Is the Clock Still Ticking?

The Effect of Stop the Clock Policies on Career Outcomes in Academia

Abstract

Stop the clock (STC) polices—policies that allow pre-tenure faculty members who experience productivity shocks to delay their tenure review—were first introduced approximately 40 years ago, yet surprisingly little is known regarding how these policies affect the career outcomes of those who use them. The limited existing research on STC policies suggests that policy use may have negative career consequences. Drawing from signaling and statistical discrimination theories, we hypothesize that faculty members' use of STC policies for family-related reasons, such as the birth or adoption of a child, sends a negative signal regarding their career commitment, and therefore negatively affects career rewards. We test this hypothesis against the explanation that career consequences following policy use reflect lower productivity. We find that faculty members who use STC policies for family reasons experience a wage penalty, which is driven by systematically lower returns to publications, and cannot be explained by differences in productivity. Despite the unintended consequences for salary, we find evidence that STC policies are effective at achieving their primary goal of helping faculty members meet research expectations for promotion.

1. Introduction

The hallmark of career success in academia is arguably receipt of tenure, with salary typically playing a close second. During the tenure review process, which follows a probationary period that typically spans six or seven years, faculty members are evaluated to determine if their accomplishments demonstrate a level of productivity worthy of continued, lifelong employment, or if their employment contract should be terminated. The "up or out" tenure model, however, is based on a traditional male model of work. Specifically, in order to meet the expectations for promotion to a tenured position, faculty members must display behaviors consistent with the ideal worker norm, in that they must exhibit complete dedication to and endless pursuit of their work during the probationary period (Hochschild, 1997; Williams, 2000; Ward and Wolf-Wendel, 2004; Drago et al., 2006). This model for promotion was developed during a time when the majority of faculty members were men supported by stay-at-home spouses, who had full responsibility for on-going household and family obligations. Past research has highlighted the challenge that the tenure clock introduces for faculty members, particularly women, because it often coincides with faculty members' prime childbearing years (Perna, 2005). Today, the promotion model poses barriers to both men and women because of changes in the allocation of family responsibilities. Although women still tend to have primary responsibility for household and childcare management, men are increasingly involved in caregiving (Bianchi, Milkie, Sayer, & Robinson, 2000; Gornick & Meyers, 2003; Sayer, 2005; Bianchi & Milkie, 2010). Thus, the tenure model is becoming out-of-date for male and female faculty members alike.

To help faculty members achieve balance between the rigors of a tenure-track faculty position and the demands of family, universities began to offer policies that allow individuals to delay their promotion review – or stop the tenure clock – under certain circumstances. Stop the

clock (STC) policies were initially introduced as policies targeted exclusively at women faculty members who gave birth during their pre-tenure years (Thornton, 2009), but these policies have since expanded in scope (Friedman, Rimsky, and Johnson, 1996). Many institutions now offer STC policies to faculty members of both genders and allow faculty to stop the tenure clock for a variety of reasons based on family events, such as the birth or adoption of a child and caring for an ill relative. STC policies have also been expanded to reasons based on non-family events, including personal illness, leaves of absences, and unforeseen research delays, such as Institutional Review Board (IRB) delays and the destruction of laboratory materials, among others. Thus, in their present-day form, the primary goal of STC policies is to "even the playing field" at the time of promotion by giving faculty members who experience shocks to research productivity, due to either family or non-family events, additional time to meet the research expectations for tenure.

STC policies have existed for approximately 40 years and are currently available at nearly 90 percent of research institutions (Hollenshead et al., 2005), yet there is a surprising lack of empirical evidence on whether these policies facilitate career advancement among tenure-track faculty members. The lack of empirical research on STC policy use and career success is problematic, given competing rationales for how STC policies might affect career outcomes. On the one hand, STC policies may indeed help pre-tenure faculty who experience productivity shocks by providing them with the extra time needed to meet promotion criteria and achieve high levels of career success. On the other hand, existing research on STC polices suggests that faculty members are often hesitant to use these policies because they fear that use results in negative career consequences, which suggests that STC policies may achieve the opposite of their intended impact (Hollenshead et al., 2005; Mason, Goulden, and Wolfinger, 2006). Indeed,

Manchester, Leslie, and Kramer (2010), who reported the results of a descriptive study on STC policy use and career success, found a negative effect of policy use on at least one aspect of career outcomes, namely salary.

The purpose of this paper is to investigate two plausible, yet very different explanations for the possible negative effects of STC policy use on career outcomes, including both promotion and salary. The first explanation, which stems from a standard assumption in economics, is that any differences in promotion probability or salary between faculty who do and do not use STC policies can be explained by productivity differences. For example, if faculty members who use STC policies experience shocks to productivity that cannot be fully compensated for by a one-year delay in the tenure review process, then those who use STC policies would experience lower productivity and, in turn, lower promotion chances relative to non-users. Similarly for salary, the traditional competitive paradigm in economics in which wages reflect marginal productivity implies a negative effect of policy use on salary to the extent that users experience a drop in productivity relative to non-users.

As an alternative, STC policy use could result in negative career consequences if faculty members who use STC policies are assumed to lack commitment to their careers. Evidence supports that an ideal worker norm, which dictates that faculty members should show unwaivering commitment to their careers, permeates academia (Williams 2000; Ward and Wolf-Wendel, 2004; Drago et al., 2006). Use of STC policies, and use of these policies for family reasons in particular, may suggest that a faculty member has personal life demands that interfere with the ability to be fully committed to work and may cast doubt on whether a faculty member has the underlying capabilities required for success in academia. Although faculty members may use STC policies for either family or non-family reasons, only use of STC for family reasons is

likely to cause negative consequences for career outcomes because use of STC for non-family reasons is less informative about faculty members' underlying commitment to academic work. According to the commitment hypothesis, faculty members who used the policy for family reasons may be held to a higher standard in promotion review or receive a lower salary for a given level of publications. Knowing which explanation operates is essential for understanding whether any consequences following use of STC policies purely reflect productivity differences, or whether policy use has unintended negative consequences for tenure-track faculty members.

This paper considers these two competing explanations by first developing an economic model that supports the hypothesis that faculty members who use STC for family reasons are inferred to lack the commitment required for success in academia, and why this perception may in turn constrain career success. Our theoretical framework incorporates insights from statistical discrimination and signaling theories. First, based on a major tenet of statistical discrimination models and the expectation that success in academia requires unwavering commitment to one's work (Williams, 2000; Drago et al., 2006), we propose that indicators of a faculty member's underlying productivity are seen as less precise (i.e. more noisy) for individuals who are deemed as having low commitment to their academic work. Second, we draw from signaling theory and propose that evaluators make inferences about a faculty member's commitment from readily observable behaviors, namely family-related STC policy use, such that faculty members who use STC policies for family reasons are perceived as less committed to their academic careers. Taken together, these two elements of our model imply the hypothesis that indicators of research productivity, measured by number of publications, are discounted for faculty members who use STC for family reasons, which results in negative career consequences.

We test the two competing hypotheses using data on pre-tenure faculty members employed at a large, public research institution who were hired between 1998 and 2002. We evaluate if STC policy use for family reasons has negative consequences for promotion and salary outcomes, and if so, which explanation drives the effect. For promotion, we find no significant difference between the outcomes of faculty members who used for family reasons and non-users regardless of whether we control for productivity measured at the time of tenure review. In addition, we find that the research output of faculty members who use the STC policy for family reasons is not significantly different from non-users, which provides suggestive evidence that STC polices are effective at their primary goal of evening the playing field at time of promotion. Because we find no evidence of a negative effect of policy use on promotion, we conclude that neither the commitment hypothesis nor the productivity hypothesis is operating. The finding that the commitment hypothesis is not applicable to the analysis of promotion at this institution is not surprising given the institutional features of the promotion evaluation process. In particular, the centralized nature of the process and the involvement of multiple evaluation steps within the institution as well as external reviewers likely limits the effect that any inference by local evaluators that faculty members who use STC for family reasons lack commitment would have on promotion outcomes.

In contrast to promotion, salary setting at this institution provides the best context for testing these two hypotheses because the process is decentralized and implemented at the local- or department-level. Using data on annual salary and STC policy use, we find a negative effect of policy use for family reasons on salary and subsequently conduct two tests to determine whether the penalty from using the STC policy is consistent with the discounting of a faculty member's research output due to an inference of low commitment or the null hypothesis that the

salary penalty is commensurate with reduced productivity. First, we evaluate if those who use the STC policy incur a wage penalty following use controlling for annual research productivity, which we measure using the faculty members' publications. We find that faculty members who use the STC policy for family reasons—but not those who use the policy for non-family reasons—incur a wage penalty after controlling for publications, which is consistent with the low commitment hypothesis but not the reduced productivity hypothesis. Second, we directly test our model by evaluating whether publications are viewed as a less precise measure of productivity for faculty members who use the STC policy for family reasons. We find that most of the wage penalty following use of the STC policy for family reasons occurs because the publications of these faculty members are rewarded less in terms of salary relative to non-users. We conclude that STC policies have unintended career consequences in that faculty members who use STC policies for family reasons receive a wage penalty and that cannot be accounted for by changes in productivity.

