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# WHAT IS A FEMINIST QUANTITATIVE METHOD? OPPORTUNITIES FOR FEMINIST ECONOMETRICS

# Sarah F. Small

# ABSTRACT

Though feminist economics encourages methodological plurality, quantitative methods and econometrics have overtaken the discipline in recent years. Many feminist economists have demonstrated reasons to be concerned about the increasing foothold of quantitative methods, and others have provided thoughtful criticisms of specific quantitative measurements. However, few have made distinctions between mainstream econometrics and feminist econometrics, and a succinct set of resources for those trying to do feminist quantitative research is difficult to find. Drawing upon insights from feminist economics, queer methods, and intersectional approaches, this article sets forth practical guidelines for feminists using econometric methods. Namely, it considers issues of data cleaning, replicability, survey weighting, comparison groups, non-binary measures of gender, intersectionality, causality claims, identification problems, atheoretical index composition, and measuring "difference." It raises questions for contemporary feminist economists to consider as we grapple with the methodological identity of our field.

### **KEYWORDS**

Econometrics, feminist methods, quantitative approaches

JEL Codes: B54, C01, B41

# HIGHLIGHTS

- Gender diagnostic estimation can be used to endogenously measure gender.
- Separate model approaches and CARTs are useful in intersectional work.
- Econometric models can be structured so they are "studying up."
- Oaxaca-Blinder and PCA methods raise some feminist concerns.
- Cohen's D and the Index of Similarity can be used to test gender differences.

 $\ensuremath{\mathbb{C}}$  2024 IAFFE

### INTRODUCTION

In the recently published *Handbook of Feminist Economics*, Joyce Jacobsen explains:

Currently, feminist use of quantitative methods in economics is barely discernible from non-feminist use. While topic choices may vary for feminists versus non-feminists, and emphases and framing of results may vary, the actual techniques used to carry out empirical analyses are basically indistinguishable. (2021: 134)

With both feminist and mainstream economists increasingly using quantitative empirical methods, I suggest that feminist economists need to take Jacobsen's observation seriously. Namely, what does it mean to do a feminist econometrics?

In the early years of the International Association for Feminist Economics (IAFFE) and the journal Feminist Economics, there was a push to move away from quantitative methods and to embrace methodological plurality, including economic studies using mixed and qualitative methods. Quantitative methods were seen as purely logical and objective by the mainstream, and feminist economists pointed not only to the masculine bias in this thinking, but also indicated that numbers are not free of bias or subjectivity (McCloskey 1993; Nelson 1995). Indeed, many prominent feminist economists suggested that econometric models often lacked substance and that the discipline needed to embrace alternative methodologies alongside quantitative methods (Bergmann 1987; Nelson 2000). However, many have expressed concern that feminist economics has strayed from its ideological roots and has become increasingly empirical and increasingly focused on econometric methods (Tejani 2019; Small and Braunstein 2024). Indeed, a push for causal econometric modeling is rampant in the field of economics at large (Hamermesh 2013; Paldam 2021). Because Feminist Economics' founding editor pledged that the journal would continue to engage with and criticize the mainstream (Strassmann 1995), it is perhaps not surprising that feminist economists have followed overall methodological trends.

Some scholars have suggested that quantitative methods themselves can be anti-feminist (Mies 1983), yet many feminist economists clearly continue to use them. Whether it is for survival in a field that grows increasingly fixated on causal econometric methods, or because "there are benefits to using the dominant language of the patriarchal system" (Apodaca 2009: 420), I posit that feminist economists still need to contend with what it means to do feminist econometrics. Indeed, as Jacobsen (2021) alludes, choice of topic and framing are not sufficient in terms of making feminist contributions to debates on quantitative methodological approaches in economics. Feminist economist Wendy Sigle-Rushton also asserts that

"feminist economists can and should take greater care in their choice of methods and model specifications and reflect to a greater extent on the assumptions that underlie their choice of method and the models they estimate" (2014: 431).

A great deal has been written on distinctly feminist approaches to qualitative methods (Finch 2004; Landman 2006; Smart 2009; O'Shaughnessy and Krogman 2012; Panfil and Miller 2015), but there seems to be less literature on feminist approaches to quantitative methods. Perhaps the most complete work within feminist economics to lay forth guidelines for quantitative methods is Sigle-Rushton's (2014) work. Sigle-Rushton (2014) describes dilemmas in using quantitative methods to do intersectional research and offers some best-practice guides. Bechtold (1999), Deborah M. Figart (2005), and Julie A. Nelson (2000) also engaged with feminist critiques of econometrics several decades ago, and their work deserves revisiting. In this article, I build upon their work and draw upon other literature from feminist economics, queer methods, and intersectional approaches to set forth practical guidelines for feminists using econometric methods. I also raise questions for contemporary feminist economists to consider as we grapple with the methodological identity of our field.

