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Gender diversity strategy in academic departments: exploring organizational determinants

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Abstract Full inclusion of women into the academics remains a daunting challenge in the United States. The situation is particularly acute within science, technology, engineering and mathematics (STEM) fields where the underrepresentation of women and their career disadvantages attract a great deal of attention. Based on a dataset combining a survey of department chairs and their performance indicators, we attempt to investigate organizational determinants of gender diversity strategies in the STEM fields. The findings suggest that academic departments' commitment to a gender diversity strategy is related to their chairs' administrative power and their assessment of current gender diversity status. Moreover, the commitment signals departments' responses to social demands for more female faculty members. Nevertheless, women chairs prove less likely to pursue a gender diversity strategy, and more female faculty members hardly increase the likelihood of adopting such a strategy. The findings require care in interpretation because in cases where there are more women, the perceived need for adding women may be lessened. As such, gender diversity strategy may be compensatory in nature. The present study underscores the need for richer theories about recruitment of women STEM faculty and possibly, modifications in public policy for STEM human resources.

Keywords Gender diversity strategy · Female department chairs · Power of department chairs · Representation of female faculty

Full inclusion of women into the academics remains a daunting challenge in the United States. The underrepresentation of women faculty and their career disadvantages have been

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heavily documented and extensively debated (National Research Council 2001, 2006, 2007, 2010a). The situation is particularly acute in science, technology, engineering, and mathematics (STEM) fields. Despite of earning roughly half of STEM doctorates in the United States, women have a very limited visibility among STEM faculty bodies and account for only 16 % of full professorship and 23 % tenure line positions in research extensive universities (NSF 2009; Burrelli 2008). Evidence abounds that women advance slower, receive fewer resources, and are less likely to be promoted relative to men (Fox and Colatrella 2006; Long et al. 1993; Long and Fox 1995; National Research Council 2001, 2006, 2007, 2010; Smart and Fox 2008; Sturm 2006, 2007).

The likely factors that are found contributive to women's disadvantage include, the disproportional burden to balance educational and career decisions with non-academic issues, such as familial responsibility (Gerson 1985; Aluko 2009) and experiences of exclusion and isolation at some point during their academic careers (Kemelgor and Etzkowitz 2001). The latest scholarship shifts the attention from individual to institutional determinants, contending that gender inequity in the academics is structural and that institutional efforts are rendered necessary and imperative to promote equality across genders (Dobbin and Jung 2011; Kalev et al. 2006; National Research Council 2001, 2006, 2007, 2010a). Among many policy instruments, gender diversity strategy has been proposed and highly adopted as a part of new organizational fabrics.

Given the leaking pipeline of women academics (Alper 1993; Van Anders 2004), not sparingly, women also constitute a small population of academic administrators, especially academic chairs in STEM fields (Dominici et al. 2009). Research indicates that academic chairs have a critical role in gender diversity efforts (Hurtado and DeAngelo 2009). For example, chairs, with the help of deans and other administrative arms, have varying influence on setting the agenda for diversity, establishing a culture of inclusion and respect for women faculty and designing rules and policies that will directly affect the long-term career outcomes for women (MIT Report 2011). Thus, as chairs set standards and policies that affect the hiring and advancement of women, such as teaching load, course assignment, distribution resources, work-family policy and salary profiles among others (Mandleco 2010), they have a critical role in the recruitment, retention and advancement of women. The policy implications of this work are clear: the representation of women in STEM departments, especially those in positions of power have potentially large implications on achieving greater gender diversity. Toward that end, we ask the timely and essential question: *what facilitates academic departments' pursuit of gender diversity strategies? Does the representation of women faculty or women chairs promulgate gender equity in STEM departments?*

In this study, we analyze the determinants of academic departments' expressed commitment to a gender diversity strategy. Of course, having a gender diversity *strategy* does not necessarily achieve better gender diversity *outcomes*. Sometimes strategies fail and in other instances, strategies are compensatory. However, it is inherently useful to determine strategic commitment and its antecedents. After all, a gender diversity strategy requires organizations to institutionalize gender equity as a part of their organizational values and to create "conditions enabling people of all […] genders to realize their capacities" (Sturm 2006, p. 250), which are likely common precursors to better gender diversity outcomes.

The academic department is an auspicious place to examine gender diversity commitments. Departments are the basic organizational units where "the processes of allocation of men [and women] and resources" unfold (Zuckerman 1970, p. 235) and where career prospects are shaped. Moreover, departments' commitment to gender equity often proves important in constructing a level playing field among men and women. For instance,

studies point out that clearly written, transparent rules for advancement promote gender equity in tenure decisions (Fox and Colatrella 2006; Smart and Fox 2008), and that a chilly organzational climate impedes particularly female faculty success (Sandler 1986).

