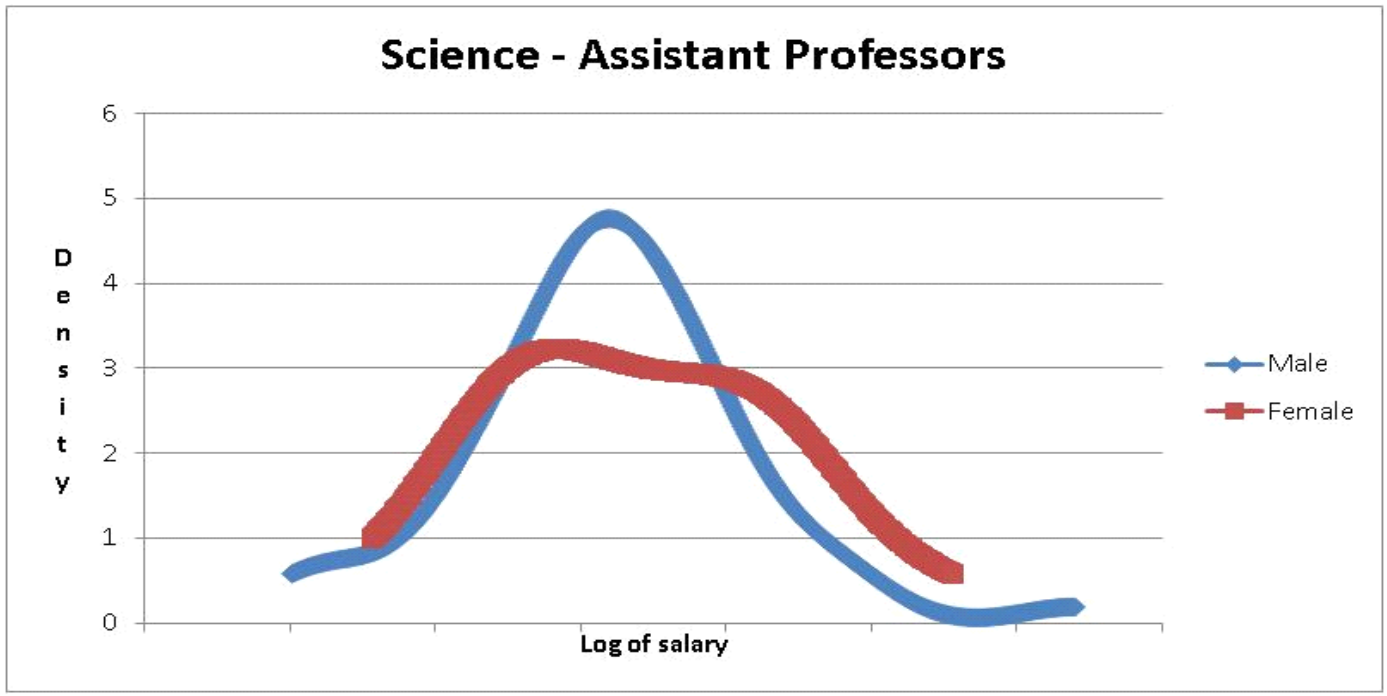
1.5
1
0.5
0
Log of salary
Male
Female


Science - Assistant Professors
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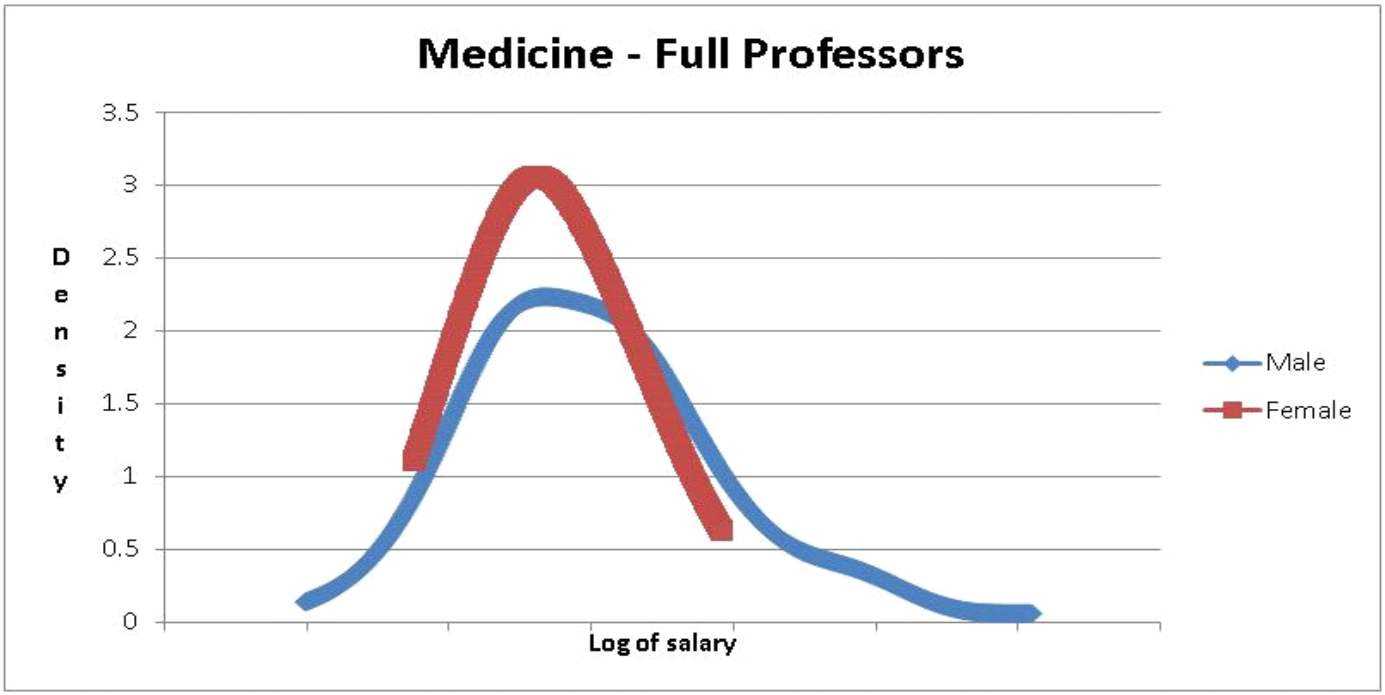