To be clear, there are several things I will not do in this article. First, I do *not* defend quantitative methods over qualitative: such an assertion would indeed be anti-feminist and plenty of scholars have already artfully engaged in this comparative debate. I encourage readers interested in such questions to consider works like Nicole Westmarland (2001), Toby Epstein Jayaratne (1983), L. Kelly, L. Regan, and S. Burton (2003), Mary Fonow and Judith A. Cook (2005), and Nicole M. Garcia, Nancy López, and Verónica Vélez (2018). I also assert that we as feminist economists should continue to push for qualitative and mixed methods to be valued in the economics discipline and that methodological plurality is essential in creating better economic research (Nelson 1995; Berik 1997). Further, while the focus of this paper is very much on econometrics, aspects of it may be relevant to those doing other types of quantitative research (for example, those offering descriptive statistics based on surveys or other quantitative data).

Second, I do *not* aim to redefine nor meaningfully reiterate what feminist economic research topics should be. Many in the economics mainstream perceive feminist economics as simple measurements of gender difference, but it involves a much deeper understanding of patriarchy, power, and social provisioning (Nelson 1995; Power 2004). Similarly, I do not aim to rehash general recommendations in feminist research methodology broadly. For instance, Marlene Kim (1997) offers a very useful guide for feminist economists, suggesting, among other things, that we use research to induce social change, use conscious subjectivity instead of value-free objectivity, bring the researcher into the research, and reduce the distance between the researcher and the research subjects. These components of feminist economic research should not be overridden when doing quantitative work, but my contribution is to more concisely hone in on actionable suggestions for those doing econometrics using secondary data sources.

Finally, I do *not* aim to provide guidance on primary data collection methods. Again, many other feminist scholars considered questions of data collection, survey design, and experimental and randomized control trial (RCT) designs (MacDonald 1995a, 1995b; Kim 1997; Esquivel et al. 2008; Sent and van Staveren 2019; Kabeer 2020a, 2020b). My goal here is to offer guidelines for distinctly feminist econometric methods using secondary data and to raise questions for feminist econometricians to consider as we move forward.

To set forth actionable suggestions for feminists using econometric methods, I begin where many econometricians also begin: with "cleaning" secondary data. I ask how feminists might clean their data and how we might articulate what is missing in a dataset. I also discuss how we can measure gender given binary constraints in many secondary datasets. I then turn to questions of regression models and design. I offer thoughts on choice of comparison groups and intersectional approaches. I also critique some types of causal model designs, models devoid of theoretical engagement, and troublesome approaches to identification. Further, I highlight literature that offers guidelines for interpreting regression results and raises feminist motivations for testing for statistical and meaningful differences in regression results. Finally, I conclude with questions and aspirations for contemporary feminist econometricians as data and methods continue to evolve.

# DATA CLEANING, REPLICABILITY, AND SAMPLE WEIGHTS

Tamraparni Dasu and Theodore Johnson (2003) estimate that 80 percent of a researcher's time is spent on a paper is the cleaning and preparation of data. However, this type of labor remains largely undiscussed in academic papers. Feminist scholars Jane E. Miller and Yana van der Meulen Rodgers (2008: 126) suggest that "before coding variables or selecting numeric values to contrast, a researcher ought to identify conventional standards, cutoffs, or comparison values used in the field." Indeed, to do so, scholars in the field must be explicit about their cleaning techniques and include them in their papers. I suggest that feminist economists could spend more space discussing critical decisions made during cleaning processes in our writing.