In examining departments' commitment to a gender diversity strategy, we focus particularly on the possible effects of the department heads' gender and their administrative power (measured in terms of level of autonomy in hiring). We investigate: (1) if departments have women chairs, are they more likely to show a gender diversity commitment, and (2) if the department head is more powerful (particularly a more powerful woman), are departments more likely to give priority to gender diversity? In all likelihood, the answers to these questions hinge in part on such factors as the number and percentages of women already in the department and the level of demand (and the supply) of women in a particular STEM field. Thus, we also look at the gender composition of the departments to determine if chairs in departments with less gender diversity are more likely to pursue a diversity strategy. Finally, it seems likely that department rankings and prestige may also have implications for a gender diversity strategy.

Using data collected from a representative sample of STEM department chairs at over 140 research extensive universities in the US, this paper seeks to identify likely factors motivating departments to be committed to a gender diversity strategy. In addition to the survey-based data, our study incorporates data of departmental rankings and other profiles released by National Research Council (2010b). The resultant departments train a disproportionate high share of female academics, while simultaneously having the lowest representation of women in their academic ranks (National Research Council 2001).

Research hypotheses

Administrative power of department chairs

Department chairs are leaders and key decision makers in the department. Thus, a first hypothesis pertains to how a gender diversity strategy is affected by the power of department chairs. Despite of the importance of department heads to university governance, scholarship has paid only limited attention (for overviews see Tucker 1984; Bryman 2007) to department chairs and even less to department chairs' power (a recent exception is Bozeman et al. 2013). Nevertheless, the policy entrepreneurship theory provides much insight. The theory purports that policy entrepreneurs are more likely to propose and implement new strategies and/or respond effectively to institutional mandates. With more national attention on gender inequity in the academe (for reviews, see National Research Council 2001, 2006, 2007, 2010a), it is likely that department chairs would think they, too have "women in science" issues and may tackle it within their discretionary limits. Moreover, academic departments have been heavily pressed to implement a gender diversity strategy, the pressure often being passed down by institutional administration and expressed by numerous policy stakeholders (Sturm 2006, 2007). Thus, administrative power for department chairs at least creates opportunities to respond positively. Evidence supports that policy entrepreneurs are key players in advancing an organizational commitment to gender diversity (Dobbin and Kalev 2007; Sturm 2006, 2007).

An alternative plausible hypothesis is that chair power interacts with duration in the position to inhibit diversity strategies (and, indeed, other types of change). In a study of US medical schools, Conrad et al. (2010) suggest that women perceive more barriers to

advancement and that this is especially the case when the chair's appointment is of extended duration rather than fixed term. The authors argue in this context:

> The fact that chairs are appointed for what appears to be indeterminate tenure creates a number of obstacles for advancement, especially given the calcified academic structure, including problems with inclusion and transparency in decision making and, given the infrequent turnover in chairs, a bottleneck for advancement. Women faculty seem more affected by this hierarchical structure than men, and addressing this may help the advancement of women in academic medicine. (Conrad et al. 2010, 804)

Further, the authors argue that faculty members perceive that chairs become out of touch overtime and that the upper administration simply supports the chairs' power without having a realistic assessment of the current situation (Conrad et al. 2010). Thus, we argue that the duration of chairs' appointments likely effects how they view problems and in turn strategize about diversity. Moreover, consistent with the idea of hierarchies producing barriers for the advancement of women, we will explore whether more powerful or autonomous chairs impede diversity.

H1 A gender diversity strategy is more likely to be adopted by department chairs with more power.

Female representation

Substantive representation theory suggests that leaders are representatives of members with whom they share the same demographic characteristics and that leaders tend to advance and implement policies favorable to those members (Bradbury and Kellough 2008; Greene et al. 2001; Keiser et al. 2002; Sowa and Selden 2003; Wilkins 2007). A consensus is building that several conditions are necessary for the presence of substantive representation (Rosenthal and Bell 2003; Sowa and Selden 2003; Wilkins and Keiser 2006). In the case of gender, first, female managers must have a certain amount of discretionary power to shape organizational policies (Keiser et al. 2002; Rosenthal and Bell 2003; Sowa and Selden 2003). The presence of such power grants female managers leeway to tilt policy outcomes toward women groups. Second, the policy areas must be gendered so that policy outputs are salient to women (Keiser et al. 2002). In the academe, department chairs are endowed with autonomous power so much so that their power directly shapes organizational strategies (Bozeman et al. 2013). Female department chairs are no exception. As numerous reports and studies lament the disadvantage of women faculty among all academic ranks in STEM fields (National Research Council 2007, 2010a), it can be expected that female department chairs have experienced or perceived these disadvantages. As such, female department chairs may act as representative agents and are thus hypothesized as more likely to promote a gender diversity strategy.

H2 Female department chairs are more likely than males to adopt a gender diversity strategy.

