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Working Paper 19-054

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An emerging form of remote work allows employees to *work-from-anywhere*, so that the worker can choose to live in a preferred geographic location. While traditional work-from-home (WFH) programs offer the worker temporal flexibility, work-from-anywhere (WFA) programs offer *both* temporal and geographic flexibility. WFA should be viewed as a nonpecuniary benefit likely to be preferred by workers who would derive greater utility by moving from their current geographic location to their preferred location. We study the effects of WFA on productivity at the United States Patent and Trademark Office (USPTO) and exploit a natural experiment in which the implementation of WFA was driven by negotiations between managers and the patent examiners' union, leading to exogeneity in the timing of individual examiners' transition from a work-from-home to a work-from-anywhere program. This transition resulted in a 4.4 percent increase in output without affecting the incidence of rework. We also report results related to a plausible mechanism: an increase in observable effort as the worker transitions from a WFH to a WFA program. We employ illustrative field interviews, micro-data on locations, and machine learning analysis to shed further light on geographic flexibility, and summarize worker, firm, and economy-wide implications of provisioning WFA.

Running Head: **Work-From-Anywhere: Productivity Effects**

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1. INTRODUCTION

Human capital has been documented as a key source of firm competitive advantage (Campbell, Coff, & Kryscynski, 2012). A growing body of work also documents the role of nonpecuniary incentives in shaping motivation of workers (e.g., Sauermann & Cohen, 2010). However, from the perspective of the firm, it is also critical to study the productivity effects of provisioning such incentives. A nonpecuniary incentive that has attracted a lot of recent attention is the provisioning of remote work. Even prior to the forced adoption of remote work during the COVID-19 crisis, the question of how remote work affects productivity has been at the center of a managerial debate. Notwithstanding a few high-profile retreats from remote work by companies like Yahoo! and IBM (Simons, 2017; Swisher, 2013), many organizations, such as Amazon, Apple, American Express, and Glassdoor, offered remote work programs even prior to the COVID-19 crisis (Glassdoor, 2019).

In this paper, we shed light on an emerging, important, and yet understudied form of remote work—*work-from-anywhere* (WFA). Here, workers are no longer required to live in the same geographic location as the firm and have greater flexibility to choose where to live. Organizations with WFA policies include GitLab, Akamai, GitHub, Zapier, NASA, and DataStax, among others (Choudhury & Salomon, 2020; Fatherly, 2016; Glassdoor, 2018; NASA, 2018; Reynolds, 2019). However, to the best of our knowledge, there is no research on the productivity effects of WFA policies. Prior research has focused on work-from-home (WFH) and the effects of moving the worker from one workspace (within the firm's office), to an alternative workspace (within the home of the worker, typically in the same geographic location as the firm's office).[4] In contrast, the unique nonpecuniary benefit of WFA to the worker is the *choice to live anywhere*.

[4] One of the comprehensive literature reviews on telecommuting states, "Home was the primary location for telecommuting in nearly all the studies included in this meta-analysis" (Gajendran & Harrison, 2007, p. 1,525).

Previous research in remote work has identified how conventional WFH programs benefit individual productivity via reduced commute times and fewer sick days (Bloom, Liang, Roberts, & Ying, 2015), which can be attributed to increased *temporal flexibility* (Evans, Kunda, & Barley, 2004). WFH also allows workers to control ambient workspace elements such as clothing, layout, music, ventilation, etc. (Gajendran & Harrison, 2007). WFA goes further by eliminating the traditional link between the geography of home and company location, resulting in *geographic flexibility*, in which a worker can remain employed at a firm without needing to live in or near the same city or town where the firm is located. In the case of WFA, employers cede to workers control of the geography in which they choose to live, *in addition* to ceding the temporal flexibility afforded by WFH. This unique new benefit of WFA compared to prior remote work programs, along with the general increase in both worker demand for, and employer provision of, WFA policies, lead us to our main research question: How does the geographic flexibility provided by WFA affect individual worker productivity? Bloom et al.'s (2015) research in a Chinese travel agency shows causal productivity effects of moving a worker from an in-office setting to a WFH regime. We ask whether there are causal productivity effects of moving from a WFH regime to a WFA regime for workers who self-select to do so.

Prior to conducting empirical analysis, we develop a proposed theoretical relationship between WFA and employee productivity, based on theoretical insights from literatures on nonpecuniary benefits, firm-specific incentives, and migration. We argue that WFA should be viewed as a nonpecuniary benefit that should be preferred by workers who would derive greater utility by moving from their current geographic location to their preferred location. Prior literature in migration and urban studies (e.g., Barcus, 2004) has theorized that workers may relocate due to low satisfaction with their current residential location. We theorize that workers self-selecting into WFA and moving from their current location to a more preferred location will experience greater residential satisfaction, greater utility, and based on theorizing by Sauermann and Cohen (2010), will exert greater productivity-enhancing effort. This effect might be especially salient if WFA is perceived by workers as a "firm-specific incentive" (Kryscynski, Coff, & Campbell, 2020), i.e., an incentive in short supply at other possible employers.

Our setting—the United States Patent and Trademark Office (USPTO), and in particular, the job of patent examiner—is in many ways the ideal setting for our research question. First, our setting allows us to exploit a natural experiment related to the implementation of a WFA policy. The bureaucratic processes governing the implementation of WFA at the USPTO allow us to estimate causal productivity changes for workers who self-select from a WFH regime into a WFA regime. More specifically, the implementation of WFA was driven by negotiations between USPTO managers and the union of patent examiners, leading to a monthly enrollment quota that created exogeneity in the *timing* of individual examiners' transition to WFA. Second, the role of a patent examiner is relatively independent. Third, examiners in our sample had spent at least two years in the USPTO office and additional time in a traditional WFH program before taking on a WFA assignment. These conditions help us in three ways. First, the independent nature of the task performed by patent examiners and the mandate to spend two years in the office help us (at least partially) control for adverse effects of remote work (e.g., effects of additional coordination costs and reduced learning effects from colocated peers) that might lead to confounding concerns in a more general setting. Second, given that all WFA employees in our study first transition from being an "in-office worker" to a "WFH worker" before further transitioning into a "WFA worker," we are able to isolate a productivity effect of geographic flexibility awarded by WFA vis-à-vis WFH. Third, the exogenous timing of transitioning from WFH to WFA enables us to estimate a causal comparison of productivity for workers who self-select to make that transition. These conditions not only present a clean empirical setting, but also serve as important boundary conditions to our findings and suggest a future research agenda.

To preview, we exploit this bureaucratic-policy-induced variation and employ examiner fixed effects, finding that examiners enjoy an increase in work output of 4.4 percent when in the WFA program compared to the baseline of when the worker was in the WFH program, with no significant increase in the amount of rework. It is important to point out that to the best of our knowledge, with the exception of the Bloom et al. (2015) study, there are no other studies in the remote work literature that document causal productivity results. Furthermore, while Bloom et al. (2015) document causal results related to WFH, this study documents causal results related to transitioning from WFH to WFA. Our secondary analysis compares WFH productivity to in-office productivity, validating insights from Bloom et al. (2015). These two analyses give a sense of the stepwise progression of productivity as USPTO workers move from in-office, to WFH, and then to WFA.

