Field Specializations among Beginning Economists: Are there Gender Differences?

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The distribution of women across academic fields remains uneven. In the economics profession this is uniquely acute as there are disproportionately fewer women in the field and the share of women has been stagnant over time in both the United States (Lundberg and Stearns (2019)) and in European academia (Auriol, Friebel and Wilhelm (2019)).

In addition, women tend to concentrate in only a few fields in economics and are sparsely represented in others. Our examination of the the most recent data from the American Economic Association on PhD dissertations (2009-2018) indicates that over 40% of women completed their dissertations in the past decade in only three fields: Labor (J), Health (I) or Microeconomics (D). Doctoral dissertation fields among the other women were distributed over the remaining 17 JEL fields. Among males, the top 3 fields accounting for 36% of specializations were Microeconomics (D), Macro/Monetary Economics (E), and Labor (J). Apart from significant gender differences in other fields, Health and Macro/Monetary stand out in particular because they are among the three most popular fields for either women or men, but not for both. This is indicative of the extent to which different fields are popular among the two groups.

The central objective of our paper is to examine the processes that underlie gender differences in PhD fields of specialization within economics. Our contribution is thus to document and understand what is driving gender segregation in field specialization in economics. Are gender differences in fields driven primarily by economic or by non-economic factors? A greater understanding of factors explaining this social inequality will help formulate ideas on how to provide greater equality of opportunity and increase intergenerational transmission of advantage. Adding a monetary component to our analysis is a novel aspect of this research.

The prevailing impression among economists is that the proportions of women economists across field specialties decline with the degree of theoretical abstraction in the specialty areas. Is this really the case? We investigate the process of field choice. Field specialization decisions are modeled within a multivariate logit binomial choice framework. The model incorporates anticipated salary by field, the probability of academic employment by field, and specialization in one or more primary fields. Because the decision to specialize in a given primary field can be correlated across outcomes, our multivariate logit model incorporates association parameters across equations to take account of correlated field choices. The model includes both choice and case specific attributes.

I. Literature

Field specialization has not enjoyed extensive discussion in the literature.[1] As far as we know, no study closely examines the determinants of choosing fields of special-

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[1] More recently, Fortin, Lemieux and Rehavi (2020) examine economic sub-fields in order to reconcile differences in job placement outcomes between research oriented and non-academic positions between women and men.

ization in economics. This is mainly due to the lack of data, but also because it is not so easy to conceptualize.

Most of the current literature about women in economics is concerned with the performance of women in academia (Ginther and Kahn (2004)). In the sciences, gender differences in publications and promotions diminished and virtually disappeared (Ceci et al. (2014)), but not in economics. Researchers have studied the effect of mentoring on job outcomes and publications (e.g.McDowell, Singell and Stater (2006)), gender ratios in PhD programs (e.g.Hale and Regev (2014)), and the under representation of women in undergraduate economics classes (Avilova and Goldin (2018)).

Field specialization is difficult to conceptualize and there is lack of data. Dolado, Felgueroso and Almunia (2012), attempt to document the gender distribution across research fields in economics for a selected group of universities and find that the probability that a woman chooses a given field is positively related to the share of women in that field. A similar finding of path-dependence in the context of gender ratios of graduate students at top PhD programs. has been found by Hale and Regev (2014).

Bayer and Rouse (2016), propose supply and demand factors that may explain why there are few women in economics and what could be the barriers to diversity in the field, but they do not discuss field diversity *per se*. *Supply factors* discussed in the literature that affect the presence in economics are decisions already made at the undergraduate level such as weak preparation in math (but not aptitude), low prior exposure to economics, lower performance in economics compared to other courses, the lack of role models in the field, and the instructor's gender (or race). In terms of *demand factors*, there is some evidence that implicit bias (a form of discrimination based on unconscious attitudes) may still be playing a role when hiring and promoting women and men. Apart from implicit bias, there may also be what is known as "institutional discrimination," which occurs when institutional rules that are put in place systematically disadvantage members of a particular group even if not intentionally.