The academic department is the basic governing body where faculty members share authority and responsibility with administrators in institutional decision making processes and where democratic participation usually prevails (American Association of University Professors 1966; Gerber 1997; Guffey et al. 2000). One natural consequence of democratic participation is that the gender composition of faculty bodies matters, especially on

gendered issues. Evidence suggests that higher proportions of women within organizations often correspond to more recruitment of women (Alison and Pfeffer 1991; Marschke et al. 2007). In the past few decades, there has been an increase in the number and proportion of women academics in STEM fields (National Research Council 2001). Arguably, their presence in academic departments allows them to voice concerns, particularly on issues related to their own well-being in the academe. As they become better represented within departments, it seems likely that their interests will be successfully infused into organizational strategies (Bratton and Ray 2002). Equally likely, as a greater balance between women and men is achieved, male academics become more exposed to (and possibly more sensitive to) women's issues, creating a more conducive environment to the adoption of policies that favorably affect women (Kanter 1977).

H3 A higher percentage of female faculty within departments increases the likelihood of departments pursuing a gender diversity strategy.

As the representation of women faculty rises within the department, it is at least possible that they select agents to pursue organizational strategies favorable to themselves. While such agents need not to be women, women leaders may share concerns and issues with women academics. In fact, using female department chairs to improve the status of women academics has been one of the policy instruments endorsed by funding agencies such as National Science Foundation. Arguably, the interaction between larger numbers or proportions of female faculty and the presence of female department chairs may be a driving force for adoption of a gender diversity strategy. Nevertheless, we note that there is a possible alternative explanation. At a certain threshold, an increased number of women faculty may have neutral or even suppressing effect on the recruitment of women as decision-makers begin to conclude that diversity concerns have been sufficiently resolved. Tentatively, we hypothesize:

H4.1 Female department chairs coupled with a higher percentage of female faculty increase the likelihood of departments pursuing a gender diversity strategy.

In line with the theories espoused above about the influence of department chairs' power and the potential for women chairs to act as representative agents for women academics, we argue that there is a powerful and distinct interaction of these two theories. Commitment to a gender diversity strategy in the department may result from the interaction between department chairs' power and their advocacy roles. On average, female department chairs seem to have less power compared to their male counterparts. (Bozeman et al. 2013). However, there are powerful female chairs. With more power, they are endowed with a greater capacity to shape organizational strategies. Thus, we expect that female department chairs with more power may be more likely to pursue a gender diversity strategy.

H4.2 Female department chairs endowed with more power increase the likelihood of departments pursing a gender diversity strategy.

While our primary expectation is noted above, we nonetheless note a strain in the literature that could provide an alternative plausible hypothesis. An interesting body of literature characterizes women in positions of power as inhibitors to gender diversity. In an attempt to achieve upward mobility, some women may choose to distance themselves from gendered stereotypes. To achieve distance, these women may perceive and advocate that they are different from the group by eliciting stereotypical views of other women (Ellemers et al. 2004). Moreover, other research indicates that the prestige associated with a

particular group will have significant implications for the decisions women make about including other women. Duguid (2011) finds that women are concerned with being valued within their work groups, as such; they will relinquish the opportunity to support the advancement of highly or moderately qualified women as potential peers. There may be a concern that new qualified women may pose a competitive threat (if the new women are seen as more valuable) or a collective threat (if the new women reinforce negative stereotypes) (Duguid 2011). As demonstrated by Allison and Scott Long (1990), there is a tendency in academic departments to undervalue the accomplishments, especially in terms of research productivity, of women compared to men. Thus we may expect to see implications of the "Queen Bee" (Ellemers et al. 2004) phenomenon in a small population of female chairs in prestigious university environments.

Peer pressure and gender diversity

In higher education, academics learn from the experiences of their peers; this is often perceived as a mechanism to seek organizational legitimacy and to increase competitive advantage (Youn and Price 2009). Moreover, research indicates that university decision makers tend to assess their own status relative to their peers and emulate behaviors from those with reputations, statuses and aspirations similar to their own (Gioia et al. 2000; Labianca et al. 2001). It can be expected that as departmental decision makers assess their programs relative to others, they may discover inadequacies and deficiencies and plausibly may further seek to rectify their less desirable traits by adopting similar strategies that have proven successful among peers. With respect to gender diversity, such assessment and adoption of successful strategies may prove particularly invaluable, as there is no specific national standard or benchmark for gender diversity. We argue that departments that have not achieved gender diversity on par with their peers will likely adopt a strategy to accomplish it.

H5 Departments assessed with a lower status than their peers on gender diversity are more likely to adopt a gender diversity strategy.

Research design

We used two survey data, the 2010 Survey of Academic Chairs/Heads (Bozeman et al. 2013) and *A data-based assessment of research-doctorate programs in the United States* (NRC 2011), to assess department chairs' commitment to prioritize gender diversity. The sampling frame targeted the population of STEM department chairs and heads working at research extensive universities. Of the 151 universities in this institutional population, 149 STEM doctoral degree-granting universities were included, from which all STEM department chairs and heads were selected. This resulted in a total population of 1,832 STEM department chairs in 149 universities. Following the tailored design method, the survey was administered to all subjects in 2010. After two waves of mailing, the response rate reached 43 %. Further statistical analysis shows little response bias with regard to subjects' demographic characteristics.