The remainder of the paper is organized as follows. The next section describes the relevant literature on potential career consequences of using STC policies that is used to motivate the two proposed explanations examined in this paper. Section 3 presents the theoretical model, which we develop by incorporating insights from statistical discrimination models, signaling theory, and higher education research. The sample used in the analysis of promotion and salary analysis is described in Section 4. The results on the effect of policy use on promotion and research output are presented in Section 5, while Section 6 reports the salary results. Section 7 concludes the paper.

2. Relevant Literature

The goal of this paper is to test whether career consequences following STC policy use for family reasons can be explained by evaluators interpreting policy use as a signal that the faculty member lacks the commitment required for success in academia, or by productivity differences between users and non-users. Based on existing studies of work-family policies within and outside of academia, there is reason to believe that this is a plausible explanation for why family-related STC policy use may result in promotion or salary penalties.

One of the main findings from the limited existing literature on STC policies is hesitancy to use the policy among faculty members who are eligible to do so. For example, Mason et al. (2006) find that among eligible faculty members at the University of California at Berkeley, 41 percent of females and 32 percent of males reported that they were afraid that using the University's STC policy would hurt their careers. Moreover, evidence from tenure denial lawsuits shows that this fear may be warranted: using STC policies was viewed as a "red flag" in tenure evaluations (Williams, 2004). The interviews of academic administrators conducted by Hollenshead et al. (2005) also corroborate this fear: one-third of respondents cited fear of career consequences as the primary reason why faculty members do not taking advantage of work-family policies, including use of STC policies for family reasons. Finally, similar to non-academic settings (e.g., Blair-Loy and Wharton, 2002; Kelly and Kalev, 2006), evidence suggests that the climate towards use of work-family policies, such as paid leave and modified duties, at universities is often less than supportive (Anderson, Morgan, and Wilson, 2002; Hollenshead et al., 2005).

Drago et al. (2006) explicitly addresses the likely causes of academics' hesitancy to use work-family policies. They argue that faculty members are constantly under pressure to separate family roles from work roles due to the expectation that they should meet the ideal worker norm by showing uncompromising dedication to their jobs (Williams, 2000). Family responsibilities are seen as limiting the time and energy available for academic work because evaluators view these resources as a fixed pie (e.g., Becker, 1985; Marshall and Barnett, 1993). Therefore, evaluators infer that faculty members' family responsibilities imply that these workers are less committed to their academic pursuits and thus are less likely to be successful in academia. Drago et al. (2006) examines how faculty members deal with biases against caregivers and find that many faculty members use "bias avoidance" strategies. Specifically, faculty members attempt to delay, minimize, or hide their family responsibilities in order to avoid perceptions that they are in violation of meeting the ideal worker norm. The authors classify the decision not to use STC policies for family reasons as a bias avoidance strategy, and their work therefore supports the notion that faculty members are hesitant to use family-related STC policies because they fear policy use will result in perceptions that they lack commitment and, ultimately, in negative career consequences.

The existing empirical research on the effect of STC policy use on career rewards is limited to Manchester, Leslie, and Kramer (2010). They find no difference in the promotion outcomes of STC users as compared to non-users, but evidence of lower salary rewards following use of a STC policy only for faculty members who used the policy for family reasons. Because their analysis does not include time-varying measures of productivity, they are unable to provide insight as to whether the salary finding reflects lower productivity of faculty members who use STC for family reasons or whether the penalty stems from an inference that these

faculty members lack commitment. The present paper extends this existing work by developing a theoretical framework for the signal of low commitment hypothesis and testing the model's implications against the hypothesis that consequences stem from productivity differences, which is the standard explanation in economics for pay differences. Although we cannot test the commitment mechanism directly, Leslie et al. (2010) show that perceived commitment is the channel through which use of flexible work practices (FWP), such as telecommuting, can have a negative effect on the career success of employees. They find that if managers attribute use of FWP by the employee as a means of balancing work and non-work responsibilities, use of FWP results in lower perceived commitment, which in turn results in lower career success (i.e., lower salary and job level). While they test their model in a Fortune 500 firm, we expect that the same mechanism operates for faculty members who use STC for family reasons due to the ideal worker norm. The expectation that success in academia requires adherences to the ideal worker norm plays a key role in our theoretical framework for how using STC for family reasons may negatively affects career outcomes, which is outlined in the following section.

3. Theoretical Model

We combine theoretical insights from statistical discrimination theory, signaling theory, and higher education research to develop a framework for how use of STC policies for family reasons may negatively affect career outcomes. Our model relies on both statistical discrimination and signaling theories because there are two sources of incomplete information in this setting: a faculty member's true productivity and his or her level of commitment to academic work. If a faculty member's true productivity was observable, then this would directly determine

career outcomes, and a faculty member's commitment level would not be relevant. In our setting, however, the indicator of productivity (i.e. publications) is likely imprecise. Consistent with a major tenet of statistical discrimination (Aigner and Cain, 1977; Lundberg and Startz, 1983), we therefore propose that commitment becomes relevant in reward allocation decisions, such that publications is interpreted as a more or less precise indicator of true productivity by evaluators, depending on a faculty member's group membership (i.e. high or low commitment, respectively). As a result, faculty members' who are perceived as low commitment types receive career penalties in terms of reduced promotion chances or lower salary for a given level of publications.

Commitment, however, is not readily observable and we therefore propose that evaluators must use observable behaviors, including use of STC policies, as a signal of the faculty members' commitment type (Spence, 1973). STC policy use, and specifically STC use for family reasons, indicates a competing, non-work priority of the faculty member that is perceived to undermine the individual's ability to achieve the ideal worker norm (Williams, 2000; Drago et al. 2006). Similar to evidence that evaluators use employees' behaviors, including hours worked (Landers, Rebitzer, and Taylor, 1996) and absenteeism rates (Ichino and Moretti, 2009) as indicators of employees' underlying characteristics, use of STC policies for family reasons is a readily observable behavior that local evaluators may use as a signal of a faculty member's commitment to academia. Alternatively, STC use for non-family reasons (e.g., personal illness, IRB related delays), is less likely to result in inferences that a worker lacks commitment because these reasons are likely perceived by evaluators as exogenous events, or events out of the individual's control, and therefore unrelated to the individual's underlying commitment. In addition, these reasons for eligibility are less likely to indicate a competing

priority for the faculty member's time and effort. In all, our model suggests that faculty members' use of STC policies for family reasons sends a signal of low commitment, and that these faculty members therefore receive career penalties.

While this paper considers the alternative hypothesis that using STC policies for family reasons results in lower career rewards due to inferences that a faculty member has low commitment to academic work, the standard economic explanation for such a penalty is that these faculty members have lower productivity. Abundant literature on the effect of children on productivity illustrates that it is possible that using STC for family reason is not just a signal for low commitment, but also a real factor that reduces productivity. For example, several studies (e.g., Kyvik, 1990; Long, 1990; Stack, 2004) found that the presence of young children has negative effect on the productivity of female academics, but not on that of males. Thus, it is possible that individuals who use STC for family reasons are not penalized because they are perceived as less committed, but because their productivity decreases as compared to individuals who do not use STC. Therefore, it is imperative to test the low commitment hypothesis, which stems from the model outlined below, against this null hypothesis of decreased productivity.

Our model starts by assuming that faculty members have *true* annual productivity given by ρ_{it}, which is normally distributed with mean $\bar{\rho}$ and a constant variance σ^2. However, we assume that an individual's ρ_{it} is not observable to evaluators. Instead, evaluators only have access to q_{it} (i.e. observed publications), which is an imperfect indicator of ρ_{it}, or:

$$q_{it} = \rho_{it} + \varepsilon_{it} \qquad (1)$$

where ε_{it} is a mean-zero, normally distributed error term that is independent of ρ and has a variance equal to σ_{ε}^2. Due to the joint normality assumption, Aigner and Cain (1977) show that

an individual's expected true productivity given the imperfect indicator (i.e. publications) is a weighted average of $\bar{\rho}$ and the individual's value of q_{it}, or:

$$E(\rho \mid q) = \frac{\sigma_{\varepsilon}^2}{\sigma^2 + \sigma_{\varepsilon}^2}\bar{\rho} + \frac{\sigma^2}{\sigma^2 + \sigma_{\varepsilon}^2} q_{it} \qquad (2)$$

where the weights depend on the relative variance of ρ and ε. As in Aigner and Cain, we assume that expected productivity directly determines salary; however, we also conceptualize it as potentially affecting promotion outcomes.