We also explore a plausible mechanism driving our results, and based on the theoretical prior articulated earlier, provide evidence that transitioning from a WFH to a WFA regime results in workers exerting greater effort. In our setting, a proxy to measuring effort is the number of first round reviews ("First Office Actions"), when the examiner has to perform a more comprehensive search of prior art compared to subsequent rounds of review. We also attempt to rule out that the observed gains in productivity when workers transition from WFH to WFA are due to mechanisms similar to those provisioned by WFH, strengthening the claim that WFA is *not* an extreme case of WFH. Using descriptive results, we document wide variation in the characteristics of locations chosen by WFA workers and validate these patterns using insights from 53 field interviews. We also summarize worker, firm, and economy-wide implications of provisioning WFA.

Our findings contribute to the literature on remote work. While prior literature has documented robust productivity effects of WFH (e.g., Bloom et al., 2015), our study documents productivity effects of granting workers *geographic flexibility* and the choice to live anywhere. Our results also contribute to the literature on nonpecuniary benefits, by drawing attention to an important, yet understudied, nonpecuniary benefit, i.e., the choice to live in a preferred geographic location. We also contribute to the literature on firm-specific incentives by studying individual productivity changes for one of the early adopters of WFA, and contribute to the literature on migration by presenting WFA as a policy that enables workers to migrate to their preferred location.

2. WORK FROM ANYWHERE AND GEOGRAPHIC FLEXIBILITY

In this section, we situate WFA within the larger body of research on nonpecuniary incentives, firm-specific incentives, and migration, and propose a theoretical explanation for why provisioning WFA affects worker productivity.

Nonpecuniary motives and the provisioning of greater effort

Research on incentives has demonstrated that nonpecuniary benefits that appeal to workers' preferences for intellectual challenge, recognition, the opportunity to make prosocial contributions, and work-life balance, can positively impact work outcomes and motivate effort (e.g., Bloom, Kretschmer, & Van Reenan, 2011; Carnahan, Kryscynski, & Olson, 2017; Roach & Sauermann, 2010; Stern, 2004).

In this stream of research, a key theoretical mechanism underlying improved productivity from provisioning nonpecuniary benefits is the existence and fulfillment of "motives"—individual workers' trait-like preferences for these nonpecuniary benefits (Lee, Shah, & Agarwal, 2020; Sauermann & Cohen, 2010). Sauermann and Cohen (2010) define incentives as "contingent benefits provided by the firm" and define a "motive" as a worker's "preference for such incentives" (p. 2,134). Different types of nonpecuniary benefits might have varying appeal to individual workers, depending on their motives (Agarwal & Ohyama, 2012; Sauermann, 2018), and stronger preferences for a particular nonpecuniary benefit increases the marginal utility of the benefit, leading to an increase in effort (Sauermann & Cohen, 2010). Sauermann and Cohen (2010) also theorize that the positive impact on worker performance derived from fulfilling individual motives "may be mediated by the quantity of effort (hours worked) as well as by the character of effort (e.g., intermediate activities and cognitive processes)…Thus, effort is a positive function of both the size of the reward...and the intensity of the individual's preference for that reward" (pp. 2,136–2,137). Lee et al. (2020) echo this argument, stating, "motives shape behavior….guide choices regarding where to work/contribute effort….and are predictive of individuals'….innovative output" (p. 2).

Recent research on firm-specific incentives also suggests that relative differences in the nature of nonpecuniary benefits offered by firms might determine how much effort workers exert (Kryscynski, Coff, & Campbell, 2020). Firms that offer nonpecuniary benefits that lead to greater individual-level utility for workers, as compared to benefits being offered by other firms where workers could be employed, are more likely to observe better individual productivity for their workers, ceteris paribus. Kryscynski et al. (2020) define firm-specific incentives as "incentives that provide more utility to workers in the focal firm than similar incentives available at other employers" (p. 2). In other words, to the extent that a nonpecuniary benefit is specific to a firm, or to a limited set of firms, it can serve as a source of human-capital-based competitive advantage. Workers whose motives are met by the nonpecuniary benefit are more likely to exert greater effort while working at the firm, and/or might be incentivized to stay longer at the firm, given limited supply of that specific benefit elsewhere (Kryscynski, 2020). Given the relative rarity of WFA as a benefit during the period of our study (compared to more established forms of remote work such as WFH), WFA can be viewed as a firm-specific incentive for early adopters.

Geographic flexibility as a nonpecuniary benefit

We now theorize why the choice to live anywhere, as provisioned by WFA, should be viewed as a nonpecuniary benefit which triggers a motive (i.e., preference for a benefit) distinct from the motives triggered by WFH, and draw on research in flexibility, migration, and urban studies to make that argument. Both WFH and WFA are nonpecuniary benefits designed to offer the worker *flexibility*. Evans et al. (2004) define flexibility in the employment relationship as "ceding control to workers over the circumstances of their work by enabling them to vary those circumstances to address personal and family needs and uncertainties" (p. 2). WFH policies are an increasingly common means of granting *temporal flexibility* to workers, granting individuals more control over the hours in which they complete their work (e.g., Briscoe, 2007).[5] However, a typical WFH policy also requires the worker to be physically proximate to—and at times present in—a designated office location at a periodic frequency, thus constraining the geographic area in which the worker can reasonably choose to live. In contrast, WFA provides the worker with a unique choice: the choice to live anywhere, or *geographic flexibility*. Workers in a WFA program might choose to work from home, or might choose to work from a co-working space, but in either case they choose where to live.[6]

A worker may have a strong preference to relocate to and live in a chosen geography for multiple reasons, reflecting the importance of "residential satisfaction," a construct from research on migration and urban studies. Residential satisfaction has been defined broadly as "the positive or

[5] The benefits of granting temporal flexibility (such as flexible work hours) to employees have been well-documented in the research on family-friendly work policies and WFH policies, with particular emphasis on improvements in work-life balance and reductions in work-family conflict. Bloom et al. (2015) found evidence that WFH led to a 13 percent performance increase (compared to working from an office), of which nine percent was due to fewer breaks and sick days, and four percent was due to a "quieter and more convenient" work environment (p. 165). Work-life balance is generally seen to improve when employees are able to WFH (Gajendran & Harrison, 2007), though some negative impacts have been noted in the areas of work-life boundary maintenance (Kossek, Lautsch, & Eaton, 2006) and family-to-work conflict (Golden, Veiga, & Simsek, 2006).

[6] As an example, Choudhury and Salomon (2020) document that workers who joined the Tulsa Remote program and moved from different cities of the U.S. to Tulsa, Oklahoma, but worked remotely once in Tulsa, predominantly chose to work from a co-working space called "36 Degrees North" after relocating to Tulsa.

negative feeling that the occupants have for where they live" (Weidemann & Anderson, 1985, p. 156), with an expansive definition of "residence" including towns and cities where the worker lives. Residential (dis)satisfaction is viewed as a driver for individuals making geographic moves, and Barcus (2004) argues that changing household needs, upward social mobility, or changing residential aspirations might contribute to residential dissatisfaction with the current location and motivate individuals to move elsewhere.