Supplementary to the survey data was information collected by the National Research Council (2011) on research-doctorate programs. The information ranged from departmental size, faculty composition, and average affiliates' research productivity to departmental rankings in research productivity, gender diversity and student outcomes. The

report provided the most extensive information on research-doctorate programs in the United States, from which information on target departments was extracted and merged with the survey data. The data were collected in 2006 and thus challenged to account for changes occurred afterwards. However, research suggests that departmental rankings and composition demonstrate a high level of consistency (Keith 1999; Keith and Babchuk 1997). One concern with NRC data was the limited size of rated academic departments. As a result, a portion of departments were not included in our analysis due to the lack of evaluative information from the NRC report. The merged data ended up with full information from 449 department chairs working at 114 universities. Further analysis showed little differences on departmental strategies, gender composition and position power between those with NRC information and those without.

Variables and model specification

Critical to this study, and serving as the dependent variable in our regression analysis, respondents were asked to assess on a four point Likert scale, the extent to which they considered increasing the gender diversity of faculty a departmental priority. The variable *gender diversity strategy* was constructed from these answers.

In the academic setting, power is often measured by individual capacities in distributing important resources and engaging in autonomous decision-makings (Caza et al. 2011; Finkelstein 1992). Department chairs' power was measured by constructing a power index based on department chairs' autonomy regarding key academic decisions—recruiting new faculty members and controlling resources and benefits associated with recruitment offers. Department chairs reported to have varying degrees of influences on hiring-related decisions regarding: salary and funding resources (i.e. additional salary, summer money, start-up money, research money), workload and working conditions (i.e. course reductions, teaching assistants, research assistants, laboratory space and supplies) and family-related benefits (i.e. spousal hiring assistance, moving expense).

To convert individual influences upon resource distribution into an *index of power,* we took the following approach: (1) We created weights from survey responses to reveal relative importance in different categories of resources, by subtracting the mean of the dummy variables for each category of resource from one, on the premise that resources less controlled by a certain level should be given more weight in calculating the index of power. (2) We multiplied dummy variables by their corresponding weights and summed them all. Next, we divided the index sum for each respondent by the number of valid responses, which partly normalized the distribution of index. The average index of power for department chairs was .19 (see Bozeman et al. 2013 for additional detail about the construction of the power index).

Other demographic, career trajectory, institutional policy and perceptual questions were asked of the respondents and were used as variables in our study. Respondents were asked to what extent they agreed with the statement "the demand for qualified women faculty exceeds the supply in my discipline," from which we constructed the *demand for more female faculty in the field* control variable. Additionally, department chairs rated their status on gender diversity relative to their disciplinary peers at other universities, upon which the variable *self-assessment of gender diversity* was created. Lastly, we used the NRC detailed information on female faculty as a percent of total core and new faculty in academic departments in 2006. We ranked this percentage and took a log transformation of the rankings to normalize its distribution. The variable, *gender diversity rankings in the field,* therefore conveys the relative standing of each academic department in a specific

field. In our analysis, we used the discipline public health as the reference group controlling for the following disciplines: engineering, physical and life sciences.

We recognize that academic department policies are, of course, subject to university-wide policies, priorities and strategies. Thus, adopting a gender diversity strategy may in part reflect departmental volition and may in part reflect university-level factors. For this purpose, multilevel mixed effects models were used. Multilevel modeling allows us to model processes at both department and university levels, responding well to the criticism made of single-level models (Lynn et al. 2000) that too much emphasis is placed on departmental characteristics without given due attention to institutional contexts. Methodologically speaking, failing to consider the hierarchical nature of the data results in biased outcomes, as the standard errors of the regression coefficients are often being underestimated if nesting effects are neglected (Cameron and Trivedi 2009). In the present study, we modeled two levels. The level-1 focused on factors within departments that presumably affected their commitment toward gender diversity strategy. The level-2 addressed the clustering effects and intended to capture university level parameters. Given that we have limited information on university level factors, we use university as a proxy. Statistically, we use the STATA command "GLLAMM" to specify models, with ordinal variables being dependent variables.

Research findings

Table 1 presents a descriptive analysis of the study variables. The mean of the dependent variable, gender diversity strategy is 2.67, suggesting that the majority of departments at least acknowledged some degree of importance in increasing gender diversity of faculty within departments. The index of power for department chairs is .19, suggesting that higher level (than the department chair) administrators are often involved in various aspects of hiring decisions. The mean of gender diversity rankings in the field is 5.31, reflecting the relative standing of academic departments within its field. With a three-point Likert scale, the mean of self-assessment of gender diversity is 2.17, suggesting that departments tend to view themselves to have a slightly better status on gender diversity over their peers. Eleven percent of department chairs are female, indicating that chair positions remain a male dominated position. On average, women account for 17 percent of core faculty, consistent with the findings that women academics are under-represented in STEM fields.