Analogous to the classic Black-White or male-female cases examined in standard models of statistical discrimination, we suppose that there are two types of faculty members: those who have high *true* commitment (θ_H) and those who have low *true* commitment (θ_L). Due to the expectation that success in academia requires that faculty members achieve the ideal worker norm of unwavering commitment, we propose that *q* is viewed by evaluators as a noisier measure of true productivity for faculty members with low commitment. Formally, this is written as:

$$q^L = \rho^L + \varepsilon^L \text{ and } q^H = \rho^H + \varepsilon^H \text{ where } \sigma_{\varepsilon,H}^2 < \sigma_{\varepsilon,L}^2 . \qquad (3)$$

This implies that Equation 2 can be rewritten for each group, high- and low-commitment, where the relative weight of mean productivity, which is allowed to vary by type (as shown in Equation 3), and the imperfect indicator for productivity differs by the faculty member's commitment level. The difference in the precision of the information contained in the indicator of productivity implies that the return to publications, measured in terms of salary and promotion chances, will be lower for faculty members who have low commitment.

Unlike race or gender, however, commitment is an individual characteristic that is not readily observable to evaluators. Instead, we employ a signaling framework and propose that evaluators use observable behaviors to make inferences about commitment and update their assessment of the faculty member's commitment level over time. Let $\tilde{\theta}_t$ be the local evaluators' assessment of the faculty member's commitment at time t. We conjecture that use of STC policies affects $\tilde{\theta}_t$ such that using STC policies for family reasons results in evaluators placing a higher probability on the faculty member having low commitment. Therefore, use of STC policies for family reasons is a signal of low commitment in our model.

We assume the local evaluators know the distribution of commitment in the population, or the fraction of faculty members (λ) that are of type θ_H. Without loss of generality, at the time of hire (t = 1), we assume evaluators perceive that a faculty member's commitment is equal to the average in the population, or

$$\tilde{\theta}_1 = \lambda\theta_H + (1-\lambda)\theta_L = \bar{\theta}. \tag{4}$$

We model perceived commitment $\tilde{\theta}_t$ over time to be a function of prior assessment, $\tilde{\theta}_{t-1}$, and use of STC policies in the last period, $S_{t-1}^R = \{0,1\}$, where $R = \{N,F\}$ indicates reason for use: *N* denotes use of STC policies for non-family reasons and *F* denotes use of STC policies for family reasons. For t >1, perceived commitment evolves as follows:

$$\tilde{\theta}_t = \omega\tilde{\theta}_{t-1} + (1-\omega)[(\lambda - \delta^F S_{t-1}^F - \delta^N S_{t-1}^N)\theta_H + (1-\lambda+\delta^F S_{t-1}^F + \delta^N S_{t-1}^N)\theta_L] \tag{5}$$

where $0 \le \omega \le 1$ represents the weight put on past information relative to new information. The parameters δ^F and δ^N allow using STC policies for family and non-family reasons to

differentially affect the perceived probability that the faculty member has low commitment. We propose that using STC policies for family reasons results in evaluators perceiving that the faculty member is more likely to have low commitment, or $\delta^F > 0$. Use of STC policies for non-family reasons, however, does not impart the same systematic inference of low commitment, so $\delta^F > \delta^N$. Moreover, because non-family reasons can include causes that may be viewed as a type of honor (e.g., taking a leave of absence to accept a prestigious visiting appointment), δ^N could even be less than zero. In addition, while we do not model this explicitly, one can imagine that the assessment of commitment is also a function of other observable behaviors besides policy use, such as time spent in the office (e.g., Landers et al. 1996).

Furthermore, it is possible that the inference of low commitment based on use of STC policies for family reasons differs systematically by gender, although there are reasons to believe that STC policy use may be interpreted as stronger signal of low commitment for either women or men. One the one hand, the signal of low commitment may be stronger for women who use STC policies, as compared to men who use these policies, because women are generally more likely to reduce their work hours or step out of the workforce entirely to meet caregiving responsibilities. Consistent with this possibility, evidence supports that mothers are viewed as less committed to work and less deserving of work-related rewards as compared to fathers (Correll et al., 2007). On the other hand, men who use STC families for family reasons may be viewed as violating traditional gender roles, and family-related use of STC policies may therefore send a stronger signal of low commitment for men as compared to women—a possibility that is consistent with a related literature on parental leaves of absences, in which researchers have found that parental leaves are interpreted as a stronger signal of low commitment for men than for women (Allen & Russell, 1999; Albrecht et al., 1999). Given these

competing rationales, we do not build a specific gender prediction into our model.[1] Instead, we explore if the effect of policy use on career outcomes differs by gender.

A central assumption of our model is that the measure of productivity used by evaluators is imprecise: ambiguity in the extent to which publications reflects true annual productivity makes it possible for systematic differentials in career outcomes to exist across groups (i.e., faculty members who use STC for family reasons versus non-users). This ambiguity allows individuals with the same quantity of publications to be rewarded differently depending on whether they are categorized as low- vs. high-commitment types. There are at least two reasons that support the notion that publications are an imperfect indicator of true productivity. First, an initial assessment of the quality and impact of a newly accepted article or book is uncertain at the time annual salary decisions are made; such information is only available years later when citations and realized impact can be assessed. Second, for research that results from coauthorship, there is uncertainty regarding the extent to which each author contributed to the development and execution of the manuscript. Both of these reasons provide support for publications being an imprecise measure of a faculty member's true productivity.

Although our model could apply to either promotion or salary rewards, there are several reasons to believe that using STC for family reasons is more likely to affect salary decisions, which are made locally (e.g., at the department-level), than promotion decisions, which involve dispersed parties. First, promotion decisions involve input from multiple parties, including department reviewers, college reviewers, external reviewers, and administrators. The department reviewers' proximity to the candidate makes it more likely that they know the reason why the STC policy was used, while the other parties are more removed and are therefore less likely to

[1] This could be captured in our model by further subscripting δ^R by gender.

have information on why the clock was stopped.[2] Therefore, the involvement of multiple parties in promotion decisions, most of whom do not have detailed information on policy use, is likely to dissipate the influence of any signal of low commitment associated with STC policy use for family reasons that may exist at the department-level. Second, promotion is typically characterized by detailed policies and procedures that ensure fair process. Typically, the initial department- or school-level tenure decision is sequentially reviewed by multiple stakeholders, including the college and Provost, to provide a series of checks and balances. Because of the multi-stage promotion process in which each level can overturn previous decisions, a penalty associated with STC policy use for family reasons is less likely to manifest in promotion decisions, as compared to salary decisions.

The institution from which the data were gathered has a centralized promotion process similar to that described above, while salary setting is decentralized. Although the size of the aggregate pool for salary rewards is determined at the University-level, each department determines how these rewards are allocated across faculty members. There is no centralized oversight of this process. Because of these different institutional structures, inferences of low commitment that may exist at the department-level are expected to influence salary setting but not promotion decision. To the extent that other universities have different institutional arrangements, the theoretical model may be applicable to promotion and salary outcomes if both are decentralized, or to neither if both are centralized.

In summary, we develop a model of incomplete information in which evaluators view use of STC policies for family reasons as a signal that the faculty member has low commitment,

[2] A consequence of adding more non-family reasons for STC eligibility is that STC use has likely become a noisier signal of low commitment over time for removed parties. This suggests that the penalty of STC on promotion has likely reduced over time.

which in turn affects career outcomes through a discounting of the individuals' research output. Signaling theory supports our proposition that use of STC policies for family reasons invokes inferences about whether a worker has high or low commitment, and models of statistical discrimination support our contention that group membership (i.e., high or low commitment type) leads to differences in career outcomes because productivity indicators are perceived as less precise for one group relative to the other.

4. Data Description

We used various administrative records from a large, public research institution to construct an original dataset that includes five cohorts of tenure-track faculty members hired between 1998 and 2002.[3] For each faculty member, the dataset includes age, gender, academic college, annual salary, promotion outcome, and history of STC use, including the year of policy use and the reason for use. The dataset includes data for each year a faculty member remained at the institution from the time of hire through 2008. At this institution, faculty members can stop the tenure clock for family reasons, including the birth or adoption of a child and caring for an ill family member, or non-family reasons, including personal illness, unanticipated research delays (e.g., laboratory explosions, IRB delays), contractual stipulations (e.g., hired without Ph.D.), and taking a leave of absence. Our dataset contains 383 pre-tenure faculty members.

To construct our indicator of productivity, we collected data on number of annual research publications for faculty members in the sample using information from publicly available curricula vitae. Although data limitations preclude us from incorporating measures of

[3] The sample does not include medical school faculty members.

teaching and service productivity, research accomplishments are the most important criteria for evaluation at research institutions. One of the challenges in constructing a measure of research productivity is that disciplines vary in how different types of publications are weighted (e.g., relative weights of books versus articles). Based on each faculty member's discipline, we categorized faculty member into groups with different primary modes of evaluation: articles, books, or performances/exhibitions.[4] Only publications in a faculty member's primary mode of evaluation were collected. Our final measure of productivity, cumulative publications, was constructed by aggregating annual publications through year *t* for each individual, for the years 1998 through 2008.