For movers, there are a multitude of criteria that may determine which new location will result in a higher level of residential satisfaction. Building on Low and Altman (1992), Hidalgo and Hernández (2001) argue that in determining residential satisfaction, both the worker's social, cultural, and community attachments to the geographic place ("place attachment"), and factors related to the physical residential environment of the geographic place (e.g., cost of living, availability of housing), should be considered. Notably, the factors leading to residential satisfaction are generally thought to change as an individual passes through various life stages (e.g., marriage, having children, retirement), such that a location that provides high residential satisfaction during one life stage could become a source of low residential satisfaction in a later life stage (Barcus, 2004). Consistent with the notion of variation in individuals' nonpecuniary motives, we theorize that different workers are likely to exhibit heterogeneous preferences for geography and consequently where to live. Some workers may prioritize a lower cost of living above other factors (e.g., Kancs, 2011; Yankow, 1999), while others may prioritize a location's diversity and level of cultural amenities (Florida, 2002). Still others may prioritize the feeling of "place attachment" related to living close to family or one's childhood home (Dahl & Sorenson, 2010), proximity to a strong social network (Sjaastad, 1962), or proximity to a religious community (Rivlin, 1982).

In summary, WFA should be viewed as a nonpecuniary benefit that should be preferred by workers whose utility would increase by moving from their current location to a more highly preferred location. Furthermore, workers whose motives are triggered by choosing WFA should exert greater effort and exhibit higher productivity when they self-select to transition from a WFH to a WFA regime. This effect might be especially salient if there is a limited supply of geographic flexibility as a benefit at other potential employers available to the worker. This theorizing leads us to our main proposition: *workers can be expected to exhibit greater output and greater effort when they self-select to transition from a work-from-home to a work-from-anywhere regime*. It is important to point out that there are several boundary conditions to this proposition, notably that the transition from a WFH to a WFA regime does not result in lower output due to higher coordination or learning costs. We discuss these and other scope conditions later in the paper.

3. EXPLORATORY FIELDWORK AND RESEARCH CONTEXT

Because of the nascent stage of research in the phenomenon of interest, we undertook exploratory qualitative work (Edmondson & McManus, 2007) to better understand the research context, and to identify potential mechanisms underlying the productivity effect of switching to a WFA regime. This exploratory work included 53 interviews with 48 USPTO managers, patent examiners, and the Patent Office Professional Association (POPA) labor union leaders (details in Appendix Table A1), as well as analysis of online job review data described later in this section.

The USPTO is the federal government agency authorized to evaluate patent and trademark applications. It is headquartered in Alexandria, Virginia, and employs about 13,000 people, including slightly more than 8,000 patent examiners (Choudhury, Khanna, & Mehta, 2017). Patent examiners are typically highly educated, holding undergraduate degrees in science and engineering, and some holding advanced degrees in technical fields. At the USPTO, examiners are hired at the civil servant "grade levels" GS-5, GS-7, GS-9, GS-11, GS-12, GS-13, GS-14, or GS-15, with pay and responsibilities increasing with each grade. During labor negotiations, examiners are represented by the USPTO's union, POPA.

A patent application specifies a set of "claims" that defines the invention the applicant wishes to protect. Applications are assigned to examiners based on the required area of technical expertise (software, chemicals, mechanical, etc.). Examiners are organized into nine "technology centers," each made up of smaller "art units." Within a given art unit, a supervisory patent examiner (SPE) assigns each new patent application to a patent examiner (Lemley & Sampat, 2012). The examiner is then responsible for reviewing the claims and moving the application through the examination process, with minimal supervisory oversight. At lower grade levels, patent examiners are typically newer and less experienced in their fields, and therefore must obtain approval on their actions from either their assigned SPE or a senior patent examiner. However, given the independent nature of the task, there is relatively little coordination of the tasks related to actual examination (e.g., prior art search), between the examiner and her supervisor, even for junior examiners (Choudhury et al., 2017; Lemley & Sampat, 2012).

In order to determine the validity of claims in an application, the patent examiner uses several proprietary search tools to review the body of publicly available work (called "prior art," it includes existing patents, published patent applications, academic and trade journal articles, and other publications). Once the examiner has (to her knowledge) exhausted the existing prior art, she issues a "First Office Action" (FOA), which can be an "allowance," accepting all claims as patentable or, more commonly, a "nonfinal rejection," which indicates that some or all claims are not patentable, and gives the basis for rejection. Applicants can respond by withdrawing, narrowing, clarifying, or providing further evidence to support the rejected claim. The examiner then reviews the response, accepts additional claims as applicable, and issues another office action. This process continues until the examiner believes that no further response will change the outcome of an application, at which point she issues a "final action." Upon receiving a final action, the applicant has the choice of abandoning all remaining rejected claims, appealing the action to a board of appeal, or restarting the application process by paying an additional $1,200 fee to initiate a "request for continued examination" (RCE). The RCE restarts the entire examination process, but is carried out by the same examiner and takes into account all prior communication.

The USPTO measures examiner productivity using the number of actions completed by an examiner within a given period of time, in relation to an expected productivity level based on examiner grade level (a proxy for experience) and examiner-specific case mix—examiners in more nuanced or complex fields are granted more time to examine a given application. Following the USPTO's measures, we take the number of actions in a given period as the measure of examiner output. We consider the number of RCEs in a given period to serve as a measure of rework.[7] To further enrich our understanding of the examiners' perspectives on their jobs, we gathered qualitative data from 542 online employee reviews at Glassdoor.com (Table A2 in Appendix). The reviews contained a number of consistent themes. Temporal and geographic flexibility are both cited as highly valuable aspects of the examiner job. Furthermore, there are frequent mentions of the independent nature of the job, giving further confirmation that our research context is one of pooled interdependence (Thompson, 1967).

Remote work programs at the USPTO

We focus on two prominent remote work programs at the USPTO: WFA (i.e., the Telework Enhancement Act Pilot Program or TEAPP) and WFH (i.e., the Patents Hoteling Program or PHP). The USPTO introduced the voluntary PHP in January 2006 with an initial cohort of 500 patent

[7] While we recognize that this is an imperfect measure (an inventor is well within rights to doggedly pursue a patent claim via an unlimited number of RCEs, regardless of the accuracy and quality of the examiner's ruling), an RCE mechanically leads to rework, as the examiner must search prior art again to write the next decision.

examiners. PHP provides eligible employees with equipment and remote access to systems and allows them to WFH up to four days per week. When they report to the office, they reserve desk space through an online system. In addition, participants must have worked at the USPTO for at least two years and demonstrated "satisfactory performance." PHP is a classic WFH program that offers temporal flexibility, but less geographic flexibility than WFA, and we refer to PHP hereafter as "WFH." USPTO administers this WFH program with two categories of examiners: those who live within 50 miles of the Alexandria, VA headquarters ("WFH≤50"), and those who live further than 50 miles from headquarters ("WFH>50"). However, our field interviews indicate that given the requirement to physically report to the office one day per week, examiners on WFH>50 could not relocate very far away from Alexandria, VA.

In December 2010, President Barack Obama signed the Telework Enhancement Act, which set standard rules and regulations for remote work at federal government agencies. Given this policy change, in early 2011, the USPTO began planning for a January 2012 launch of a WFA program (i.e., TEAPP), allowing employees to live and work anywhere in the contiguous U.S. (greater than 50 miles from the USPTO) and travel to headquarters periodically at their own expense, thus awarding eligible patent examiners geographic flexibility. Importantly for our purposes, the USPTO did not adjust wages for employees opting to participate in either the WFH or WFA programs.