Kevin Guyan (2022) examines many of these critical decisions. For example, he notes that when classifying groups, researchers might decide to "lump" or "split," but should be very deliberate about this decision

based on the type of work they wish to do. Namely, "splitters" might group identity characteristics with intentions to reflect individual nuances and complexities. This will necessarily involve a large number of categories, sometimes with samples too small to be statistically meaningful in an econometric model. For "lumpers," there are a smallest number of possible categories, bigger groups are created, and there is greater diversity within each group. One clear example of this dilemma is lumping respondents in a "BIPOC" (Black, Indigenous, or People of Color) category. To have such a category certainly obfuscates the nuance within the group: is the tradeoff, for say, statistical significance, worth obfuscating these nuances? I do not suggest there is a correct answer here, but rather wonder if feminist researchers should address these data cleaning questions in their research papers. One very good example of this is in Christopher S. Carpenter, Maxine J. Lee, and Laura Nettuno (2022): the authors explain in great detail their data's survey questions on gender (which offers four options: male, female, transgender, and none of these), then explain how they lump these responses together (or not) in their empirical models, including both theoretical explanations about gender identity as well as statistical justifications focused on questions of significance.

Transparency in data cleaning is also essential for replication and reproducibility of studies, which certainly have feminist advantages. Economics is somewhat behind in terms of its expectations for replicability (Christensen and Miguel 2018), but transparency in our research may help make more abundantly clear that political decisions are made in our data cleaning and method design. In other words, making our studies more easily replicable may help us see that economic studies are not as positivist or objective as they are often presented (Nelson 1995): objectivity is not inherent in math or quantitative data itself, but in the depth and scope of interrogation of studies in a scientific community (Christensen and Miguel 2018; Nelson 2021). Additionally, replicability might encourage more research integrity and ultimately access and inclusivity in scholarly communities (Resnik and Shamoo 2017; Azevedo et al. 2022).

For those doing intersectional work, especially intracategorical work like the kind Leslie McCall (2005) describes, small sample sizes and reliance on survey weights become very evident. Kenneth A. Bollen et al. (2016) explain how using typical survey weights in regression analyses is often sufficient, but with smaller samples, they can produce biased estimates. In cases where one is studying a smaller sample in a larger survey, one might ask, how many individuals within the group I am studying are *actually* surveyed? Do the survey weights make sense for this given group of analysis? Again, I point to Carpenter, Lee, and Nettuno (2022) as a useful example of econometric work which clearly addresses the second question: they note that their data on transgender individuals in the United States includes survey weights, but that such weights are based on a Census which does not capture gender minorities and that the weights do not account for a transgender respondent's selection into nonresponse and mid-survey attrition. To otherwise answer these questions, feminist economists might also show summary statistics with and without survey weights. This helps a reader get a sense of how much work the survey weights are doing in the analysis for a given group in the sample. Roderick J. Little (2008) also suggests Bayesian predictive models may produce better estimates in smaller samples.

Ultimately, clear-cut rules for data cleaning and survey weight decisions are impossible to provide given these decisions are made in the context of one's dataset and research question. Still, feminist economists might be more transparent about their data and its cleaning decisions in order to avoid unsound generalizations or obfuscate nuance.

# MEASURING GENDER

Many econometricians working with secondary data face issues with the measurement of gender. In the US Census, for instance, respondents are only allowed to select "male" or "female." This forces respondents to select a binary sex, despite the fact that some people are born with sex traits that differ from those in narrow binary definitions of male and female. Additionally, this type of question does not allow for an expression of gender, for instance, woman, man, non-binary, genderfluid, agender, two-spirit, and so on.

Currently, the editorial policy of *Feminist Economics* is to make reference in one's writing to gender rather than sex. This makes sense: we as social scientists should rarely be making claims based on sex characteristics but rather on socialized gender. But when surveys only allow respondents to indicate binary sex, what is most accurate for a feminist economist to write? To assume that all respondents who indicated they were "female" are also "women" is not correct. But to write about sex might be otherwise misleading in that it implies the phenomena one is studying is associated with sex traits rather than gender. For example, to simply write something like, "females are more risk averse in financial markets than males" would imply that financial risk aversion is a biological trait, not a social one, which is of course an inappropriate claim for an economist, as a social scientist, to make.

For many datasets, there may not be a satisfactory solution to this problem, aside from pushing for better data collection. Still, acknowledging the lack of information can ensure clarity in our research. For instance, a feminist economist might write something like, "survey data only allow for sex measurement and not gender, but because I am studying social gender phenomena, write in terms of gender. This unfortunately assumes all respondents are cisgender, which data cannot confirm." Ethan T.

Bamberger and Aiden Farrow (2021) suggest statements such as these serve to actively combat normative assumptions and erasure. It is certainly an imperfect response to inadequate data, but highlighting its inadequacies is imperative.