II. Conceptual Framework

We apply the multivariate binary field choice model presented in Bel, Fok and Paap (2018), to field specialization choices made by economics graduate students at the doctoral dissertation stage. We first estimate the model for a pooled sample of women and men in order to obtain an overall estimate of gender differences in field specialization after conditioning on covariates and taking into account the correlated choices among our ten primary fields of specialization.

In this decision environment one can specialize in multiple primary fields. Assuming away the correlation across choices, the model would reduce to an independent binomial logit framework. In our estimation, we apply the strategy termed the Composite Conditional Likelihood (CCL) estimation method, which transforms the complexity of the estimation task to maximum likelihood estimation of conditional probabilites. The determinants of doctoral field specialization in this model are grouped into three broad categories: a) graduate school environmental factors (e.g. departmental rankings, gender composition of the faculty, faculty research output by field), b) economic factors (e.g. expected starting academic salary, expected salary 7 years post-PhD, expected probability of starting academic employment), and c) personal characteristics (e.g. gender, graduate school cohort). In order to isolate gender effects we include an indicator variable for females.

As a starting point, we employ the Duncan Dissimilarity Index (DDI) to measure the disparity between the distributions of the single primary field specializations for women and men:

$$D_{mf} = \frac{1}{2} \sum_{j=1}^{J} \left| \overline{\pi}_{mj} - \overline{\pi}_{fj} \right|,$$

where $J = 10$ is the total number of pri-

mary field specializations, and $\overline{\pi}_{ks}, k = m, f$ is the sample proportion for primary field specialization j. The value of the index represents the proportion of either gender who would have to change their field specialization in order for there to be complete parity.[2]

III. Data

The data come from several sources: Academic Analytics, EconLit, and official websites of states in the United States. The main data come from Academic Analytics (AA), a data gathering entity (co-operating with the University of Arizona) that has information on over 270,000 faculty members at more than 385 PhD granting universities in the United States and abroad. AA data are structured by departments and disciplines and includes information on 1) publications, 2) citations, 3) research funding, and 4) honorific awards.

The AA data are merged with the AEA EconLit database that includes information on all published articles in economics along with their JEL codes in order to identify the main field of research specialization for each academic economist. The data on graduate students come from EconLit for the years 2009 to 2018. Every year the December issue of the *Journal of Economic Literature* publishes a list of doctoral degrees conferred by U.S. and Canadian universities during the previous academic year along with the JEL codes that identify the doctoral thesis field(s) of specialization.

Gender information is obtained from Gender-API.com for about 90 % of the sample and the rest is coded manually. We apply the modal JEL code(s) present on the submitted dissertations to determine the graduate students' field specialization(s). Future work will entail conducting robustness checks.

Salary information is collected from state universities as it is common for these institutions to have policies that make faculty salaries publicly available. These salary records usually identify the home department of the faculty member, a secondary department if applicable, the individual's position, and whether they are employed full-time.

Our sample is currently comprised of individuals who specialize either in only one primary doctoral field or in two primary doctoral fields. Thus, the decision setting is one in which an economics graduate student chooses one or two specializations from a menu of 10 primary doctoral fields.

$<< INSERT\_TABLE\_1 >>$

IV. Emprical Results

Table 1 reports the field distributions of women and men PhD economists from two samples.[3] The first corresponds to graduate students who defended their PhD between 2009 and 2018. In this sample, gender differences in specializations are statistically significant in 4 fields. Women are more likely to be present in Labor/Health by 13 percentage points and less likely to be in Econometrics, Micro and Macro/Finance by 2, 3 and 6 percentage points, respectively.

The second sample corresponds to economists employed in academia whom we have divided into three subgroups based on the year of completion of their PhDs. Among those who have completed their PhD prior to 1989,

[2]If the field distributions were identical for the two groups, the value of the index would be 0. At the other extreme if there were no gender overlap (complete segregation) in fields of specialization, the value of the index would be 1 (or 100 if scaled up to percentages).