Employees were eligible to participate in WFA if they: (1) were already enrolled in the "WFH>50 miles" program; (2) had access to the Internet and USPTO systems; (3) agreed to change their "duty station" (i.e., primary office location) to a location greater than 50 miles from USTPO headquarters; and (4) waived their rights to travel reimbursement for required trips back to headquarters. The USPTO capped the number of trips that WFA employees would need to make to headquarters at 12 days and/or five trips during a fiscal year. The USPTO also provided WFA workers with online communication tools such as Microsoft Lync, WebEx webinar services, and Cisco Voice over Internet Protocol (VoIP). On January 30, 2012, the USPTO officially launched the WFA program.

4. DATA

USPTO examiner personnel data

This paper draws on multiple sources of data. The first dataset used for this study is an annual record of all patent examiners active at the USPTO from 2007–2015, with 9,210 unique examiners. This data also provides the general schedule level (GS) of every USPTO examiner, data that is otherwise not public. As described earlier, the GS of an examiner is of particular importance: it serves as a natural hierarchy for promotions, is mechanically correlated with tenure and experience, and higher-grade examiners have increasing levels of autonomy in their workflows. Hence, controlling for GS is important to account for unobservable task-specific human capital of examiners (Gibbons & Waldman, 2004). We also obtained data on “expectancy,” i.e., a benchmark measure of productivity. For each examiner, this measure is calculated every month, as a function of the “United States Patent Classification” (USPC) class of patents to be examined by that examiner that month.

We also utilize a second, unique, USPTO-provided, personnel dataset specifically focused on remote workers. This dataset includes examiner identifiers, as well as the remote work program(s) in which the examiner enrolled: WFH≤50, WFH>50, and WFA. The examiner-specific start date for each specific remote work program allowed us to track an examiner across programs. This data also identifies the city and state of a remote examiner (as of August 2016), which is important for analyses of characteristics of preferred locations of examiners (to be described later).

USPTO patent data

Data on patents and patent application-level transactions were collected from a combination of two publicly available datasets: USPTO's Public Patent Application Information Retrieval (PAIR) dataset and PatentsView. Data collected include the name of the examiner assigned to a patent, the examiner's art unit, and the application's USPC classification. We then collected data on all transactions executed by an examiner, focusing on two specific metrics of productivity: total actions and RCEs.[8] Total actions is a measure of an examiner's aggregate output, and aligns with the PTO's internal performance measure of expectancies, while RCEs is a measure of rework.

5. IDENTIFICATION STRATEGY: NATURAL EXPERIMENT

To provide robust econometric estimates of the effects of WFA on output and rework, we exploit a natural experiment within the USPTO. Crucially, the implementation of WFA was driven by negotiations between USPTO management and the union of patent examiners, POPA. Specifically, these negotiations resulted in an exogenous monthly quota for eligible examiners transitioning to WFA in the first 24 months of program implementation. The number of slots was decided by a committee comprising management and union members. If a slot was not available in a given month, the prospective enrollee was placed on a waiting list. Our field interviews indicated that all slots allocated for the first several months were exhausted, implying that even if an examiner was eligible for WFA, he or she would have had to wait an unknown length of time before transitioning to WFA. As such, the timing of an eligible examiner's transition to WFA was relatively

[8] We assume here that shirking—another possible negative outcome associated with increased autonomy—is reflected in the productivity measure, given that we are using an objective measure of productivity. Concerns about shirking were addressed at the USPTO in a contemporaneous time frame, with claims of "examiner fraud" and "attendance abuse" made by *The Washington Post* (Rein, 2014; 2016), based on critical findings from the U.S. Department of Commerce's Office of the Inspector General. However, all of these findings related to either (1) overreporting of hours worked or (2) shifts in the timing of work completed, such as backloading at the end of a calendar quarter, which raised concerns about the accuracy and quality of work completed. USPTO Office Director Michelle K. Lee told lawmakers that she and her team "do not tolerate any kind of attendance abuse" (Rein, 2016). Our measure of productivity is only output dependent, so overreporting of time worked would not affect this measure. Second, our measure of rework—while not a perfect proxy for quality—should capture any substantial degradation in work quality due to backloading or other timing shifts. In robustness checks (available upon request), we also employ month fixed effects to test our causal results, and results remain robust.

exogenous. Our field interviews indicated that prior tenure, experience, or performance were *not* considered in allocating slots to eligible examiners.

While it is likely that observable and unobservable factors determine whether or not examiners transition into WFA, we attempt to provide robust econometric estimates by focusing on the sample of examiners who selected to transition into the WFA program over the first 24 months and exploit variation in *when* (i.e., which month) the examiner could transition into WFA, variation that is exogenous (and orthogonal to prior performance, seniority, and other examiner characteristics) given the monthly quotas administered by the USPTO management *and* POPA. Our identification strategy thus enables us to generate causal treatment effects for the sample of examiners who self-selected to transition from WFH to WFA, i.e., all examiners in our sample can be thought of as treated, varying only in the amount of time they have had to wait to be exposed to the treatment (WFA). To validate our natural experiment and the insights generated by the field interviews, we test whether the variation in WFA transition time was truly exogenous by regressing the time it took an eligible examiner to transition to WFA on observable measures of past performance. Results from these and other tests are reported later: we find no evidence of selection on prior performance (or other observables), validating our principal identification strategy.

6. ESTIMATION AND RESULTS

In order to leverage the natural experiment, we limit our sample to examiners who enrolled in WFA in either 2012 or 2013. Hereafter, we refer to this sample as the "WFA sample." The WFA sample comprises 831 (out of 9,210 total) examiners. Table 1 reports summary statistics for the WFA sample; for summary statistics of the full sample, see the Appendix (Table A3).

[Table 1 about here]

Causal estimation of the effect of WFA on productivity as compared to WFH baseline

The main proposition of the paper is that workers exhibit greater output when they transition from a WFH to a WFA regime. We utilize the natural experiment described above, employing the following examiner month-level specification:

$$Output_{it} = \alpha + \beta_{it} * WFA_{it} + \xi_{it} + \gamma_t + \lambda_i + \epsilon_i$$

where WFA_{it} is a binary indicator that turns on (and stays on) when an examiner "i" enrolls in WFA during month "t" of the 2012–2013 timeframe. As described earlier, we measure individual output using total actions and individual rework using the number of RCEs. ξ_{it} is a vector of controls that includes examiner month-specific grade level and examiner month-specific expectancy, while γ_t is a full set of time (month) fixed effects and λ_i is an optional set of examiner fixed effects. Standard errors are clustered at the examiner level.[9] Columns 1–4 of Table 2 provide the focal set of results evaluating the effect of WFA on productivity.