Quantitative researchers also face issues with explaining how neither gender nor sex are static. Panel data, as opposed to cross-sectional, may help us capture temporal changes in gender or sex, but often only if the data collection tool is designed to do so. Additionally, explaining how gender changes in various contexts can be difficult to do with quantitative data: Niels Spierings (2012, 2016) suggests that multilevel regression models might be a useful tool for feminist researchers to use to understand the spatio-temporality of gender. For instance, multilevel models can allow researchers to measure gendered behavior or outcomes both at the organizational level and the individual level (Lederer, Messing, and Sultan-Taïeb 2023).

In her work "Toward a Feminist Econometrics," Esther Redmount (2005) proposes a "model of endogenous gender" where gender is considered a continuous and endogenously determined variable. Redmount (2005) offers an analogy to research in health: in earlier years of health research, one was either sick or well (a binary) until analysts considered health as a continuous and endogenously determined variable (for example, determined by nutrition, activity, disease prevention, and so forth). She suggests that our understanding of gender should be similarly modeled: not as a simple exogenous binary variable. However, in order to create a model of endogenous gender, we need to know how an individual's gender has been informed, requiring a "melding of economic and sociological/psychological datasets" (Redmount 2005: 162).

This is precisely what Travis Campbell et al. (2024), Ian Burn and Michael E. Martell (2022), and Duc Hien Nguyen (2024) do using Adolescent to Adult Health Survey (AdHealth) and Behavioral Risk Factor Surveillance System (BRFSS) panel data and gender diagnostic techniques. Such techniques are perhaps best explained by Burn and Martell (2022), who write,

Methodologically, the crux of these measures is that they utilize survey responses to measure how similar a respondent's answers are to their same-sex peers... To measure this, the gender diagnostic methods use a logit regression where a binary indicator of sex is regressed on the survey responses to predict the probability a respondent is male (or female). These predicted probabilities are then used as a measure of conformity because individuals with high predicted values behave in ways that are more typical of their sex (Burn and Martell 2022: 788).

In other words, sets of reported behaviors (often based on questions about personality characteristics, interests, hobbies, and so on) are classified as masculine and feminine behaviors using the logit regressions, and individuals are ascribed measures of masculinity and femininity, or of gender conformity or typicality. This means that regardless of a respondent's sex or gender, their behavior is compared to how most of their female peers behave and how most of their male peers behave. This allows researchers to answer pointed questions about gendered behavior rather than sex using their quantitative data. However, Nguyen (2024) offers a word of caution: because this technique relies on measuring degrees of similarity in behaviors between a person and their peers in a given sample, it implicitly requires researchers to presuppose that stable, coherent, and relatively homogenous gender norms exist. Burn and Martell (2022) offer more technical criticisms, first noting that the measure is only informative if enough of the behavioral measures are strongly correlated with sex. They also note tradeoffs in designing the initial logistic regression: if the model is too complex, it may suffer from over-fitting and the predictions may not be meaningful, but with too much simplicity, the measure is less meaningful theoretically.

Still, these methods provide exciting opportunities to move beyond gender binaries in quantitative research and instead consider the endogeneity of gender construction more deeply. For instance, Burn and Martell (2022) find evidence that suggests transgender women in the United States face labor market penalties for having more feminine gender expressions. Campbell et al. (2024) expand these techniques by allowing for situational fluidity in gender expression (for example, different degree of femininity at home vs at work). Within economics, use of gender diagnostic techniques seems to be common among those working on LGBTQ+ issues, many of whom are feminist economists. Still, economists focusing on cisgender or heterosexual populations certainly have a lot to gain from adopting these techniques and embracing Redmount's (2005) call for a model of endogenous gender.

# **REGRESSION MODELING AND DESIGN**

#### **Comparison groups**

The ability to compare average experiences across groups is often seen as a key advantage of feminist quantitative work as opposed to qualitative. However, some scholars have recommended researchers avoid unnecessary comparison between groups, because, with too much frequency, such comparisons have been conducted for the sake of proving superiority of one group over another (Azibo 1988; Cokley and Awad 2013). For this reason, quantitative feminist researchers should be careful in making

comparisons: there should be a clearly articulated research question that necessitates comparison. Alternatively, comparison might be used if it is to challenge results from studies by others, much like Nelson (2015).

Additionally, Bechtold (1999) suggests that in econometric studies, there is a tendency to over-represent activities related to the "haves" in society. When setting up a quantitative comparative model, we might ask: by setting up the model in this way, who or what am I implying is the norm? For instance, when groups like White respondents or men are the reference or comparison group, attention is drawn to the problems of the oppressed category of individuals and not the privileges of those who are in relationships of dominance over them (Cokley and Awad 2013).