The NRC report used quartiles to classify program size, based on the number of doctoral students enrolled in 2005. The mean program size is 2.56. Engineering departments account for 40 % of the sample, followed by physical science (30 %) and life science (16 %) programs. Public health departments comprise 14 % of the final sample. Most department chairs (79 %) agreed with the statement that "the demand for qualified women faculty exceeds the supply" in their field. The average tenure for department chairs is roughly 7.6 years, with a big variation ranging from 1 year to nearly 30 years.

The correlation relationships among key variables are reported in Table 2. Our analysis indicates that gender diversity strategy is significantly related to department chairs' administrative power, self-assessment of gender diversity, program size, demand for more female faculty in the field and the female chair in the department. The correlation with female chair is negative, possibly indicating that the presence of a female chair marks progress in departmental pursuit of gender diversity, thus lessening the further needs to pursue the cause. Those assessed with a lower status on gender equity seem more committed to gender diversity strategy. Together, it is likely that gender diversity strategy is compensatory in nature, a point we will further address in multi-level mixed models.

Table 1 Descriptive statistics of study variables

Variables	Mean	SD	Min	Max
Gender diversity strategy	2.67	.88	1	4
Power of department chairs	.19	.12	0	.58
Gender diversity rankings in the field	5.31	.97	0	6.31
Self-assessment of gender diversity	2.17	.66	1	3
Female department chairs	.11	.32	0	1
Percentage of female faculty	.17	.13	0	.67
Program size	2.56	1.11	1	4
Demand more of female faculty in the field	5.41	1.90	1	7
Public university	.76	.43	0	1
Tenure of department chairs	7.57	5.72	1	29
Public health	.14	.35	0	1
Engineering	.40	.49	0	1
Physical science	.30	.46	0	1
Life science	.16	.37	0	1

Gender diversity strategy is positively correlated with social demands for more female faculty member and the size of academic departments, suggesting that gender diversity strategy is likely a response to social pressure.

The regression outcomes are presented in Table 3. Model 1 serves as a baseline model, including all three categories of factors that are hypothesized to shape departments' gender diversity strategy. Model 2 adds one extra interaction term between female department chairs and the percentage of female faculty within the department, intending to provide an answer for the question "does the presence of female department chairs combined with a higher percentage of female faculty increase the likelihood of department chairs pursuing a gender diversity strategy?" Model 3 revises previous models by adding the interaction effects between female department chairs and the power index and their tenure, attempting to answer the question "are female department chairs with more power more likely to have their department adopt a gender diversity strategy?" and "whether powerful chairs with a longer duration inhibits their advocacy roles?"

Given that Model 3 presents the most comprehensive answers among all specifications, the interpretation is largely focused on Model 3 (also see Table 4). Nevertheless, regression outcomes are largely consistent except in the roles of female chairs. All models suggest that academic departments with more autonomous and powerful department chairs are more likely to embrace a gender diversity strategy, therefore validating the hypothesis 1. This finding seems noteworthy, indicating that when department chairs (men or women) are accorded more power and autonomy, they are more likely to pursue a gender diversity strategy.

Gender diversity rankings have no significant impact on departmental commitment to a gender diversity strategy. The finding suggests that the numeric under-representation of female faculty per se fails to motivate academic departments to actively pursue such a strategy, indicating no support for the hypothesis 3. Instead, departments with self-assessed lower status on gender diversity seem more likely to adopt a gender diversity strategy, which provides favorable support evidence for Hypothesis 5. Across all three models, the

Table 2 Correlation relationships among key study variables

Variables	Gender diversity strategy	Power of dep. chairs	Gender diversity rankings in the field	Self-assessment of gender diversity	Female dep. chair	Percentage of female faculty	Program size
Gender diversity strategy	1.00						
Power of department chairs	.10**	1.00					
Gender diversity rankings in the field	−.01	.01	1.00				
Self-assessment of gender diversity	−.28***	.04	.08	1.00			
Female department chairs	−.11**	−.07	.05	.05	1.00		
Percentage of female faculty	−.02	−.02	.75***	−.03	.06	1.00	
Program size	.12**	−.06	.14**	−.03	.03	.05	1.00
Demand more of female faculty in the field	.41***	−.03	−.12***	−.24***	−.12**	−.12***	.06