[3]The JEL field classification we use comprises 10 mutually exclusive primary groupings: Econometrics (C. Mathematical and Quantative Methods); Micro (D. Microeconomics); Labor/Health (I. Health, Education and Welfare, J. Labor and Demographic Economics); Macro/Finance (E. Macroeconomics and Monetary Economics, G. Financial Economics); IO (L. Industrial Organization); Environmental & Agricultural (Q. Agric. & Natural Resource Economics, Environmental Economics); International/Development/Growth (F. International Economics, O. Economic Development, Innovation, Technological Change and Growth); Public (H. Public Economics); Economic History (B. History of Economic Thought, Methodology, and Heterodox Approaches, N.Economic History); Other (P. Economic Systems, A. General Economics, K. Law and Economics, M. Business Administration, R. Urban, Regional, Real Estate & Transportation Economics, Y. Misc., Z. Other Topics.)

gender differences in specializations are statistically significant in five broadly defined primary fields: Econometrics, Labor/Health, Macro/Finance, International/Development/Growth and Other. Women are underrepresented in Econometrics and Macro/Finance (by 2 and 9 percentage points, respectively) and they are over-represented in Labor/Health (by 14 percentage points) and Other fields (by 3 percentage points). In this earlier period, women were also underrepresented in International/Develop/Growth by 2 percentage points (in later cohorts, they were over represented).

Gender differences in these fields continue to be significant for more recent PhD graduates (except in Other). In the group of academic economists who completed their degrees during 1990-2003, an underrepresentation for women occurs in Micro by 4 percentage points. The gaps in Labor/Health and Macro/Finance slightly diminish (by 1 percentage point).

In the most recent sample of academics, those who completed their degrees between 2004 and 2016, the gaps continue to exist in the same fields and in addition occur in Industrial Organization (2 percentage points). The gaps in Econometrics remain constant at 2 percentage points; they increase for Micro – now at 5 percentage points – and decline in Labor/Health (to 9 percentage points) and Macro/Finance (to 5 percentage points). In the case of Development/Growth/International the gap remains at 2 percentage points. Thus, across academics gender gaps remain constant in Econometrics and Development/Growth/International, are larger in more recent cohorts in Micro, and are decreasing in Labor/Health and Macro/Finance.

In the last row of Table 1 we report the DDI for single primary field dissimilarity between women and men. Among the graduate student sample reporting one primary field specialization, 14 percent of either women or men would have to change specializations in order to achieve complete parity in the specialization distributions. In the sample of academics this share is similar. Among the most experienced academics, close to 15 % would have to change fields for complete parity to be achieved, while for the most recent sample this figure is close to 13 %.

$<< INSERT\_TABLE\_2 >>$

Next, we report the gender effects from our multivariate CCL logit model. They are reported as marginal effects in Table 2 calculated for discrete changes from 0 to 1, with all other variables set equal to their sample mean values. The female indicator variable is statistically significant for six fields. Other things equal, women are more likely than men to select Agriculture & Environmental Economics as a doctoral field of specialization and less likely to select Labor/Health, Macro/Finance, IO, Public Economics, or Development/Growth/International. The major difference from the unconditional raw data results occurs with respect to the Labor/Health field which was selected by 33% of the women versus being selected by 21% of the men. Had other things been equal for men and women, women would be 34% less likely to select Labor/Health as a doctoral field than men.

V. Summary and Conclusions

Our preliminary results indicate a relatively modest gender disparity in field specialization among the most recent cohorts of graduate students. This disparity is slightly lower among a similar cohort of academics. Earlier cohorts for academic economists exhibit larger gender disparities in field specialization. This pattern arises from some combination of the evolution of field specialization over individuals' academic careers and differences over time in graduate student cohorts and job selection.

We also find that statistically significant differences in field specialization exist among the most popular fields selected by women and men. Surprisingly, although Labor/Health and International/Development/Growth are fields where we find a significant female presence, our model shows that once we con-

Table 1—Distribution of fields among women and men with one field.