By flipping this common modeling structure on its head, feminist econometricians can better "study up." Joey Sprague explains this approach best, writing that

without a parallel concentration of research focusing on the problematic character of elites and the social institutions bolstering their privilege, the focus on what is wrong with disadvantaged people creates a picture in which those on the downside of hierarchies have, and thus by implication are, problems. (2016: 15)

Studying up focuses on elites and social institutions and their roles in oppression and does not perpetuate the notion that oppressed individuals are themselves the problem. One example of "studying up" is in Dania V. Francis (2012), who studies teachers' perceptions of student behavior. In Francis' (2012) econometric model, Black girls are set as the comparison group, forcing the reader to interpret the model by considering the unfair advantages White girls accrue rather than disadvantages faced by Black girls in American schooling.

#### Choice of variables

When designing a regression model, decisions need to be made about which variables to include. Many researchers have been trained to consider numerous statistical issues when selecting variables to include in a regression model, but few have considered, for instance, what it means to "control" for gender or race. Is controlling for gender analogous to controlling for patriarchy, and is controlling for race analogous to controlling for racism? I suggest that to assume a simple race or gender dummy variable adequately captures all differences in experience is incorrect: this type of modeling allows for gender or racial differences in the outcome at baseline, it also forces this difference to be the same at all levels of the predictor (Figart 2005; Shapiro, Klein, and Morgan 2021). Kevin Cokley and Germine H. Awad (2013) advocate for including variables that provide a deeper understanding of social processes rather than simple measures of group membership. For instance, they note that,

Often group membership (e.g., sex, race, sexual orientation, income) is used to explain differences between groups. The use of distal variables should be avoided in favor of deeper level process variables such as gender identity, cultural variables (e.g., collectivism), and socio economic status. (Cokley and Awad 2013)

#### Intersectionality

For many econometricians doing intercategorical intersectional work (McCall 2005), use of interaction terms in regression models is common. In her list of best practices for feminist quantitative researchers, Sigle-Rushton (2014: 439) writes:

As a matter of good practice, all interactions that are included in the models should be tested for significance (with careful attention to sample size problems and how they can affect measures of significance) and the model fit should be compared to that of the more restrictive mode. (see Hobcraft and Sigle-Rushton [2012] for an example)

However, rather than including dummy variables or interaction terms for measures like race, gender, or marital status, several quantitative intersectionality researchers have advocated for a separate models approach (Sprague 2016; Scott and Siltanen 2017). For example, in Sarah F. Small (2023), separate models are estimated for a sample of White couples and Black couples in the United States to understand the relationship between relative shares of housework and business ownership. One benefit of the separate models approach is that it allows for covariates to vary for different groups, which makes sense in that the effect of different variables within a given model may be very different for different groups. The separate models approach also allows readers more ease in understanding a models' explanatory power across groups (for instance, through the R-squared term).

Further, when using survey data in particular, it is likely the case that individuals of varying social groups interpret questions in different ways. Catherine E. Harnois (2010) introduces "multiple group analysis" which allows her to determine whether it is appropriate to use the same measurement instrument for people in different groups. First, she tests the stability of the measurement tool across three groups using confirmatory factor analysis (CFA). In her illustration, she examines how questions using the term "feminism" might be perceived among Black,

White, Latina women in the United States. Harnois (2010) then runs a combined model then three separate regression models to show how difference in definitional understanding effects results. This illustration is powerful in showing the strengths of a separate models approach. However, Sigle-Rushton (2014: 440) also highlights that "separate models should be (although often are not) tested against the null hypothesis that the parameter does not, in fact, vary across groups." Indeed, this is an important component of the separate models approach, and its relative weakness to an interaction term model, where readers may observe this with greater ease.

Whether one uses an interaction-term model or a separate models approach, this still does not directly address a key concern of quantitative intersectional work: linear regressions will assume linear relationships that are antithetical to intersectionality theorists assertions that dynamics of oppression and privilege do not necessarily have simple linear or additive relationships. Sigle-Rushton (2014: 441) suggests feminist economists take this charge more seriously and consider non-linear models in their work. For instance, she offers classification and regression trees (CART) as an example of a technique that can "aid in the identification of non-linear relationships and in the choice of parsimonious models that are more consistent with the aims of an inter-categorical [intersectional] approach" (Sigle-Rushton 2014: 441).