We address the concern that publications, in terms of type and quantity (i.e., the number of publications needed to meet tenure requirements differs by disciplines), cannot be equated across disciplines in the following way. For the analysis of promotion outcomes and research output at tenure review, we standardize the total number of publications at the time of promotion using eight discipline areas as defined by Smart and McLaughlin (1978), which stems from combining the following three dimensions of research: 1) Applied versus Pure; 2) Hard versus Soft; and 3) Life versus Non-life. We combined these groupings with information on primary mode of evaluation (i.e. books versus articles) to create twelve groups and standardized publications at time of promotion within each group to construct one measure of productivity per faculty member. For the salary analysis, we have multiple years of data per faculty member and can therefore control for individual-level productivity differences across faculty members using fixed effects estimation, which allows us to sidestep the issue of finding comparable measures of

[4] Primary mode was determined based on all publicly available curriculum vitae for the department and through contacting the department chair.

publications across disciplines. Fixed effects estimation is not possible for the analysis of promotion and publications at the time of tenure review because these are one-time outcomes.

As is often the case in academic studies that include faculty members that span a variety of disciplines, our measure of research output does not include a measure for quality of publications. Indeed, most studies that measured faculty productivity across disciplines use number of publications as the measure of productivity (Kyvik and Teigen, 1996; Pfeffer and Langton, 1993; Sax, Hagedorn, Arredondo and Dicrisi, 2002; Ginther and Hayes 2003). To the extent that quality is a time-invariant feature of a faculty member's research output, we are able to control for quality in the salary analysis using fixed effects estimation; however, we are unable to control for the quality dimension in the promotion analysis.

From the original 383 pre-tenure faculty members, we dropped faculty members based on availability of publication data. Due to challenges in quantifying performances and exhibitions, we dropped faculty members who had these as their primary mode of evaluation (22 faculty). An additional 40 faculty members were dropped because of missing data on publications because we were unable to locate their curricula vitae.[5] One additional faculty member was dropped from the salary analysis because of missing information on the year this individual used the STC policy; this individual was retained for the promotion analysis. The final dataset for the promotion analysis is 321 faculty members, while the data used for the salary analysis includes 320 faculty members with multiple observations per person (N = 2,429).

Table 1 displays the frequencies of STC policy use in the sample. Of the 321 faculty members, 50 used the STC policy at least one time (15 individuals used the STC policy more than once). Approximately half of the users were female faculty members (27). Including

[5] Of those with missing publication data, 1 had used STC for family reasons and two had used STC for non-family reasons.

multiple spells of STC policy use by the same individuals, 45 uses of the STC policy were for family reasons and 23 were for non-family reasons. Both male and female faculty members used STC for family reasons. Descriptive statistics for the sample are displayed in Table 2. The only significant difference between users and non-users is the proportion of females: among users, females comprise 54 percent of the sample, while they comprise just 35 percent of non-users. Therefore, while the frequencies are comparable, female faculty members are more likely to use STC policies relative to males.

5. Effect of STC Policy Use on Promotion

In this section we investigate whether using STC policies for family reasons has negative consequences for promotion outcomes. To the extent to which we find a negative effect of policy use on promotion chances, we can determine if this effect is due to differences in productivity by including standardized publications at tenure review. However, as previously noted, the institutional features of the promotion evaluation process at this institution limit the applicability of the low commitment hypothesis, which makes this outcome not well suited for testing whether career consequences stem from policy use being viewed as a signal of low commitment.

We restrict the sample to those faculty members who went up for promotion and estimate the effect of using the STC policy by reason for use on the probability of promotion (Table 3).[6] Without controlling for standardized publications, we find that faculty members who use the policy for family reasons do not have different promotion chances relative to non-users (Column

[6] When we consider the promotion outcomes for the entire sample, we find a positive effect of STC policy use for family reasons on promotion chances due to the confound between policy use, retention, and promotion chances (i.e. there is a positive relationship between policy use, retention, and promotion chances because most faculty members who use STC policies do so after being employed for a few years).

1). This finding does not change when we control for standardized publications at time of tenure review (Column 2). Because we do not find a negative effect of STC policy use for family reasons on promotion outcomes regardless of whether we control for standardized publications, the hypothesis that career consequences stem from productivity differences is not applicable. Interestingly, we see that the chance of promotion for faculty members who use STC for non-family reasons are significantly lower than non-users even after controlling for research output. However, our model does not include a prediction for this finding; future work should investigate what drives this outcome.

Despite our inability to provide insight into the possible explanations for why policy use may have a negative effect on promotion, we investigate the effectiveness of STC policies at achieving their primary goal of "evening the playing field" by providing faculty members with additional time to compile evidence of research productivity. We do this by estimating the effect of policy use on research output at time of tenure review. Given that STC policies delay review in one-year blocks of time, which is uniformly applied to faculty members who meet a wide variety of eligibility criteria, it is important to consider how well these policies meet their primary aim. For example, a one-year delay in promotion review may more than compensate a faculty member for lost time due to IRB delays, but may grossly undercompensate a faculty member whose research laboratory and specimens were destroyed in an accident. In addition, whether a one-year delay undercompensates, equalizes, or overcompensates may differ by gender. For example, eligibility due to the birth of a child may be more likely to undercompensate women, as compared to men, due to the physical burdens of childbirth as well as evidence that women typically take the predominant role in childcare for infants (Drago, 2009). Because the STC policy is a relatively crude policy tool in that it delays the tenure review

in increments of one-year, it is unclear how use of the STC policy will relate to research output at the time of review.

When we estimate the effect of STC policy use on standardized total publications at the time of tenure review, we find no significant difference between faculty members who used the STC policy relative to non-users (Table 4). STC policy users have a slightly greater number of publications at time of promotion relative to non-users, although the difference is not significant. When we split the sample by gender (Table 5), we see that the overall number of publications is not statistically different for users relative to non-users for both genders (Columns 1 and 3). When we further split the sample by both gender and reason for use, we find that both men and women who use the STC policy for family reasons have higher publications at promotion relative to non-users, although the coefficient is not statistically significant (Columns 2 and 4). While there is no significant difference among men, women who use the STC policy for non-family reasons have significantly fewer publications relative to non-users (Column 2, $p<0.10$). Overall, these findings suggest that STC policies are generally effective in that they allow faculty members to make up for lost research time, with the exception of females who use the STC policy for non-family reasons.

To summarize, we extend the initial work of Manchester, Leslie, and Kramer (2010) by including measures of research productivity in our analysis. We find that use of STC for family reasons does not have a negative effect on promotion outcomes even after controlling for measures of research productivity. In addition, we find suggestive evidence that STC policies are effective at helping faculty members who experience productivity shocks meet the criteria for promotion in terms of research output. However, it is important to note that the above analyses are limited by the one-time nature of these outcomes, which precludes us from controlling for

time-invariant differences between users and non-users. This limitation implies that our results should be considered suggestive in nature, rather than definitive. In addition, this analysis is restricted to faculty members employed at one institution. Despite these limitations, these findings provide the most comprehensive evaluation to date of the effectiveness of STC polices at achieving their primary goal.

6. Effect of STC Policy Use on Salary

While we find no evidence of a negative effect of STC policy use for family reasons on promotion, initial results reported by Manchester et al. (2010) indicate a penalty for salary. Assuming that a penalty exists, we can test the two proposed mechanisms – commitment hypothesis versus productivity hypothesis – for career consequences using information on salary because salary setting is determined at the local- or department-level in our setting. This section first outlines the empirical specification used to differentiate the two hypotheses and, second, provides the results from the salary analysis.

6.1 Empirical Specification for Salary Analysis

We differentiate the two explanations for a potential salary penalty using two tests. First, we evaluate the productivity hypothesis relative to the commitment hypothesis by testing whether salary levels for those who use the STC policy for family reasons are lower relative to non-users even after controlling for our indicator of productivity, cumulative publications through time t, $\sum_{\tau=1}^{t} p_{\tau}$. Second, we explicitly test our model's proposition that publications are a noisier indicator of true productivity for those who use the STC policy for family reasons by testing

whether they have lower salary returns to publications relative to faculty members who do not use the STC policy. Our model has no clear empirical prediction for the effect of using the STC policy for non-family reasons on wages.

For both tests, we model annual salary in time *t* assuming the standard log-linear specification:

$$\ln salary_{it} = \gamma_1 \sum_{\tau=1}^{t-1} p_{\tau i} + \gamma_2 (\sum_{\tau=1}^{t-1} p_{\tau i})^2 + \phi^{RK} S^R_{i,k,t-1} + \beta X_{it-1} + \eta_i + \mu_{it-1}. \qquad (6)$$

Because salary at time *t* is a culmination of past salary decisions, we examine the effect of using STC by reason for use on log salary allowing for k past lags of STC use, $S^R_{i,k,t-1}$.[7] We control for a quadratic in cumulative publications, $\sum_{\tau=1}^{t} p_\tau$, through time t, which allows the influence of publications on salary to diminish at high levels of accomplishments. Including a quadratic term is consistent with wage compression in academia (e.g., Pfeffer and Davis-Blake, 1990) and salary setting practices at the institution of interest: additional publications correspond to additional salary to a point, but once a ceiling is reached additional publications do not result in additional salary.