	Graduate students[a]			Academics								
				1989 and earlier			1990-2003			2004-2016		
	Women	Men	Diff.	Women	Men	Diff.	Women	Men	Diff.	Women	Men	Diff.
Econometrics (C)	3.40	5.84	-2.44***	2.08	3.76	-1.68**	2..32	4.11	-1.79***	3.82	5.46	-1.64**
			(0.558)			‘(0.80)			(0.62)			(0.70)
Micro (D)	10.71	13.89	-3.19***	11.68	13.10	-1.420	11.61	15.27	-3.66***	12.26	17.58	-5.32***
			(0.852)			(1.45)			(1.15)			(1.19)
Labor/Health (I,J)	33.58	20.83	12.74***	28.80	14.54	14.27***	27.62	14.66	12.96***	23.49	14.07	9.42***
			(1.083)			(1.59)			(1.26)			(1.21)
Macro/Finance (E,G)	14.38	20.72	-6.34***	14.40	23.64	-9.24***	15.45	24.04	-8.58***	19.90	24.63	-4.74***
			(0.989)			(1.79)			(1.36)			(1.37)
IO (L)	5.31	5.84	-0.530	6.72	7.91	-1.19	6.89	8.08	-1.19	6.39	8.04	-1.65*
			‘(0.587)			(1.15)			(0.88)			(0.86)
Environ / Agric (Q)	9.07	9.53	-0.450	8.64	10.60	-1.96	9.05	9.80	-0.76	10.13	9.19	0.94
			(0.740)			(1.31)			(0.97)			(0.95)
Public(H)	2.45	2.70	-0.250	4.00	3.73	0.268	2.88	3.16	-0.28	2.57	2.39	0.18
			(0.406)			(0.82)			(0.57)			(0.50)
Int/Develop/Growth (O,F)	14.20	12.89	1.310	6.88	8.92	-2.05*	11.29	8.54	2.75***	10.57	8.36	2.21**
			(0.860)			(1.21)			(0.96)			(0.93)
Econ History (B,N)	0.95	1.13	-0.180	2.40	2.77	-0.366	1.20	1.64	-0.44	1.03	1.60	-0.57
			(0.262)			(0.70)			(0.40)			(0.38)
Other (P,A,K,M,R,Y,Z)	5.94	6.62	0.670	14.40	11.04	3.36**	11.69	10.70	0.99	9.84	8.68	1.16
			(0.621)			(1.38)			(1.03)			(0.93)
Observations	2,209	5,290		625	3,832		1,249	3,478		1,362	3,134	
DDI[b]			14.06%			14.50%			15.70%			12.60%

Note: [a] This refers to graduate students that have defended during 2009-2018. [b] Duncan Dissimilarity Index

Source: Academic Analytics and EconLit data.

Table 2—Marginal effects - multifield (doctoral sample)

	(1) Econ	(2) Micro	(3) Labor	(4) Macro	(5) IO	(6) Ag	(7) Public	(8) Dev	(9) Hist	(10) Oth
Female (d)	-0.042	-0.072	-0.341***	-0.042***	-0.459***	0.302***	-0.060**	-0.144***	0.304	0.051
	(0.074)	(0.101)	(0.004)	(0.009)	(0.147)	(0.041)	(0.029)	(0.031)	(0.442)	(0.036)
N	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853

Note: Labor: Labor/Health; Macro: Macro/Finance; Ag: Agriculture & Environmental Economics; Dev: Development/Growth/International Marginal effects; Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; (d) for discrete change of dummy variable from 0 to 1;

Source: Academic Analytics and EconLit data.

dition on differences in characteristics between women and men, men would have a much larger presence than women in that field. Understanding this process will be a major thrust of our subsequent analysis. Furthermore, preliminary results (not reported here) indicate that field specialization disparity increases when all multifield specializations are considered in addition to the single ones as is the case here.

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