#### Claims of exogeneity: issues with instrumental variable estimation

As the economics discipline becomes more obsessed with causality in econometric modeling, feminist economists should be critical of models that claim causality in many contexts, but especially in those making use of instrumental variables. For instance, in a model estimating the impact of fertility on women's labor force participation, Hyunbae Chun and Jeungil Oh (2002) use son preference as an instrumental variable: they claim it is endogenous to fertility but exogenous to labor force participation. However, this is in fact endogenous: a society with son preference obviously has a social and economic reason for this son preference, implying that women and girls likely face more barriers in the paid labor market. In this case, the instrumental variable is not exogenous. Indeed, feminist economists might find concern with many such instrumental variables: preferences and social structures are determined endogenously, so it is often difficult to find a measure that is truly exogenous to one's dependent variable (Bowles 1998; Chandra 2009).

Even in instrumental variable models in which authors are able to find a variable that is conceivably appropriately exogenous, claims at causality can be farfetched. For instance, in a paper modeling video game use by girls and their subsequent pursuit of STEM, the authors used ownership of microwaves as their instrument: this was appropriately correlated with video game ownership, but not academic performance (Bustamante-Barreto, Corredor, and Hernandez-Posada 2022). However, the model did not include any measure of gender norms in the household, for instance, so one cannot simply say this relationship between video game usage and STEM pursuit is causal on its own. Ultimately, such a claim does a disservice to the true depth of the research question. With the discipline's increasing obsession with causality, it is clear that incorrect or inconsequential IV estimation will not be disincentivized. For this reason, feminist economists should think about how they can do and support descriptive non-causal quantitative research in their citation and reviewing practices as well as in their own writing.

#### **Oaxaca-Blinder decomposition critiques**

Feminist economists have long criticized gender wage gap models, for instance, which include a variety of educational and occupational variables, then look to the error term as an estimate of the share for the gap attributable to discrimination. Particularly, many scholars have pointed to identification problems in Oaxaca–Blinder decomposition models.<sup>1</sup> Carlos G. Ospino, Paola Roldán Vasquez, and Nacira Barraza Narváez (2010) nicely summarize critiques of Oaxaca-Blinder decomposition models, but of particular interest are criticisms that the residual term - often thought of as discrimination - is not particularly reliable given the value of the difference in intercepts depends on the decisions of measurement. Tymon Słoczyński (2020) also finds that such model's regression estimates are particularly sensitive to whether the "disadvantaged" group in the study is a numerical minority or majority in the sample. Oaxaca-Blinder decomposition models also often underestimate issues of prelabor market discrimination (like in education, for instance) and make it impossible to distinguish between different occupational distributions from differences in individual-level characteristics (Madden 1999; Karamessini and Ioakimoglou 2007). Additionally, conventional Oaxaca-Blinder models do not allow for relationships between characteristics and wages to non-linear (Atal, Nopo, and Winde 2009). However, several alternatives have been introduced for this (Bauer and Sinning 2008; Sinning, Hahn, and Bauer 2008; Guo and Basse 2023). Others have tried to revise models that better disentangle discriminatory dynamics: methods introduced in Maria Karamessini and Elias Ioakimoglu (2007), for instance, allow for separate estimates of the impact of social and individual gender wage discrimination on the gender pay gap. While these developments have not successfully grappled with each of the issues raised by Ospino, Vasquez,

and Narváez (2010), feminist economists engaging with such models can continue to make improvements.

# Techniques obscuring theoretical engagement: principal component analysis

Feminist economists have long made use of novel indices for their micro and macro econometric modeling (Dijkstra and Hanmer 2000; Klasen and Schüler 2011; Bagstad, Berik, and Gaddis 2014; Dilli, Carmichael, and Rijpma 2019; Berik 2022). However, each has been constructed with a great deal of theoretical engagement. Many newer econometric techniques which construct indices can be devoid of theoretical engagement if researchers allow them to be black boxes. For example, principal component analysis (PCA) has become more routine in measuring issues like socioeconomic status (Vyas and Kumaranayake 2006). While PCA has key advantages in reducing overfitting of a model, reducing dimensionality of one's data, and removing correlated variables, researchers lose a great deal of interpretable information when implementing PCA into their econometric models. David J. McKenzie (2003) has noted, for instance, that PCAs which aim to create indices capturing socioeconomic status and obscure important features because variables that are more unequally distributed between individuals or households are given more weight in a PCA. Without a sufficiently broad range of variables, however, problems of "clumping" and "truncation" can occur in the PCA.