** $p < .05$

*** $p < .001$

Table 3 Multi-level mixed models on departments' gender diversity strategy

Dependent: gender diversity strategy	Model 1	Model 2	Model 3
Department characteristics			
Power of department chairs	1.02(.01)**	1.02(.01)**	1.02(.01)**
Gender diversity rankings in the field	.91(.13)	.91(.13)	.90(.13)
Self-assessment of gender diversity	.51(.08)***	.51(.08))***	.52(.08)***
Female department chairs	.77(.24)	.49(.26)	.15(.12)**
Percentage of female faculty	3.19(3.51)	2.45(2.75)	2.56(2.84)
Female chair × female percentage		10.10(22.69)	13.63(30.96)
Female chair × power			1.03(.03)
Female chair × tenure of department chairs			1.10(.09)
Tenure of department chairs × power of department chairs			1.00(.00)
Program size	1.22(.11)**	1.23(.11)**	1.24(.11)**
Supply of female scientists	1.44(.09)***	1.45(.09)***	1.46(.10)***
Public	.72(.16)	.72(.16)	.74(.16)
Tenure of department chairs	.97(.02)	.97(.02)	–
Engineering	1.85 (.65)	1.87(.65)	1.74(.61)
Physical science	2.15(.78)**	2.12(.76)**	1.98(.71)**
Life science	2.49(.92)**	2.48(.91)**	2.36(.85)**
University-level variance	.15(.19)***	.12(.18)***	.05(.17)***

The coefficients reported are odds ratios and standard errors are reported in the parentheses

** $p < .05$

*** $p < .001$

effects of such assessment prove positive and strong on departmental commitment to a gender diversity strategy. Focusing on those departments with a worse assessment than their peers on gender diversity, such departments are significantly more likely to adopt a gender diversity strategy (regression not shown, but available). This seems to imply that gender diversity strategies often are compensatory.

More (or less) female faculty in the department is not associated with an emphasis on gender diversity strategy. An interaction between the gender of the department chairs and the percentage of women on the faculty bore no relation to gender diversity strategy; neither did the interactions between female department chairs and their power and tenure. Thus, both hypothesis 4.1 and 4.2 are not supported. The presence of female department heads coupled with more female faculty members failed to promote departmental commitment to gender diversity. The power of female department chairs has no significant effect on departmental pursuit of a gender diversity strategy; neither a longer tenure impeded such a pursuit. However, after controlling all these interaction effects, female chairs seem to have negative impact on departmental pursuit of gender diversity, opposite to the hypothesis 2.

A number of possible explanations for this negative finding warrant further research. One possibility is that a female chair in the department signal that all is well and that there is no need to focus extensively on increasing the number of women in the department. Indeed, Table 2 provides some evidence in support of this view, suggesting that the presence of a female chair is negatively correlated with departmental pursuit of a gender

Table 4 Research hypothesis and empirical findings

Research hypotheses	Empirical findings
H1: A gender diversity strategy is more likely to be adopted by department chairs with more power	Full support
H2: Female department chairs are more likely than males to adopt a gender diversity strategy	Opposite effect
H3: A higher percentage of female faculty within departments increases the likelihood of departments pursuing a gender diversity strategy	Fail to reject
H4.1: Female department chairs coupled with a higher percentage of female faculty increase the likelihood of departments pursuing a gender diversity strategy	Fail to reject
H4.2: Female department chairs endowed with more power increase the likelihood of departments pursuing a gender diversity strategy	Fail to reject
H5: Departments assessed with a lower status than their peers on gender diversity are more likely to adopt a gender diversity strategy	Full support

diversity strategy. Together with the negative finding in Table 3, this could imply that a gender diversity strategy (as suggested above) is compensatory. The presence of a female chair indicates that much progress has been made, substantially or symbolically, on gender equity and departmental priority on equity has been satisfied. A second interpretation is that women department chairs, once having succeeded to the first level of line management, do not want to be pegged as "the women's champion" but, rather, seek other missions, ones perhaps not perceived as stereotypical, that are likely to increase their chances of future administrative promotions to dean or other positions in the administrative hierarchy. The evidence is resounding that female chairs have negative impact on departmental pursuit of a gender diversity strategy. Consistent with this finding is that female department chairs are less likely than male chairs to agree with the statement "the demand for qualified women faculty exceeds the supply in my discipline" (32.94 % male vs. 3.82 % female). The lesser-perceived needs for gender diversity among female department chairs may in part explain a relative lack of emphasis on gender diversity strategy. It is highly likely that both interpretations hold in the case of female chairs as the presence of a female chair may convey a positive message on gender diversity, which reduces the concern in the department. A third possibility is that the gender of the department chair interacts with the field (Silander et al. 2013; Haake 2011) and, in turn, affects the propensity to pursue a gender strategy. However, adding interaction terms between female department chairs and academic fields fails to produce any significant outcomes. Thus, no evidence is available to support this third scenario.

The lack of a relationship between the percentage of female faculty and gender diversity strategy require caution in interpretation. Given the negative correlation coefficient (Table 2), it is likely that the compensatory theory holds. With more women faculty in departments, the need for adding more is lessened. However, at the low end, it is unclear why the departments with few female professors fail to have a gender diversity strategy. One speculation is that there are strong threshold effects operating, either based on progression of absolute numbers or percentages, such that (1) at lower levels of women on the faculty there is a strong perceived need for more women, (2) that felt need recedes as more women are brought to faculty positions, (3) the need perhaps vanishes altogether near the point at which (proportional) gender equity is achieved. In this study, ten percent of academic departments had more than 30 % of female scientists among their core faculty. Adding a square term of the percentage of female faculty failed to produce any significant differences than Model 3 (Regression not reported, but available). As such, no empirical evidence is found in favor of the threshold effects. It warrants further study why the representation of women academics fails to advance departmental pursuit of a gender diversity strategy.