[Table 2 about here]

Columns 1 and 2 report results relevant to output. Specifically, Column 1 identifies the effect of WFA on the total number of actions completed by each examiner in a given month, with Column 2 including a set of examiner fixed effects to identify the effect not just within the sample of examiners transitioning to WFA in 2012 and 2013, but also *within* each examiner. There is a positive, highly significant effect of WFA on overall output of 0.574 actions (p-value = .000), roughly corresponding to a 4.42 percent increase in the total number of actions on a mean of 12.97 per month. Columns 3 and 4 present results indicating that WFA does not increase the amount of RCEs an examiner engages in (without and with examiner fixed effects, p-values = .339 and .975,

[9] All results remain robust to standard errors that are clustered at the production unit (i.e., art unit) to account for intra-art unit correlation of error terms, particularly as they relate to unobserved routines within the art unit.

respectively). In summary, our core proposition that workers exhibit greater output when they transition from a WFH to a WFA regime is supported.

Baseline comparison of WFH productivity and in-office productivity

We also test whether the transition from working in the office to WFH is associated with greater output. To recap, prior to its WFA program, the USPTO had implemented a WFH program which offered examiners less geographic flexibility. Here, we split the WFH participants into those living within 50 miles of the office, and those living more than 50 miles from the office (WFH≤50 and WFH>50). Given that the bureaucratic assignment process was only used for transition into the WFA program, we can no longer rely on the natural experiment in this setting; we estimate the specification below within the full sample of existing examiners across all months (576,267 examiner-months from 2007–2015):

$$Output_{it} = \alpha + \beta_{1it} * WFA_{it} + \beta_{2it} * WFH \leq 50_{it} + B_{3it} * WFH > 50_{it} + \xi_{it} + \gamma_t + \lambda_i + \epsilon_i$$

where WFA_{it}, $WFH \leq 50_{it}$, and $WFH > 50_{it}$ are indicator variables for when an examiner enrolled in each program, indicators that remain on until the examiner switches programs. As before, ξ_{it} is a vector of controls that includes examiner month-specific grade level and examiner month-specific expectancy, while γ_t is a full set of time (year) fixed effects and λ_i is a set of examiner fixed effects, which are of particular importance in this exercise as they allow us to track examiners as they switch from program to program. As before, standard errors are clustered at the examiner level. Table 3 provides results from this estimation exercise:

[Table 3 about here]

Column 2 reports the most restrictive specification with examiner fixed effects. The traditional WFH>50 miles program showed the lowest productivity increase versus working in the office, while WFH≤50 miles had roughly twice the impact as WFH>50 miles (p-values = .000 and

.000, respectively). As this model includes examiner fixed effects, we note that the coefficients are semi-additive: WFA captures the effect of remote work above and beyond WFH>50 miles, as examiners must have been enrolled in WFH>50 before being eligible for WFA. Hence, in this model, all telework programs incrementally increase productivity compared to working in the office. The impact of WFA, when interpreted additively (as the combination of the point estimates for the WFH>50 and WFA dummies), is far beyond the impact of the WFH programs alone (p-value = .000). It is important to note that we interpret these results in the context of one another rather than as causal estimates; the full sample regressions illuminate the relative differences between the remote work programs rather than causal treatment effects.

7. EVIDENCE ON MECHANISM AND SUPPLEMENTARY ANALYSES

Mechanism Test

To recap, we build on Sauermann and Cohen (2010) and Kryscynski (2020) to theorize that workers whose motives (i.e., preferences) are met by the provisioning of a nonpecuniary benefit such as WFA are more likely to exert greater *effort* as they transition from a WFH to a WFA regime. To test this, we measure effort using "First Office Actions" (FOAs).

The USPTO statutes provide evidence that an examiner needs to exert greater effort while working on an FOA, compared to other actions, noting (emphasis added by authors),

> It is a prerequisite to a speedy and just determination of the issues involved in the examination of an application *that a careful and comprehensive search, commensurate with the limitations appearing in the most detailed claims in the case, be made in preparing the first action on the merits* so that the second action on the merits can be made final or the application allowed with no further searching other than to update the original search (Statute 904.03).

Additionally, USPTO Statute 904 outlines *why* the examiner needs to exert greater effort while working on an FOA compared to other actions, and states (emphasis added by authors),

> *Following the First Office Action, the examiner need not ordinarily make a second search of the prior art*, unless necessitated by amendments to the claims by the applicant in a reply to the First Office Action, except to check to determine whether any reference which would appear to

be substantially more pertinent than the prior art cited in the First Office Action has become available subsequent to the initial prior art search.

In summary, FOAs require substantially more examiner effort than other actions in searching for prior art and documenting search results, an insight we also validated in our field interviews. Results on patterns of effort measured using FOAs are reported in Table 4, Columns 1 and 2, where Column 2 is the most saturated model and shows an increase in FOAs (effort) when the examiner transitions from WFH to WFA (p-value = .031).

[Table 4 about here]

Ruling Out Alternative Mechanisms

We also attempt to rule out that the productivity improvements associated with transitioning to WFA are driven simply by mechanisms similar to those in WFH regimes, such as reductions in commute time and/or reduced monitoring. To estimate this, we compare WFA examiners residing 50–75 miles from Alexandria, VA to WFA examiners residing over 75 miles away from Alexandria, VA. Examiners living 50–75 miles away from Alexandria, VA after transitioning from WFH to WFA likely *did not relocate* as a result of moving from a WFH to a WFA regime. It is plausible that these examiners were already living in their preferred location. However, these examiners (living 50–75 miles away from Alexandria, VA) stopped commuting to the USPTO headquarters a minimum of one day per week (as required by the WFH program), thus saving commute time and monitoring costs, once they transitioned from WFH to WFA.

In contrast, WFA examiners living over 75 miles away from Alexandria, VA likely relocated beyond a reasonable commuting distance as a result of the transition from WFH to WFA. These examiners (like their peers on WFA in the 50–75 mile radius) also experienced a reduction in their weekly commute and monitoring as they moved from WFH to WFA. However, it is only when they moved from WFH to WFA that they presumably relocated to their preferred location. Thus, comparing productivity patterns of WFA examiners in the 50–75 mile radius to those of WFA examiners outside the 75 mile radius allows us to control for the effect of alternative mechanisms (less commute and monitoring) and leads to a cleaner estimation of the effect of geographic flexibility, and moving to one's preferred location, on work output.

Table 5 reports results. In Column 2, we report that the WFA effect is driven entirely by examiners residing over 75 miles away, pointing to productivity being driven by geographic flexibility, above and beyond the flexibility of reduced commute time (p-value = .000). These results are robust to other cutoffs, such as 100 miles (rather than 75 miles).

[Table 5 about here]

Supplementary Analysis: Choice of Preferred Location

We now present descriptive results documenting wide variation in locations (Figure 1) and characteristics of locations (Figure 2) chosen by WFA examiners. The purpose of this exercise is to demonstrate that workers may have different preferences for the same nonpecuniary benefit, in this case the benefit being WFA, as suggested by Agarwal and Ohyama (2013). First, we study observable characteristics of geographic locations self-selected by WFA examiners, and find that their choices exhibit wide variation on multiple dimensions, such as cost of living and quality of life. The choice of locational characteristics reported in Figure 2 is based on availability of data and is not an attempt to show variation across all possible locational characteristics.

[Figures 1 and 2 about here]

Our field interviews also suggested that geographic flexibility benefitted individuals in a myriad of ways. One examiner noted,

> I'm a military spouse, which means I live in a world with frequent moves and personal upheavals that prevent many spouses from pursuing lasting careers, especially careers of their choice. WFA has been the most meaningful telework program that I have encountered in the military social sphere, as it allows me to follow my husband to any state in the U.S. at

> a moment's notice, and… pursue my own aspirations to contribute both to my home and to society.