Clumping or clustering is described as households being grouped together in a small number of distinct clusters. Truncation implies a more even distribution of [socioeconomic status], but spread over a narrow range, making differentiating between socio-economic groups difficult (e.g., not being able to distinguish between the poor and the very poor). (Vyas and Kumaranayake 2006: 461)

Once indices derived from a PCA are plugged into a regression model, it becomes very difficult to pin down precise factors contributing to a given relationship. Additionally, indices derived from PCA are necessarily relative measures and do not provide information in terms of absolute levels, which might prove challenging for meaningful comparisons across studies. By way of example, I point readers to Chistopher Rauh and Laëtitia Renée (2023), who artfully illustrate interpretation issues with PCA in their modeling on parenting styles. They offer a side-by-side comparison of models using PCA and those not, and ultimately opt to proceed with alternative metrics in their modeling. If not used with careful theoretical engagement, the relative "black box" nature of PCA contributes to trends within the economics discipline toward more sophisticated econometric modeling with less meaningful economic questions. In other words, as Nelson (1995) cites in her description of feminist critiques of mainstream economic modeling, I too suggest that such methods might contribute to a discipline with too many economists "skilled in technique but innocent of real economic issues" (Krueger 1991: 1044–45).

# INTERPRETATION AND TESTING FOR MEANINGFUL DIFFERENCE

When the time comes to interpret results from an econometric model, I suggest any feminist econometrician heed Miller and Rodgers' (2008) clear guidance. They offer several suggestions for writing about results, particularly in terms of writing about whether an association is causal, if results follow theoretical expectations in terms sign and size of the association, and if a given result is large enough to matter in realworld contexts. Namely, Miller and Rodgers (2008) assert that statistical significance alone is not adequate for assessing the "importance" of one variable in affecting another. They offer clear guidance for recognizing and explaining the difference between coefficients for different types of variables and for choosing appropriate numeric contrasts for continuous variables based on knowledge of their distributions and real-world context. They also offer examples to illustrating how one can make tables and figures more accessible to readers. Miller and Rodgers (2008) focus primarily on issues of interpretation, artfully responding to contemporary debates (Hoover and Siegler 2008; McCloskey and Ziliak 2008).

Sigle-Rushton (2014) already notes that researchers using separate models approach need to offer statistical comparisons across groups. However, feminist economist Julie A. Nelson (2014, 2016) shows that even when a statistically significant difference in means is found, the degree of overlap among individuals in each group is considerable. Nelson has done a great deal of work illustrating that many researchers tend to "find" results that confirm socially-held prior beliefs about behavioral differences between men and women (Nelson 2014, 2015, 2016).<sup>2</sup> Nelson uses measures like Cohen's D and the Index of Similarity to test for meaningful differences in risk raking and finds very little difference between genders actually exists in the aggregate. I posit that quantitative research on gender or racial difference ought to include these two tests where possible.

Nelson (2016: 118) explains that Cohen's D is a useful way of "measuring and communicating the *substantive* size of any difference in means in a way that takes into account both within-sex variability and possibility

of overlap between men's and women's distributions." Generally, in the context of men and women, the measure calculates the difference between the two groups' means for some behavior or outcome (often produced by regression point estimates), then divides that by the pooled standard deviation (a measure of the average within-group variation). This produces a value D, which "gives a large measure of 'difference' the larger is the difference between the means and the smaller is the within-group variability and a reduced measure of 'difference' as the difference in means gets smaller and within-group variability increases" (Nelson 2016: 118). Nelson (2016) provides some suggestions for writing about Cohen's D in one's research: namely, she suggests various avenues for how the D ought to be interpreted for digestible, public consumption.

Nelson (2012) also introduced the Index of Similarity: an easily computable and understandable measure of the degree of overlap between two distributions. The index is interpreted as the proportion of individuals in two distinct groups that are similar in the sense that their characteristics or behaviors exactly match up with someone in the other group. Using the Index of Similarity alongside Cohen's D creates some symmetry in research studies: one technique measures difference, while the other measures similarity.