For both tests we also control for time-varying covariates X_{it-1}, including year of service, position, and calendar year dummies, as well as time-invariant characteristics, η_i, using fixed effects estimation. By controlling for time-invariant characteristics, we estimate the effect of STC policy use on salary within person, or whether using the STC policy results in deviations from the individuals' typical salary. Using fixed effects estimation has several advantages. First,

[7] Notice that salary at time t is a function of covariates measured through t-1 because it is determined at time t-1 (i.e. during the prior academic year).

it allows us to sidestep the issue of having comparable measures of research productivity across disciplines because we estimate the effect on salary within persons. Second, we estimate the effect of policy use on salary controlling for fixed characteristics like gender, discipline, caliber of Ph.D. institution, underling ability as well as general quality of research and overall commitment to an academic career. Therefore, using fixed effects estimation implies that the coefficient on the indicator for using the STC policy captures changes in evaluators' assessment of the faculty member's productivity, holding all other person-specific characteristics of the faculty member constant, which under the commitment hypothesis is theorized to operate through perceptions of low commitment.

For our first test, we evaluate whether faculty members who use the STC policy for family reasons receive lower salary rewards than expected given time-invariant and time-varying measures of productivity (i.e. publications), or test whether $\phi^F_{i,k,t-1} < 0$. We conduct the test for two different specifications for the histories of $S^R_{i,k,t-1}$: k =1 and k = 4, to examine the immediate and longer-term effect on policy use on salary.

The second test is grounded in the theory of statistical discrimination and explicitly tests our model's proposition that publications are a less precise measure of underlying productivity for faculty members categorized as low commitment. To implement the test, we allow the return to publications to vary based on use of the STC policy:

$$\ln salary_{it} = \gamma_1 \sum_{\tau=1}^{t} p_{\tau i} + \gamma_2 (\sum_{\tau=1}^{t} p_{\tau i})^2 + \phi^R S^R_{it-1} + \delta^R_1 S^R_{it-1} \sum_{\tau=1}^{t} p_{\tau i} + \delta^R_2 S^R_{it-1} (\sum_{\tau=1}^{t} p_{\tau i})^2 + \beta X_{it} + \eta_i + \mu_{it}. \quad (7)$$

To test the hypothesis that the salary penalty stems from an inference of low commitment, we evaluate whether the returns to publications are lower for faculty members who use the STC policy for family reasons relative to non-users, or $\delta_1^F + 2\delta_2^F(\sum_{\tau=1}^{t} p_{it}) < 0$.

One limitation of the first test is that it requires that we fully capture all time-varying dimensions of output that are valid determinants of wages. Although we include publications in the faculty member's primary mode of evaluation, we acknowledge that this is an incomplete measure of output because it does not contain information on teaching, service, publications in secondary modes of evaluation (e.g., number of books published when articles is the primary mode of evaluation). Besides providing a direct test of our model, an advantage of the second test is that it is robust to concerns that our measure of productivity is not comprehensive. In particular, we expect that the return to a valid indicator of productivity, such as publications, is uniform across faculty members in a discipline and does not differ following use of STC policies. Even if there was a systematic change in evaluation standards (i.e., reweighting of research productivity versus other duties), this would affect all faculty members in a given year and not differentially affect users relative to non-users. Therefore, finding that returns systematically differ by policy use provides support for the commitment hypothesis, but is inconsistent with the explanation that wage penalties solely reflect reductions in productivity.

6.2 Salary Results

This subsection reports and discusses the results for how using STC for family reasons affects salary. First, we determine whether publications in the primary mode of evaluation is a valid measure of the productivity indicators evaluators use in salary decisions. Second, we present the results from the two tests of our model using annual data on salary, STC use, and publications.

We validate our measure of productivity by testing if cumulative publications is a significant determinant of annual salary. Table 6 shows the results from estimating the effect of cumulative publications in the primary mode of evaluation through time *t* on the natural log of salary at time *t*. Column 2 shows that salary is significantly related to cumulative publications when this measure enters linearly, while Column 3 shows that there is a significant relationship between wages and the quadratic of publications. We use the quadratic specification for the remainder of the paper because it allows the impact of additional publications to diminish with higher levels of accomplishment. These results also show that a large part of the variation in salary is explained by calendar year, which is expected given that total salary pools are determined at the University-level based on financial resources, including allotments from the State, and then distributed at the college- and department-levels. To summarize, the results in Table 6 show that our measure of research output is a significant determinant of annual wages, and therefore a valid measure of the indicators of productivity evaluators use to determine salary.

As specified in Section 6.1, we use fixed effects estimation for the salary analysis, which allows us to estimate the effect of policy use on salary controlling for time-invariant characteristics, including gender, discipline, quality of Ph.D. training, underlying ability, etc. First, we test if use of the STC policy for family reasons has a negative effect on salary after controlling for cumulative publications. Second, we examine if the returns to cumulative publications are lower following use of the STC policy for family reasons.

Table 7 reports the results from estimating the effect of STC policy use on log salary modeled as a one-year lag (Columns 1 and 2) and a four-year lag (Columns 3 and 4) using fixed effect estimation. Without controlling for publications (Columns 1 and 3), we estimate a significant, negative effect of using the STC policy for family reasons on wages in both lag

specifications. When we allow for a four-year lag (Column 3), we see that the penalty for using the STC policy for family reasons is immediate and peaks two years following use: two years after using the STC policy for family reasons, users have an annual salary that is 3.8 percent lower than their typical pay. To conduct our first test, we add cumulative publications and their quadratic in each lag specification (Columns 2 and 4). We find that the size of the penalty increases in the four-year lagged specification and is essentially unchanged in the one-year lag specification. We find that using the STC policy for family reasons has a negative and significant effect on salary even after controlling for publications, which implies that we reject the null hypothesis that the penalty stems from reduced productivity. The wage pattern following use of the STC policy for non-family reasons is distinct from that following use for family reasons. Across both lag specifications, the effect of using the STC policy for non-family reasons on annual salary is practically and statistically non-significant. The one exception is a *positive* effect four years after using the policy for non-family reasons.

We also consider whether the inference of low commitment due to using STC for family reasons differs by gender. Table 8 displays the salary results allowing for an interaction between using the STC policy and gender. Overall, we find that the wage penalty following use does not significantly differ by gender. The one exception is use of the STC policy for non-family reasons four years after use, which is significantly greater for women at the 5 percent level; there is no clear theoretical rationale for this difference. In terms of magnitudes, we find that the wage penalty following use of the STC policy for family reasons is larger for men two- and three-years following use and larger for women one-year after policy use (Column 2). A larger penalty for men who use the STC policy for family reasons is consistent with findings from the literature on career interruptions from parental leave taking (Albrecht et al., 1999; Allen & Russell, 1999),

which finds a larger penalty for men who take parental leave relative to women. It is important to note, however, that the gender difference is not significant in our dataset.

Based on the finding presented in Table 7, we find evidence consistent with evaluators viewing use of the STC policy for family reasons as a signal of low commitment, which causes them to devalue these faculty members in salary determination decisions. One may be concerned, however, that our indicator of output may be incomplete. For example, it is possible that the salary reduction reflects actual reduced output in other spheres, such as teaching or service responsibilities, and not the systematic discounting of research output that we hypothesize. Notably, reduced teaching and service output would have to persist for four years after the faculty member used the STC policy for family reasons in order for reduced teaching and service output to pose a plausible alternative explanation for our findings. Nevertheless, we can sidestep this issue by testing whether the return to publications is systematically lower following policy use for family reasons.

Table 9 reports the results from our second test, which directly evaluates the proposition that publications are treated as a noisier indicator of productivity for faculty members who are categorized as low commitment. The coefficients on the interaction terms between cumulative publications and use of the STC policy by reason imply a distinct pattern of returns by reason for use. We find that returns to publications are significantly different for faculty members who use the STC policy for family reasons relative to non-users. The relationship between cumulative publications and wages is concave for non-users and non-family users, but flatter and eventually convex for those who use the STC policy for family reasons. Figure 1 plots the returns to cumulative publications using the coefficients reported in Table 9 for each group holding constant year of service, position, and calendar year. The graph suggests that for cumulative

publications fewer than 15, faculty members who use the STC policy for family reasons are rewarded less for publications as compared to faculty members who do not use the STC policy or who use the STC policy for non-family reasons. However, for cumulative publications exceeding 15, the salary return to publications is higher for those who used the STC policy for family-reasons relative to non-users. In the sample, the average cumulative publications at the time of promotion review is 10 with a median of 7. Thus, for the majority of faculty members, using the STC policy for family reasons resulted in the discounting of publications and, in turn, lower salary rewards.