Another examiner explained the benefit of living close to specialized medical facilities:

> I have a daughter with a medical condition that, because of WFA, my family and I were able to search the northeast looking for the ideal location that would provide the services and supports for my daughter that we felt were best for her. As a result, we moved to Pennsylvania a little over two years ago. I cannot fathom what it must be like to uproot one's family AND have to find a new job in the process. I feel so lucky that I was able to make the move… to get the care my daughter needs and be able to keep the job I love doing.

Proximity to extended family was also mentioned in multiple interviews, with one examiner explaining that WFA,

> has also allowed me to be closer to my family, such that my children are able to see their grandparents on a regular basis. They also get to play with their cousins often, who are within the same age range. Being closer to family has improved my overall happiness because we are able to spend time together on all holidays rather than just the major ones.

Our field interviews also indicated that moving to lower cost-of-living locations was a frequently cited benefit of geographic flexibility. One examiner noted,

> I selected the Patent Office as D.C. seemed an interesting place to live, with the understanding that I would make a lateral move to a private law firm in the D.C. area to improve my professional experience and to enhance my chances of leaving the D.C. area when I was ready to start a family. After three years, the Office began offering full-time telework schedules and I saw some of my colleagues depart D.C. to move to areas that were considerably more affordable… I have been a [WFA] worker for the last four years, living in Alabama with my wife and two children.

While these insights begin to paint a picture of geographic locational choices under a WFA regime, it is important to note that they do not capture the full range of factors that might be relevant to how workers chose where to live, suggesting an opportunity for future research.

8. ROBUSTNESS CHECKS

To test for concerns around time trends and post-treatment performance reversion to the mean (due to reciprocity or other unobserved mechanisms), we plot month-specific predicted total actions in Figure 3 and find no evidence of such mean reversion. Figure 3, however, revealed a decline in output in the month prior to treatment (i.e., month t-1), relative to the month prior to that (i.e., month t-2). Given this, we separately drop the month prior to treatment and the two months prior to treatment from our regression analysis (reported earlier), and all results remain robust. Further, in order to validate our natural experiment, we look for evidence of selection in the time examiners had to wait for the WFA treatment, for those employees enrolling in WFA in 2012 or 2013. We estimate a model to determine whether previous performance, expected performance (expectancy), or rework is correlated with how soon an examiner receives WFA. In order to do so, we limit our sample to those examiners who obtained WFA in 2012 or 2013 and estimate variations on the following model:

$$Months_i = \alpha + \beta_{1i} * X_{it,<2012} + \xi_{it} + \epsilon_i$$

where $Months_i$ is an examiner-specific measure of the number of months (0–23) it took an eligible examiner to actually get in the program. X refers to total actions, total RCEs, or expectancy; hence, $X_{it,<2012}$ refers to an examiner's annual prior performance, rework, or expected performance. ξ_{it} is a set of controls for an examiner's GS level (seniority) for each month. Table 6 presents results showing no evidence of previous performance, expected performance, or rework being correlated with the amount of time it took an examiner to transition to WFA, validating our identification strategy (all p-values > .100).

To further establish exogeneity in the timing of treatment, we conduct a placebo treatment test, reported in Figure 4. In each iteration of the placebo test, we shuffle the start month for all 831 WFA examiners—that is, we randomly assign, without replacement, which month each examiner starts WFA in the 2012-2013 time frame. We merge these placebo treatments back into the panel dataset and recompute the WFA dummy that indicates whether the current month t is greater than or equal to examiner i's placebo start month. We re-estimate the regression reported in Table 2, Column 2 with this new dummy variable (all other variables are the same), and we record the coefficient estimate associated with the synthetic treatment variable. We do this 500 times with random shuffles of start date. Finally, we calculate a p-value by computing the proportion of the 500 iterations that yield coefficient estimates larger than what we find using actual data. None of the 500 estimates are greater than 0.574 ($p < .002$).

[Figure 3, Table 6, and Figure 4 here]

A potential concern is that examiners, upon transitioning to WFA, may exhibit lower *quality* in their work. For instance, while examiners may increase overall output and effort, it is *ex ante* unclear whether quality of patent examination also changes. We study how the transition from WFH to WFA affects examiner-added citations, a metric highlighted in prior research by Alcácer and Gittelman (2006). Results reported in the appendix (Table A6) show that we are unable to distinguish from the null (p-value = .401); i.e., there appears to be no reduction in the quality of work for examiners transitioning to WFA based on the number of citations added by examiners. Using 542 Glassdoor reviews of USPTO workers and machine learning models such as word2vec, we also provide evidence that WFA was viewed as a "benefit" by workers (Appendix Figure A2).

9. WELFARE ESTIMATES

Implications for the Firm

We summarize implications from provisioning WFA for the USPTO. Using our estimates of a 4.4 percent increase in examiner-level production with no increase in the amount of rework (or RCEs), we can estimate a net profit increase at the USPTO under two assumptions. First, we assume that the 4.4 percent increase in total actions reasonably corresponds to a 4.4 percent increase in the number of patents examined, which we argue is plausible. Using the 4.4 percent increase in patent examination output, we can estimate that USPTO profit increases two ways, one simple and one more nuanced. One, we assume the number of examiners remains fixed and that pendency (i.e., number of outstanding patent examinations) is not a concern to the USPTO and simply estimate a 4.4 percent increase on $3 billion in annual fees collected (USPTO, 2017), with no increase in costs for patent examinations, for a total increase of $132 million.

A second, more realistic, estimate would also consider the USPTO's continuing concerns with pendency (backlog), which have caused the USPTO to increase hiring substantially in recent years (United States Government Accountability Office, 2008). Productivity improvements from WFA could reduce the need for new hires in addition to improving output (and, hence, fees collected), so above and beyond the $132 million increase in fee revenue, we estimate a 4.4 percent reduction in FTE and the subsequent fixed hiring and variable wage costs. As the USPTO hired 780 additional examiners each year with an average salary of roughly $80,000 and hiring costs of roughly $20,000 (Choudhury et al., 2017), we estimate a one-time cost reduction of $700,000 and a continuing annual cost savings of $2.75 million. Additionally, in 2015, the USPTO estimated that it saved $38.2 million in real estate avoidance costs due to remote workers freeing up office space at headquarters (USPTO, 2015). This is arguably a lower bound of related cost savings, given that the USPTO might have experienced savings in building maintenance and utilities as well.

In addition to additional profits from the increased work output of examiners, we quantify other implications for the USPTO. Results reported in Appendix Table A7 indicate that controlling for year and grade fixed effects, turnover decreased as examiners transitioned from WFH to WFA (p-value = .000). This is consistent with the prediction of Kryscynski (2020), who posits that the provisioning of firm-specific incentives will lead to reduction in employee turnover. Also, in 2013, due in part to the agency's remote work options, the USPTO was ranked highest on the "Best Places to Work in the Federal Government" survey (USPTO, 2013). Future research should study whether this award additionally affected hiring and turnover outcomes at the USPTO from 2014 onward.