In addition to implementing these measures to test for meaningful differences between groups, Nelson (2014) advises researchers against using essentialist statements. For example, in her meta-analyses on gender and risk taking, Nelson (2014: 568) would prefer a researcher write, "In our sample, we found a statistically significant difference in mean risk aversion between men and women" as opposed to the more essentialist statement, "Women are more risk averse than men." Researchers should also acknowledge and investigate how a measure in their study itself may be bias. For instance, in the case of gender and risk taking, the areas of risk studied are often selectively chosen to be masculine rather than feminine risk. For example, bearing children or becoming a housewife comes with extreme risk (Bergmann 1981), but is rarely considered in economic work on gender and risk taking.

### ADDITIONAL CONSIDERATIONS AND CONCLUSIONS

Throughout this paper, I have suggested that feminist econometricians: (1) be transparent about data cleaning and survey weights, (2) consider alternative measures of gender, (3) "study up" with their choice of comparison groups, (4) choose variables capturing social processes rather than simple measures of group membership, (5) weigh the tradeoffs of using separate models versus interaction terms through the lens of intersectionality, (6) be cautious with claims of exogeneity and Oaxaca-Blinder methods, (7) reconsider techniques that obfuscate theory (for

instance, PCA), and (8) test for meaningful differences across groups using the index of similarity and Cohen's D where appropriate.

Still, there are several questions concerning missing data, poor and unethical data collection, and the training of future econometricians. First, cleaning implies there is something wrong with the data collected. However, as Guyan (2022) describes, for many LGBTQ people, providing the "wrong answer" is not a mistake but an attempt to subvert cis/heteronormative biases baked into the survey or data collection instrument. Guyan (2022) cites examples where respondents write in their own answers instead of selecting "male" or "female" and Census responses where queer couples identify themselves as "married" even when governments do not recognize same-sex marriage. These examples demonstrate how collection methods can fail to restrict how participants share data about their lives and experiences. And indeed, feminist economists could be explicit about where secondary datasets are biased or missing pertinent information. For instance, are the ways questions worded bias in a masculine, racist, classist, or heteronormative way? What are the options respondents are given? Relatedly, should feminist economists be advocating for better quantitative data collection like they did with time-use data (Esquivel 2011)?

Relatedly, feminist economists might consider disclosing their thought process in terms of ethical decisions about which surveys and datasets to use. Were the data collected in ways which were safe? For example, U.S. National Crime and Victimization Survey often enters respondents' homes and ask individuals if they have experienced domestic violence without consideration for whether the perpetrator of such violence is present. Given the harm this may cause, are these data therefore ethical for us to use (let alone accurate)? How do we aim to contend with artificial intelligence, "big data," and algorithmic fairness (D'ignazio and Klein 2020)? Additionally, as data and methods continue to change, are we training the next generation of feminist economists to ask these questions? And more broadly, is there a heterodox econometric approach?

Ultimately, Sprague (2016) echoes many of Nelson's (1995) original critiques about quantitative research methods: "... economically privileged men prove their masculinity through technical mastery. Emphasizing an unnecessarily high level of technical complexity in evaluating research suggests that quantitative social scientists are adhering to the standard underwriting of a specific form of masculinity" (Sprague 2016: 111). Feminist economists revisiting the mission of the discipline as it was established in the 1990s will have an interest in upending this masculine bias toward fake objectivity and unnecessary technical complexity found in so many econometric approaches. As the economics discipline and feminist economics becomes increasingly quantitative and increasingly obsessed

with causal inference (Hamermesh 2013; Tejani 2019; Paldam 2021), feminist economists have an obligation to investigate the consequences of this shift and to embrace one another's descriptive (non-causal) quantitative modeling as well as qualitative methods of analysis. Further, in the field of gender studies, quantitative methods are scarce (Undurraga 2010; Spierings 2012), leaving an opportunity for feminist economists to define a feminist econometrics for both researchers in economics and in gender studies. Marrying feminism and economics has been largely focused on questions of topic and method: this article adds to feminist debates on method in an era where the discipline has become even more fixated on quantitative methods.

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### NOTES ON CONTRIBUTOR

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#### NOTES

- <sup>1</sup> Oaxaca and Sierminska (2023) explain how Evelyn M. Kitagawa's work fits in with the Oaxaca-Blinder technique. A critical feminist reading of Kitagawa's exclusion is worthwhile, which I leave to historians of economic thought to study.
- <sup>2</sup> Nelson also contends that researchers are often incentivized to find gender differences in their studies, as papers which demonstrate no gender differences are difficult to publish (Nelson 2014). This is a battle we as feminist economists need to forge in our roles as peer reviewers and journal editors.

#### OPPORTUNITIES FOR FEMINIST ECONOMETRICS

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