The results show that larger departments (i.e. departments enrolling more doctoral students in 2005) have an increased likelihood of adopting a gender diversity strategy. Table 2 suggests that larger departments tend to have better status on gender diversity rankings in the field. Arguably, the emphasis on gender diversity strategy among larger departments may reflect collective effects of numerous factors. Larger departments typically have a larger footprint in the university such that a lack of women faculty may be more apparent. Coupled with more resources, department chairs can effectively respond to the concern on gender inequity.

Department chairs that sense the shortage of women faculty in their respective fields are more likely to promote a gender diversity strategy. This finding seems unsurprising. If there is a real or a perceived scarcity of women, then recruiting women would be more likely to require effort and resources and these, in turn, are more likely to give rise to

systematic thinking and strategy. By contrast, if the supply of women is relatively plentiful then it is likely easy enough to simply hire women without targeting or background work, as there will likely be an ample number of female applicants for any vacancy.

Public and private universities differ little in emphasis on gender diversity strategy. Relative to the public health field where women faculty numbers are nearly representative, departments in physical and life fields are more likely to pursue a gender diversity strategy. As both departments tend to have lower representation of female faculty relative to public health departments, this resonates well with our theory that diversity strategy is more compensatory and that diversity strategy may reflects collective awareness of gender inequity in the fields. However, engineering departments are not as committed to a gender diversity strategy as public health departments, raising a perplexing question for further research.

Discussion

Building on the burgeoning literature emphasizing the importance of institutional factors, this inquiry attempts to uncover organizational determinants of a gender diversity strategy in STEM departments in the context of United States. The results show that department chairs with more power prove to be more committed to gender diversity and departments assessed with a lower status on gender diversity also do. The substantive representation theory fails to explain why academic departments embrace a gender diversity strategy. The presence of more female faculty in the department fails to promote departmental commitment to gender diversity. The interaction effects among female chairs, position power, tenure and female faculty members have no impact on departmental pursuit of a gender diversity strategy. No empirical evidence is found in support of the threshold effects of faculty members either. After controlling all these effects, female chairs prove to inhibit the adoption of a gender diversity strategy in the department. The larger departments are more prone to adopt a gender diversity strategy. Those who think that the fields are short of qualified female faculty are more likely to be committed to gender diversity.

Regardless of their gender, department chairs with strong administrative power are more likely to pursue a gender diversity strategy, suggesting that middle-management level power is a key factor in advancing an organizational commitment to gender diversity. The finding is in contrast with the notion that centralized structure is the best means to implement a gender diversity strategy. Over the past few decades, scholarship has attributed the incomplete integration of female academics largely to the decentralized structure within universities, contending that decentralized structure creates extra barriers for universities to implement gender diversity strategy and that more power on the department level does not advance organizational commitment to gender diversity (See, Dobbin and Kalev 2007; Sturm 2006, 2007). However, we find the opposite-that more power for department chairs allows them to respond effectively to the concerns about gender diversity.

Self-assessment of gender diversity status in the department seems to be an effective instrument in advancing an organizational commitment to gender diversity strategy. Self-assessment allows the department to pin down women's problems, investigate the dimensions of those problems, and perhaps raises collective awareness about gender equity and even the need to develop specific policy strategies (Allan 2003; Bird et al. 2004).

Engaging in self-assessment per se may signal that departments are concerned with gender diversity. Though female representation per se fails to advance organizational commitment to a gender diversity strategy, such strategy can be adopted once departments are engaged in self-assessment of the status of their female faculty.

The past few decades have seen intensive effort on American universities to investigate their institutional climates and to propose changes toward more diversity and equity (Sturm 2006, 2007). One good case in point is the production of status of women faculty reports (Allan 2003; Bird et al. 2004; Hopkins 2002; Su and Gaughan 2014). Roughly two-thirds of research universities (the population of this study) have had such reports and some of them even institutionalized this practice. Under heavy institutional pressure, academic department are arguably more active in assessing their gender diversity status. So, self-assessment may be an effective instrument at the disposal of institutional leaders to further promote commitment to gender diversity strategy.