This finding is consistent with the notion that evaluators treat use of STC policies for family reasons as a signal of low commitment, which in turn affects returns to publications. For faculty members with publications below a certain threshold, STC policy use for family reasons is seen as a signal of low commitment and the faculty member is therefore assessed as having lower potential for success in academia due to an inability to meet the ideal worker norm of unwavering commitment. After a certain point, however, research output seems to outweigh any signal of low commitment to academic work that STC policy use for family reasons imparts. Indeed, faculty members who have published well above a certain threshold may be deemed to have what it takes to succeed in academia and are therefore not penalized, but instead given a per publication pay premium, relative to non-users. It is possible that faculty members who are successful in meeting the social and values-based demands of both academic career and family (Blair-Loy, 2003; Jacobs and Winslow, 2004) are regarded as "super-employees" who can juggle career and family successfully (Rothbard, 2001), and should therefore be compensated at a higher rate.

It is important to note that, with the addition of the interaction term between publications and use of the STC policy by reason, the main effect of using the policy for family reasons is no longer significant. This implies that the channel through which faculty members incur a penalty from STC policy use is the discounting of their publications. Also worth noting is that, although not statistically significant, faculty members who use the STC policy for non-family reasons receive a higher return to research output relative to non-users. This could be due to policy use being seen as a signal of high commitment in that the faculty member is able to produce scholarship despite their unexpected circumstances, such as illness or research delays.

One may be concerned that the results are driven by a reduction in research output following use of STC for family reasons. While we control for publications in the analysis, we also further investigate this possibility by plotting average output in the years leading up to and following STC use by reason for use in Figure 2. This graph shows that there is not a discernable drop in research output following STC use for family reasons. In fact, publications are higher following policy use. This evidence further supports our conclusion that productivity differences do not account for the observed salary differences between faculty members who do and do not use the STC policy for family reasons.

Another potential limitation of the analysis is the absence of quality measures for publications. One potential interpretation of the results is that the wage penalty from using the STC policy for family reasons reflects a reduction in the quality of output produced due to increased family responsibilities. However, there are several reasons why the salary results are likely not due to a change in the quality of research produced by a faculty member. First, we find that using STC for family reasons does not have a negative effect on promotion outcomes. If the quality of faculty members who used STC for family reasons was systematically reduced, then

this would be reflected in the promotion evaluation of both internal and external reviewers. Second, we find an immediate, negative effect of policy use on salary. Given the lags inherent in the publication process, if the quality of a faculty member's research discontinuously dropped due to an increase in family demands, we would expect that the wage penalty following use would be delayed because the research published immediately following policy use likely reflects work that was on-going several years before STC use. Third, we find that the negative effect of using STC for family reasons on wages does not significantly differ by gender. Because family responsibilities often fall disproportionately on women, if research quality were to be affected by family demands, we would expect it to have a larger impact on women.

We used fixed effects in the salary analysis, a methodology that controls for stable individual differences, including commitment to academic work. Thus, the possibility that faculty members who use STC policies for family reasons are generally less committed to academic work than faculty members who do not use these policies does not provide an alternative explanation for our findings. At the same time, it is possible that faculty members who use STC policies for family reasons experience a *temporary* reduction in their commitment, and that evaluators' assumptions that these faculty lack commitment are therefore correct. Although we cannot rule out this possibility, we also find that faculty members who use STC policies for family reasons do not experience a temporary drop in research productivity. Thus, in order for this explanation to be plausible, one has to assume that commitment and productivity are unrelated. Finally, a recent study on flexible work practices (e.g., telecommuting, flexible schedules) find that use of these practices for family-reasons has a negative impact on managers' perceptions of employee commitment, controlling for employees' self-reported commitment (Leslie et al., 2010). Thus, there is reason to believe that evaluators overestimate the extent to

which faculty members who use STC policies for family reasons experience a drop in commitment.

6. Conclusion

Despite the fact that institutions have offered pre-tenure faculty members the option of delaying their promotion review through STC polices for four decades, there is a lack of empirical evidence on the consequences of these policies despite qualitative reports that they may negatively impact the careers of pre-tenure faculty members. In order to consider how STC policies may have negative consequences for career rewards, we combine statistical discrimination and signaling theories with research from higher education to provide support for the hypothesis that evaluators perceive use of STC policies for family reasons as a signal that users lack the commitment necessary to succeed in academia, which in turn results in lower assessments of productivity and, ultimately, lower rewards.

Using data on annual salary, we test this hypothesis against the standard hypothesis in economics that the salary penalty following use of STC policies for family reasons reflects reduced productivity of these faculty members. We find that faculty members who use STC policies for family reasons receive a wage penalty following use controlling for publications as well as time-invariant characteristics. Furthermore, we find that the return to publications for faculty members who use STC policies for family reasons are systematically lower than non-users, with the exception of users with extremely high research output. These findings are consistent with use of STC policies for family reasons acting as an observable behavior that evaluators use to infer a faculty member's commitment level in the presence of an imprecise measure of true productivity. In the absence of overwhelming evidence of a successful fit in

academia (i.e. extremely high number of publications), we find that use of STC policies for family reasons is used as a signal that the faculty member lacks the commitment necessary to succeed in academia, and thus they are deemed as less productive and less deserving of salary rewards. In contrast to salary, we find no evidence of a negative effect of using STC policies for family reasons on promotion outcomes.

This paper is also the first to document the relationship between use of STC policies and research output at the time of promotion. We find suggestive evidence that STC policies are effective at equalizing the chances of promotion at tenure review in light of shocks to research output from family reasons: faculty members who use STC policies for family reasons do not have significantly lower or higher research output at tenure review relative to non-users. However, we find that STC policies may not fully compensate faculty members who experience shocks to research output for non-family reasons. In addition, faculty members who use STC for non-family reasons have lower promotion outcomes. Both of these findings regarding use of STC for non-family reasons require further investigation.

Although our model is the first to explicitly consider the effects of STC policy use for family reasons on career rewards, many of the tenets of our model are consistent with literature in other fields. Recent work in psychology finds that evaluators perceive women as lacking the qualities needed for success in stereotypically male work roles (e.g., leadership and management), and therefore devalue women's contributions when there is some degree of ambiguity or uncertainty surrounding measures of their observable productivity (e.g., individual contributions to team performance) (Heilman and Haynes, 2005). Similarly, when evaluators perceive workers' characteristics as a poor fit with their work roles, their performance is discounted. For example, women in stereotypical male positions receive lower performance

ratings than females in stereotypical female positions, regardless of any actual differences in objective indicators of their performance (Lyness and Heilman, 2006).

The findings of this paper should be interpreted with care due to the limitations of the analyses. First, the paper uses a sample of pre-tenure faculty members employed at a single research institution, which limits the external validity of the findings. Second, the analysis of research outcomes and promotion chances does not address possible selection into the policy due to the one-time nature of the decision. Finally, while the salary analysis controls for time-invariant characteristics as well as time-varying publications, it does not include a measure of quality of publications. While there are several reasons why the salary results are not likely driven by this omission, we cannot rule out the possibility that salary effects stem from changes in quality.

While we consider the effect of STC use on both promotion and salary outcomes, the conclusions we can draw from the two analyses are markedly different. First, the different institutional arrangements that govern salary and promotion at the institution under examination are distinct and the commitment hypothesis is most applicable to salary setting due to its decentralized structure. Second, annual data on salary enables us to control for time-invariant characteristics of faculty members to provide a robust test of the hypothesis that STC policy use for family-reasons triggers inferences that the faculty member has low commitment. This is not possible in the promotion analysis given the one-time nature of the decision.

Whereas most previous analyses of faculty salaries can only make limited claims of possible discrimination between groups in wage setting because they lack data on productivity, our finding that the returns to indicators of productivity are lower for faculty members who use

STC for family reasons provides some of the most robust evidence to date on statistical discrimination against caregivers in academia. Therefore, we contribute to the existing literature (e.g., Altonji and Pierret, 2001) in that evaluators, even those in academia, face uncertainty about the productivity of individuals, which prompts the use of observable attributes or behaviors to statistically discriminate between individuals.

In conclusion, we find evidence that STC policies are effective, yet imperfect. More specifically, these policies appear to be effective at helping to even the playing field for faculty members at the time of promotion, but have unintended consequence for salary. Despite their intended goal of supporting the career advancement of pre-tenure faculty members, these policies appear to provide evaluators with a means of differentiating faculty members, which results in systematically lower salary rewards for those who use STC policies for family reasons. In terms of implications for universities, our findings suggest that STC policies are beneficial in helping faculty members meet the standards for promotion, however, features of the salary determination process lead to penalties for users. Policies that enhance the objectivity of salary setting by increasing oversight, or limiting local autonomy, in salary setting may ameliorate the wage penalty experienced by policy users. Interestingly, we find that the negative effect of STC policy use for family reasons affects both men and women, indicating that policy use has negative salary consequences for caregivers in general, rather than being limited solely to women. However, because women faculty members are more likely to use the policy for family reasons, STC policies may contribute to the gender pay gap in academia.