Log of salary
Male
Female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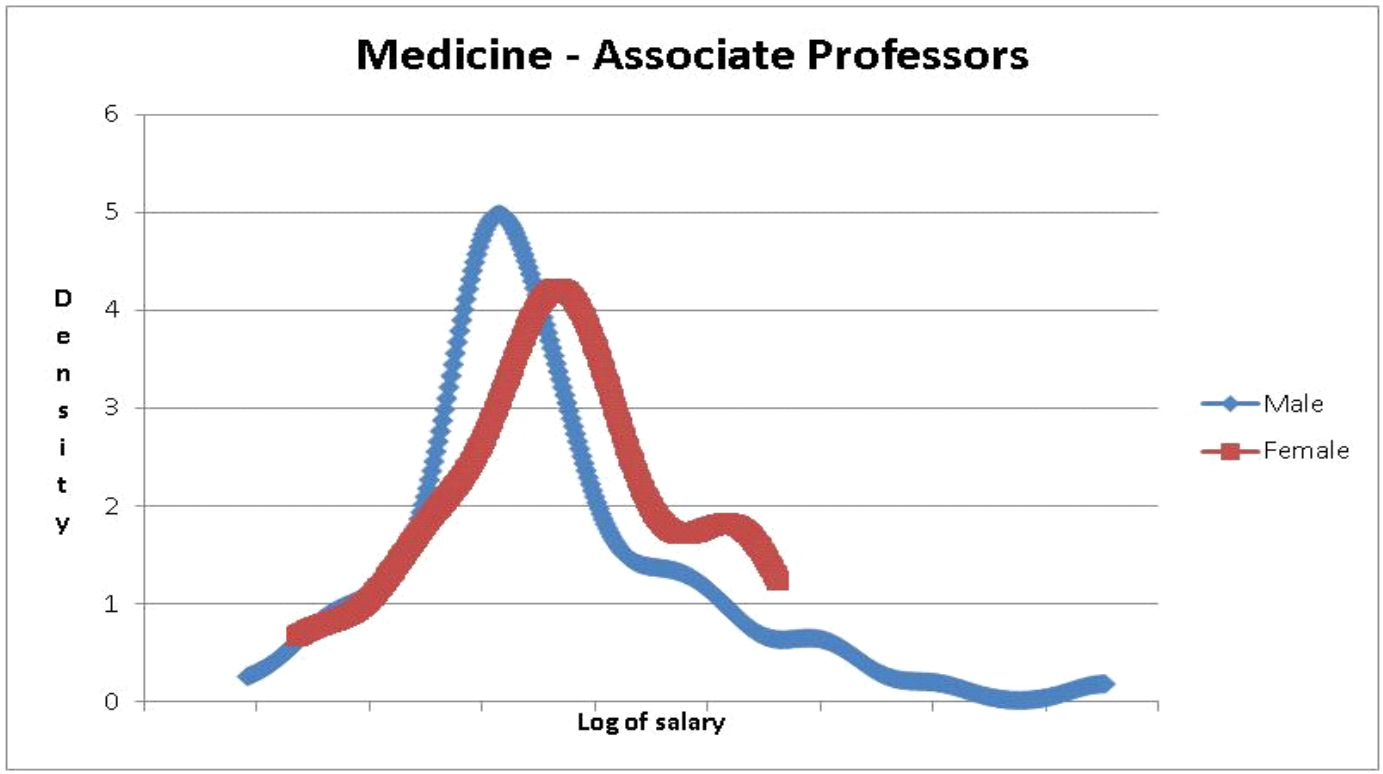
Density
Log of salary
Male
Female


Medicine - Associate Professors
Density