Implications for the U.S. Economy and Environment

One particular feature specific to our setting is that the USPTO also helps set the rate of U.S. innovation, standing as one last bottleneck in the traditional innovation process. A 4.4 percent increase in patent grants could lead to innovation spillovers of up to $1.3 billion. We arrive at this estimate through the following calculations. Choudhury et al. (2017) indicate that the average number of patent grants from 2009–2012 was 211,973 patents per year; this figure, taken into consideration with our estimated 4.4 percent increase in production, would lead to roughly 9,326 more patents being granted every year. Prior literature also indicates that the mean value for patents granted to U.S. patentees was $78,168 in 1992 dollars and the median value of a patent to a U.S. assignee to be $7,175 in 1992 dollars (Bessen, 2008). We convert the mean and median values of a patent to a U.S. assignee to 2020 dollars and estimate that a 4.4 percent increase in production of patents at the USPTO creates $122 million in value for the U.S. economy (considering the median value of a patent in 2020 dollars) and $1.3 billion in value for the U.S. economy (considering the mean value of a patent in 2020 dollars). Finally, environmental benefits also accrue from the program; in 2015, the agency estimated that its remote workers avoided driving 84 million miles, thus reducing emissions by more than 44,000 tons (USPTO, 2015).

10. DISCUSSION

We study the relationship between geographic flexibility granted through a WFA program and worker productivity in a highly skilled work context. Our choice of setting presents us with two important empirical opportunities. First, the presence of a natural experiment originating from bureaucratic policy allows us to estimate a causal treatment effect for workers who self-select into transitioning from WFH to WFA. Second, the dual mandate—to first spend two years in the office with other coworkers and then spend time in a traditional WFH program prior to becoming a WFA worker—allows us to control for the negative effects of remote work and to compare the productivity effects of WFH and WFA.

We find robust productivity effects, with a 4.4 percent increase in work output under WFA compared to WFH, with no effect on rework, in support of our core proposition. We posit that WFA should be viewed as a nonpecuniary benefit that should be preferred by workers who would derive greater utility by relocating from their current location to a preferred location, and provide evidence that workers exert greater productivity-enhancing effort when they self-select to transition to their preferred location. In examining the productivity increase in transitioning to WFA, we conduct supplementary analyses ruling out WFH-related mechanisms such as lower commute time and reduced monitoring. These findings are important, as they suggest that WFA (and geographic flexibility) is a novel nonpecuniary benefit, not simply an extreme case of WFH. We also provide descriptive evidence that workers exhibit heterogeneous preferences in choosing their preferred location, and summarize worker, firm, and economy-wide implications of provisioning WFA.

This paper makes an important contribution to research on remote work. We study an emerging form of remote work, i.e., work-from-anywhere, and highlight the importance of *geographic flexibility*, which allows workers to derive greater utility by relocating from their current location to a preferred location. Drawing on the literature on flexibility, migration, and urban studies, we posit that geographic flexibility allows individuals to derive greater residential satisfaction, with residence defined in an expansive way to include the town/city of the worker. The prior literature on remote work has largely focused on work-from-home and has theorized that WFH offers the worker temporal flexibility and flexibility in choosing working conditions (Gajendran & Harrison, 2007). In contrast, WFA affords all of the benefits of WFH, plus the flexibility to choose where to live. As a result, while the WFH literature, notably Bloom et al. (2015), identifies productivity-enhancing mechanisms, such as reduced commute time, fewer work breaks, sick days, and the benefits of a quieter work environment, our focus on geographic flexibility points to a mechanism unique to WFA: productivity-enhancing effort when the worker self-selects to move to a preferred location. As such, we argue that WFA needs to be studied as a separate form of remote work, with some underlying mechanisms similar to those of WFH, but with its own unique effect on worker utility and productivity.

Our results also contribute to the literature on nonpecuniary incentives. First, while prior literature has focused on the motives (i.e., preferences) of individuals regarding intellectual challenge, independence (Sauermann & Cohen, 2010), "taste for science" (Stern, 2004), and prosocial impact (Carnahan et al., 2017), we highlight a nonpecuniary benefit that triggers the workers' motive for living in a preferred location. We make a second contribution by studying productivity effects of a nonpecuniary benefit that is provisioned without reducing workers' wages. Prior research on incentives, especially the hedonic wage analysis literature predicts a "negative trade-off between wages and 'positive' job attributes, attributes like status or flexibility in hours of work" (Lazear & Shaw, 2007, pp. 102–103). Indeed, empirical research demonstrates at least some willingness on the part of workers to exchange wages for nonpecuniary benefits (Gambardella, Panico, & Valentini, 2015; Stern, 2004). Mas & Pallais (2017) find that, on average, workers are willing to accept eight percent lower wages in exchange for remote work. Our study suggests that the provisioning of a nonpecuniary incentive such as WFA can create value for the firm *while keeping wages constant*, via an increase in worker productivity and savings in real estate costs.

Our research also speaks to the emerging literature on firm-specific incentives (Kryscynski, 2020). The USPTO was arguably an early adopter of WFA, with its January 2012 implementation beginning just over a year after the signing of the Telework Enhancement Act, which allowed the USPTO and other government agencies to launch remote work policies such as WFA. During the timeframe of the study (January 2012–December 2013), WFA was a relatively rare benefit across the firms where patent examiners could find suitable employment, and it is conceivable that there might not have been a large number of employment options in an examiner's preferred location.. The literature on firm-specific incentives suggests that if a focal firm offers more total utility to employees than competitors by provisioning a firm-specific nonpecuniary benefit, the focal firm should observe greater individual productivity from its workers (Kryscynski et al., 2020). Our study is focused on a single organization, i.e., the USPTO, and this constrains us from making between-firm comparisons to study how variation in the forms of remote work (e.g., WFA, WFH) provisioned at different firms differently affects worker productivity. However, we do advance the empirical literature on firm-specific incentives by demonstrating within-firm productivity gains from provisioning WFA, arguably a firm-specific incentive. Also, while the provisioning of WFA across the U.S. economy has increased in recent years, it is still relatively rare in many industries, suggesting that WFA could still be provisioned as an effective firm-specific incentive to enhance worker productivity, in some settings.

Finally, our study contributes to the literature on migration. While this literature has long studied the productivity effects of geographic mobility experienced by migrant workers (Borjas & Doran, 2012; Choudhury & Kim, 2019), we make a connection between the migration literature and the literature on remote work. In summary, we posit that geographic flexibility awarded by WFA enables workers to migrate to their preferred location and demonstrate in our context, that this geographic move leads to productivity gains.

Our study has several limitations and scope conditions, which suggest an agenda for future research. Similar to Bloom et al. (2015), our study is focused on a single organization. Additionally, it is plausible that in other settings where workers have greater dependence on coworkers and supervisors to accomplish their tasks, increased coordination costs might offset the gains from higher productivity. It is also plausible that the gains from WFA are restricted to settings where workers are approaching diminishing returns in learning from colocated peers and/or are relatively less dependent on coworkers and supervisors to accomplish their tasks. While the organization of work at the USPTO is arguably based on principles of pooled interdependence, future research should validate our findings in other settings that exhibit other forms of interdependence, i.e., sequential and reciprocal interdependence (Thompson, 1967). Future research can also validate the effects of WFA in settings where the worker might not have relevant prior task-specific human capital, and/or where the task is more or less routine compared to patent examination. It would also be interesting to "stress test" the productivity effects of WFA in settings such as "cultural industries" (Lampel, Lant, & Shamsie, 2000), where firms and workers have been theorized to deal with a combination of ambiguity and dynamism, related to producing goods that serve an aesthetic or expressive, rather than a utilitarian, purpose. Future research could also study whether variation in time spent in a physical office correlates with productivity effects after moving to a WFA program.