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Table 1: Frequency of STC Policy Use in Sample

	Frequency		
	Total	Males	Females
Never Used STC	271	177	94
Used STC	50	24	28
Used 1 Time	37	16	21
Used 2 Times	14	8	6
Used more than 2 Times	1	0	1
By Reason (includes multiple spells)			
Family Reasons	45	20	25
Non-Family Reasons	23	12	11

Notes: Use of STC by faculty members in the sample. Fifty faculty members used the policy for a total of 68 spells.

Table 2: Descriptive Statistics by STC Policy Use

	Non-users		Users		Different at
Faculty Characteristic	Mean	St. Dev.	Mean	St. Dev	5% level?
Female	0.347	-	0.540	-	Yes
White	0.753	-	0.740	-	No
Hire Age: < 30	0.21	-	0.220	-	No
Hire Age: 30 to 34	0.402	-	0.480	-	No
Hire Age: 35 to 39	0.199	-	0.200	-	No
Hire age: 40 or Over	0.188	-	0.100	-	No
Hire Year: 1998	0.199	-	0.120	-	No
Hire Year: 1999	0.196	-	0.240	-	No
Hire Year: 2000	0.251	-	0.200	-	No
Hire Year: 2001	0.203	-	0.200	-	No
Hire Year: 2002	0.151	-	0.240	-	No
Starting Salary	$49,661	$13,499	$50,273	$2,450	No
Publications at Promotion	10.705	11.875	8.92	12.780	No
Observations	271		50		

Notes: Descriptive statistics based on the 50 faculty members who used the policy.

Table 3: Relationship Between STC Use and Promotion

	1	2
Used STC (Family)	0.027	0.025
	(0.050)	(0.050)
Used STC (Non-Family)	-0.189**	-0.205**
	(0.090)	(0.089)
Female	-0.018	-0.003
	(0.035)	(0.035)
Start Age < 30 years	0.023	0.03
	(0.054)	(0.054)
Start Age 31 to 35 years	0.055	0.064
	(0.045)	(0.045)
Start Age 36 to 40 years	0.043	0.038
	(0.050)	(0.050)
Hired in 1999	0.000	0.009
	(0.049)	(0.049)
Hired in 2000	0.004	0.006
	(0.048)	(0.047)
Hired in 2001	-0.017	-0.024
	(0.050)	(0.050)
Hired in 2002	0.035	0.042
	(0.055)	(0.055)
Ln(Wage) in first year	-0.058	-0.06
	(0.109)	(0.108)
Standardized Total Publications		0.032**
		(0.016)
College Controls	Included	Included
Constant	1.518	1.525
	(1.158)	(1.150)
R-squared	0.060	0.077
N	245	245

Notes: Dependent variable receipt of tenure. Sample restricted to faculty members who went up for promotion; faculty who prematurely left institution were not included. Standardized total publications is total publications at time of promotion, which is 6 years after hire year (or 6 + number of times STC was used), standardized by discipline and primary mode of evaluation (12 groups).

Table 4: Relationship between Total Publications at Tenure Review and STC Use

	1	2
Used STC	1.43	
	(1.732)	
Used STC (Family)		2.689
		(1.943)
Used STC (Non-Family)		1.369
		(2.764)
Female	-3.939***	-4.045***
	(1.329)	(1.329)
Hire Age: < 30	-0.074	-0.164
	(2.060)	(2.061)
Hire Age: 30 to 34	-0.557	-0.722
	(1.796)	(1.804)
Hire Age: 35 to 39	1.601	1.466
	(2.017)	(2.021)
Hire Year: 1999	-2.928	-3.015
	(1.980)	(1.980)
Hire Year: 2000	-0.401	-0.487
	(1.883)	(1.884)
Hire Year: 2001	2.024	2.042
	(1.998)	(2.003)
Hire Year: 2002	-1.769	-1.864
	(2.122)	(2.127)
Starting Salary	0.608	0.717
	(4.098)	(4.093)
College Controls	Included	Included
Constant	1.482	-1.432
	(43.595)	(42.148)
R-squared	0.24	0.261
N	321	321

Notes: Dependent variable is total publications in primary medium of evaluation at time of promotion, which is 6 years after hire year (or 6 + number of times STC was used).

* p<0.10, ** p<0.05, *** p<0.01

Table 5: Relationship between Total Publications at Tenure Review and STC Use, By Gender

	Females		Males	
	1	2	3	4
Used STC	0.426		2.811	
	(1.573)		(2.962)	
Used STC (Family)		2.235		3.298
		(1.688)		(3.459)
Used STC (Non-Family)		-4.743*		5.690
		(2.705)		(4.292)
Hire Age: < 30	-1.619	-1.896	0.434	0.289
	(2.095)	(2.066)	(3.219)	(3.212)
Hire Age: 30 to 34	0.23	-0.401	-0.63	-0.658
	(1.788)	(1.789)	(2.826)	(2.821)
Hire Age: 35 to 39	-0.843	-1.26	2.568	2.45
	(1.988)	(1.965)	(3.175)	(3.178)
Hire Year: 1999	-1.345	-1.142	-4.062	-4.258
	(2.253)	(2.215)	(2.899)	(2.891)
Hire Year: 2000	-0.021	0.064	-1.246	-1.47
	(1.846)	(1.818)	(2.921)	(2.916)
Hire Year: 2001	4.294**	4.852**	0.567	0.394
	(2.034)	(2.016)	(3.055)	(3.049)
Hire Year: 2002	-0.799	-0.355	-3.313	-3.537
	(2.165)	(2.142)	(3.276)	(3.273)
Starting Salary	1.113	2.064	0.115	0.416
	(4.372)	(4.322)	(6.083)	(6.082)
College Controls	Included	Included	Included	Included
Constant	-8.435	-18.384	7.719	4.463
	(46.364)	(45.827)	(64.852)	(64.838)
R-squared	0.309	0.338	0.197	0.207
N	121	121	200	200

Notes: Dependent variable is total publications in primary medium of evaluation at time of promotion, which is 6 years after hire year (or 6 + number of times STC was used).

* p<0.10, ** p<0.05, *** p<0.01

Table 6: Effect of Measured Productivity on Annual Wages

	1	2	3
Publications through time t		0.0020***	0.0036***
		(0.0007)	(0.0013)
Publications through time t, Squared			-0.0000*
			(0.0000)
Year of Service	-0.0004	0.0025	0.002
	(0.0133)	(0.0125)	(0.0128)
Associate Professor	0.0450***	0.0430***	0.0422***
	(0.0075)	(0.0073)	(0.0072)
Year Dummy, 2000	0.0506***	0.0459***	0.0457***
	(0.0138)	(0.0129)	(0.0133)
Year Dummy, 2001	0.1128***	0.1041***	0.1038***
	(0.0268)	(0.0251)	(0.0257)
Year Dummy, 2002	0.1640***	0.1505***	0.1500***
	(0.0396)	(0.0371)	(0.0381)
Year Dummy, 2003	0.1644***	0.1459***	0.1448***
	(0.0525)	(0.0493)	(0.0505)
Year Dummy, 2004	0.2107***	0.1870***	0.1855***
	(0.0657)	(0.0617)	(0.0632)
Year Dummy, 2005	0.2804***	0.2507***	0.2486***
	(0.0789)	(0.0740)	(0.0759)
Year Dummy, 2006	0.3521***	0.3168***	0.3145***
	(0.0918)	(0.0862)	(0.0884)
Year Dummy, 2007	0.4209***	0.3797***	0.3773***
	(0.1051)	(0.0988)	(0.1012)
Year Dummy, 2008	0.4654***	0.4195***	0.4174***
	(0.1186)	(0.1115)	(0.1142)
Constant	10.7037***	10.6980***	10.6939***
	(0.0071)	(0.0071)	(0.0078)
R-squared	0.858	0.86	0.861
N	2429	2429	2429

Notes: Dependent variable is natural log of annual salary in time t. Estimated using fixed effects to control for time invariant aspects of productivity. Publications are total works in primary medium of evaluation, books or articles, published as of time t. Standard errors clustered at individual-level. * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table 7: Effect of STC on Wages Controlling for Publications