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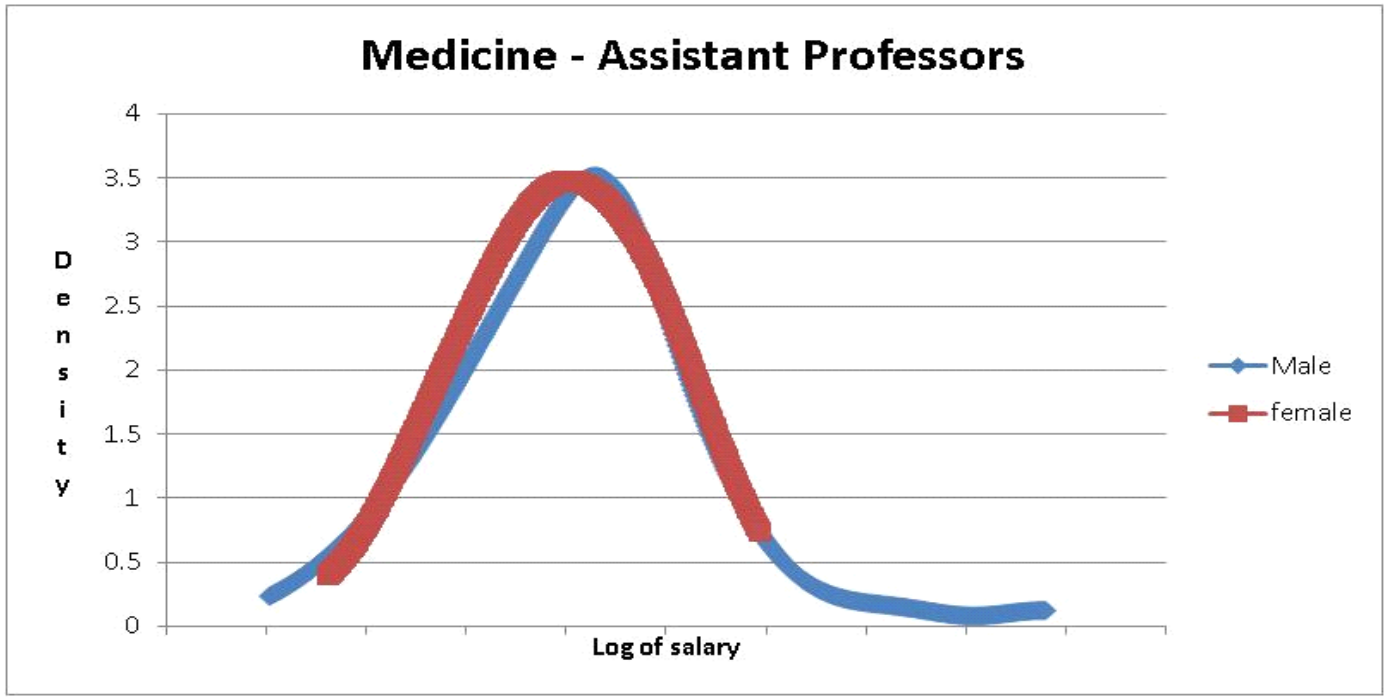
1
2
3
4
5
6
Log of salary
Male
Female


Medicine - Assistant Professors
Density
4
3.5
3
2.5
2
1.5
1
0.5
0
Log of salary
Male
female