Female chairs are less likely to promote gender diversity strategy than their male counterparts. They also tend to have lower scores regarding the shortage of qualified women faculty in the field. Together, these findings suggest that female chairs do not champion for gender diversities strategies. Over years, advancing women to leadership positions has been assumed by funding agencies such as National Science Foundation to promote gender diversity in academia, but the present study provides different evidence for that view. This is not necessarily an unfortunate finding and resonates with some previous studies (for instance, Ellemers et al. 2004; Monroe et al. 2008; Su and Gaughan 2014). It is likely that female leaders' distance from being female advocates reflects broad institutional barriers as very few female leaders exist and/or have sufficient power or resources to engage in such effort (Rosser 2004; Sturm 2006). Alternatively, female leaders may be more socialized toward the universalism principle (Freidson 1984; Long and Fox 1995), underestimating the needs of diversity initiatives. We find preliminary evidence for both arguments that women chairs are highly underrepresented in universities and they tend to underestimate the demands of female faculty in their fields. Other interpretations such as the tokenism theory (Laws 1975; Yoder 1991) are also plausible and future studies are warranted in this regard.

Limitations

While several of the variables significantly predict changes in the probability of a gender diversity strategy, the results should be analyzed with caution. There are some limitations that should be addressed in future research. For one, there is possible endogeniety bias for several reasons: (1) In some instances there may be a university mandate for department chairs to diversify their respective departments; (2) There is possibly sufficient diversity of faculty prior to the department chair taking office and thus they need not prioritize gender diversity; (3) In a given discipline, there is potentially a true under-supply of women thus it is impossible to prioritize gender diversity. To resolve the potential biases, data should be incorporated that accounts for the existence of university gender diversity initiatives and data to assess departments' actual diversification strategies. Additionally, future model specifications will benefit from incorporating measurable data about the supply of female earned doctorates eligible for positions in academe as well as data on specific trends of diversity within each department. Moreover, further research need to be conducted to

examine what specific roles women take in increasing gender diversity, such as which policies they advocate for women.

Conclusion

The findings no less have public policy implications. This study questions the theory of "leadership from the top" approach to achieving gender equity, suggesting at least that it should not be used as a sole approach. Results suggest that academic chairs can have an important role in the development and implementation of a gender diversity strategy. Funding agencies would be well served to be more attentive to the roles department chairs play and to spend more resources on motivating them to facilitate a gender diversity strategy.

The intuitive idea that female department chairs will pursue gender equity strategies receives no support in this study. This is not to deny the needs of promoting women to leader positions; rather to develop more realistic expectations for them. Pursuing chair positions is an important career step and women administrators, no more than men, have multiple goals for their department and for their own careers. Moreover, it is at least possible that the causality is in the other direction-that is, female chairs not always actively pursue gender equity because they are in departments that have already made much progress and, indeed, that progress may be one of the reasons the female department chair holds her position.

Of the major findings from this study, one that has especial public policy relevance is that the perception that the demand for qualified female faculty exceeds the supply is a positive predictor of a gender diversity strategy. For those seeking to influence national policy on pipeline issues or even locally within the university, this finding suggests that by simply making department chairs aware of pipeline issues, they will be more likely to prioritize gender diversity. Research suggests that localized intervention can change perception and effort on diversity. Stockard et al. (2008) find that the promotion of gender equity is positively influenced by exposing department heads in top-ranked chemistry departments to carefully planned intervention regarding reasons underlying the underrepresentation and progress barriers for women. After attending a workshop to motivate interest in gender pipeline issues, participants reported a stronger commitment to seek departmental change immediately after the event. Specifically they created detailed strategies to address lack of diversity issues. Not unexpectedly, but still importantly, perceptions guide action.

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Appendix

See Table 5.

Table 5 Variable construction

Variable	Construction
Gender diversity strategy	A four-Likert scale variable assessing the extent to which department chair consider "increasing the gender diversity of faculty" to be departmental priority, ranging from 1 (not that important), 2(somewhat important) to 4 (top priority)
Power of department chairs	Power index, see Bozeman et al. (2013)
Gender diversity rankings in the field	The variable was extracted from NRC (2010) report, constructed as a specific ranking in light of female faculty as a percent of total core and new faculty in 2006 within academic departments
Self-assessment of gender diversity	A three-Likert scale variable extracted from the survey question: "relative to your disciplinary peers at other universities, how would you rate your own department on gender diversity?" The variable range from 1(worse), 2(about the same) to 3(better)
Female department chairs	A dummy variable with one indicating female department chairs, and zero otherwise. Male department chairs serve as a reference group
Percentage of female faculty	The variable was extracted from NRC (2010) report, indicating female faculty as a percentage of total core and new faculty in 2006 within academic departments
Program size	Quartiles based on the number of students enrolled in Fall 2005. 1 is smallest and 4 is largest
Tenure of department chairs	The variable was constructed by asking respondents to identify which year they took the chair position in the survey.
Demand more of female faculty in the field	A seven-Likert scale variable extracted from the survey question: "The demand for qualified women faculty exceeds the supply in my discipline". The variable ranges from 1(completely disagree) to 7(completely agree)
Engineering fields	Dummy variable: one engineering fields, zero otherwise
Physical sciences	Dummy variable: one physical sciences, zero otherwise
Life sciences	Dummy variable: one life sciences, zero otherwise

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