	1	2	3	4
Used STC in t-1 (Non-Family)	-0.0054	-0.0024	0.0022	0.0033
	(0.0167)	(0.0157)	(0.0264)	(0.0247)
Used STC in t-2 (Non-Family)			-0.0156	-0.0176
			(0.0311)	(0.0279)
Used STC in t-3 (Non-Family)			0.0275	0.0278
			(0.0280)	(0.0261)
Used STC in t-4 (Non-Family)			0.0666**	0.0692**
			(0.0334)	(0.0334)
Used STC in t-1 (Family)	-0.0230***	-0.0229***	-0.0222*	-0.0251**
	(0.0067)	(0.0066)	(0.0122)	(0.0114)
Used STC in t-2 (Family)			-0.0382***	-0.0410***
			(0.0115)	(0.0112)
Used STC in t-3 (Family)			-0.0299***	-0.0326***
			(0.0101)	(0.0099)
Used STC in t-4 (Family)			-0.0167*	-0.0167*
			(0.0096)	(0.0092)
Publications through time t		0.0036***		0.0047***
		(0.0013)		(0.0015)
Publications through time t, Squared		-0.0000*		-0.0000***
		(0.0000)		(0.0000)
Year of Service	-0.0013	0.0013	-0.0225	-0.0263*
	(0.0131)	(0.0126)	(0.0150)	(0.0150)
Associate Professor	0.0442***	0.0415***	0.0267***	0.0236***
	(0.0075)	(0.0072)	(0.0078)	(0.0075)
Year Dummies	Included	Included	Included	Included
Constant	10.7038***	10.6940***	11.3821***	11.37761***
	(0.0071)	(0.0078)	(0.1316)	(0.1320)
R-squared	0.858	0.861	0.820	0.823
N	2429	2429	1486	1486

Notes: Dependent variable is natural log of annual salary in time t. Estimated using fixed effects to control for time invariant aspects of productivity. Publications are total works in primary medium of evaluation, books or articles, published as of time t. Standard errors clustered at individual-level. * p<0.10, ** p<0.05, *** p<0.01

Table 8: Effect of STC on Wage by Reason, Interacted with Gender

	1	2
Used STC in t-1 (Non-Family)	0.0162	0.0106
	(0.0226)	(0.0311)
Used STC in t-2 (Non-Family)		-0.0332
		(0.0489)
Used STC in t-3 (Non-Family)		0.0446
		(0.0330)
Used STC in t-4 (Non-Family)		0.0512**
		(0.0225)
Used STC in t-1 (Family)	-0.0231**	-0.0359**
	(0.0109)	(0.0141)
Used STC in t-2 (Family)		-0.0650***
		(0.0148)
Used STC in t-3 (Family)		-0.0433***
		(0.0100)
Used STC in t-4 (Family)		-0.0143
		(0.0107)
Used STC in t-1 (Non-Family) x Female	-0.0424	-0.0203
	(0.0292)	(0.0406)
Used STC in t-2 (Non-Family) x Female		0.0205
		(0.0220)
Used STC in t-3 (Non-Family) x Female		0.0181
		(0.0538)
Used STC in t-4 (Non-Family) x Female		0.0452**
		(0.0213)
Used STC in t-1 (Family) x Female	0.0003	-0.0450
	(0.0137)	(0.0400)
Used STC in t-2 (Family) x Female		0.0212
		(0.0184)
Used STC in t-3 (Family) x Female		0.0494
		(0.0731)
Used STC in t-4 (Family) x Female		-0.0036
		(0.0169)
Constant	10.6940***	11.3630***
	(0.0078)	(0.1318)
R-squared	0.861	0.825
N	2429	1486

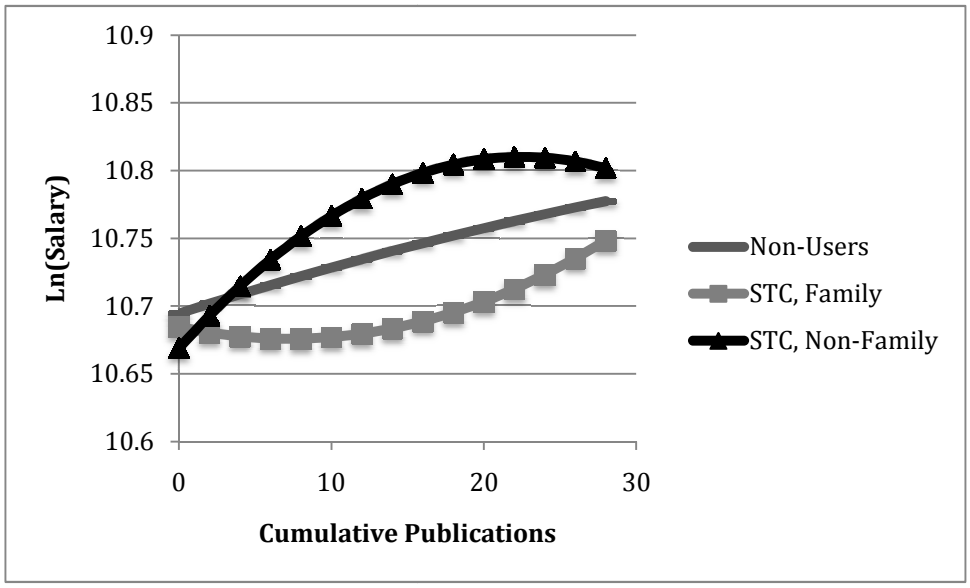
Notes: Dependent variable is natural log of annual salary in time t. Estimated using fixed effects to control for time invariant aspects of productivity. Estimation also includes position, year of service and quadratic in publications as of time t. Standard errors clustered at individual-level. * p<0.10, ** p<0.05, *** p<0.01

Table 9: Effect of STC on Wage by Reason, Interacted with Publications

	1
Used STC in t-1 (Non-Family)	-0.0257
	(0.0245)
Used STC in t-1 (Family)	-0.0099
	(0.0070)
Publications through time t	0.0037***
	(0.0013)
Publications through time t, Squared	-0.0000*
	(0.0000)
STC in t-1 (Non-Family) x Publications through t	0.0090
	(0.0064)
STC in t-1 (Non-Family) x Publications through t, Squared	-0.0003
	(0.0002)
STC in t-1 (Family) x Publications through t	-0.0061***
	(0.0020)
STC in t-1 (Family) x Publications through t, Squared	0.0002***
	(0.0001)
Year of Service	-0.0015
	(0.0131)
Associate Professor	0.0445***
	(0.0075)
Year Dummies	Included
Constant	10.6951***
	(0.0079)
R-squared	0.860
N	2411

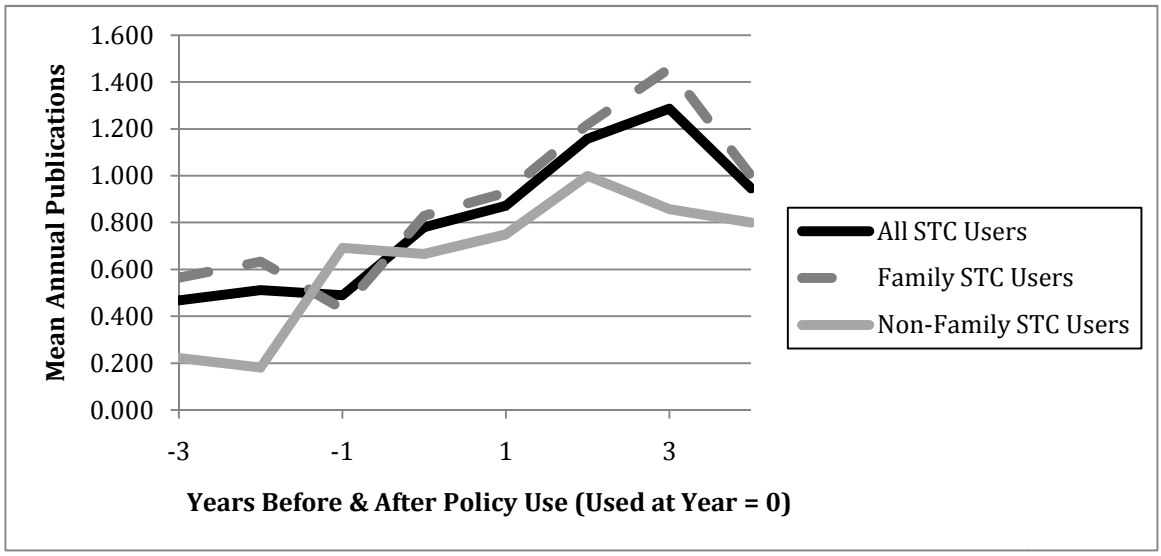
Notes: Dependent variable is natural log of annual salary in time t. Estimated using fixed effects to control for time invariant aspects of productivity. Publications are total works in primary medium of evaluation, books or articles, published as of time t. Standard errors clustered at individual-level. * p<0.10, ** p<0.05, *** p<0.01

Figure 1: Return to Publications by STC Use



Notes: Figure plots relationship between quadratic in publications and natural log of salary using coefficients from Table 5.

Figure 2: Average Research Output Before and After STC Use



Notes: Figure plots average annual research output in years before and after STC policy use.