Among other possible future research directions, we would like to highlight two. First, given the prior literature on communities of practice (Wenger & Snyder, 2000), future research can study whether WFA workers might benefit from remote communities of practice. It has been suggested that coworking spaces and incubators act as a source of knowledge transfer that promotes innovation and collaboration (Wagner & Watch, 2017). Future research could explore productivity differences among WFA workers who work from home vis-à-vis WFA workers who work from coworking spaces. Second, it would be interesting to study whether some WFA workers revert back to their original location and/or continue relocating over the life cycle of their careers. Prior research in migration has suggested that migrants often make relocation decisions based on imperfect information, and may experience "buyer's regret" about their decision to move (Barcus, 2004); it would be interesting to study this in the context of WFA workers.

Our research contributes to an active managerial debate on the effectiveness of remote work. In February 2013, then-CEO Marissa Mayer famously rescinded the remote work program at Yahoo!, explaining in a company memo, "Some of the best decisions and insights come from hallway and cafeteria discussions, meeting new people, and impromptu team meetings…. We need to be one Yahoo!, and that starts with physically being together" (Swisher, 2013). Yet, along with some highly visible retreats from WFA regimes, other employers continue (typically with less fanfare) to increase WFA opportunities and more generally support the concept of remote work. Akamai's "Akamai Anywhere" WFA policy is one such example (Mayer, 2017). In promoting the agency's WFA policy, NASA's Chief Technology Officer noted that, "The potential exists for… an employee's office to expand from a 12' by 12' room to virtually everywhere" (Porterfield, 2016). A series of empirical studies around WFA could help resolve this debate.

The COVID-19 crisis of 2020 has forced millions of workers to quickly transition to remote work, drawing the attention of CEOs and senior managers to remote work policies such as WFA. In May 2020, Facebook founder Mark Zuckerberg announced that 50 percent of its workers could work remotely within 10 years and mentioned that the while the company was considering allowing employees to WFA, those workers might be subject to salary cuts (Lerman & Dwoskin, 2020). Other companies that have announced ambitious remote work plans include Twitter, Shopify and the Indian IT giant TCS (Kelly, 2020; Khetarpal, 2020). In the spirit of the firm-specific incentives literature, future research could study how variation in *how* firms implement WFA policies (e.g., with or without wage reduction) correlates to differential productivity effects.

In conclusion, at a time when remote work has become a top-of-mind policy of interest for CEOs and senior managers, to the best of our knowledge, our study represents the first empirical exploration of work-from-anywhere, an emerging form of remote work. Using unique data and a natural experiment, we provide a set of robust econometric results on the productivity effects of moving workers from a work-from-home to a work-from-anywhere regime. We also theorize why geographic flexibility and the choice to live anywhere is an important and novel nonpecuniary benefit, and our study contributes to literatures on remote work, nonpecuniary incentives, firm-specific incentives, and migration.

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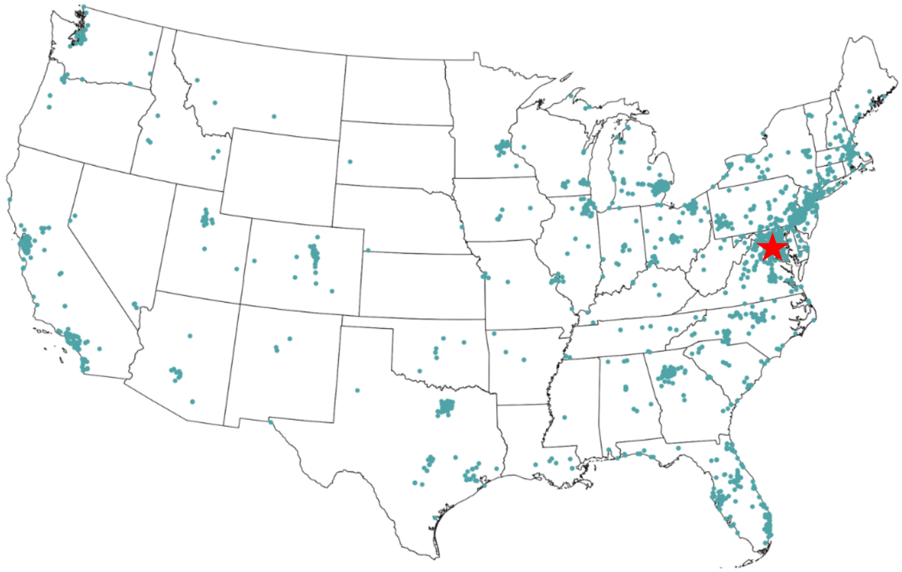
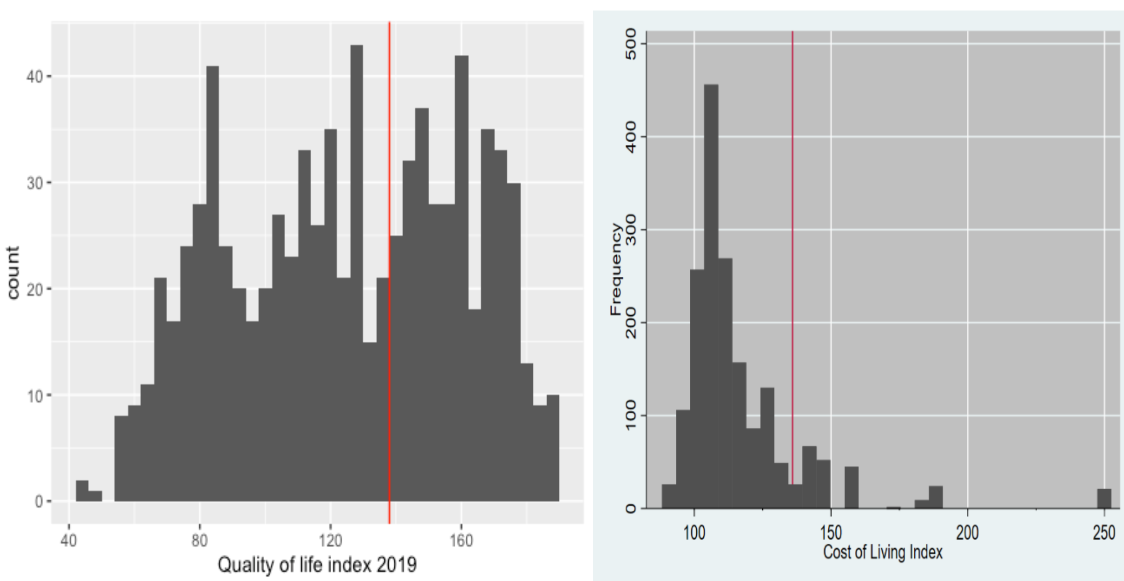
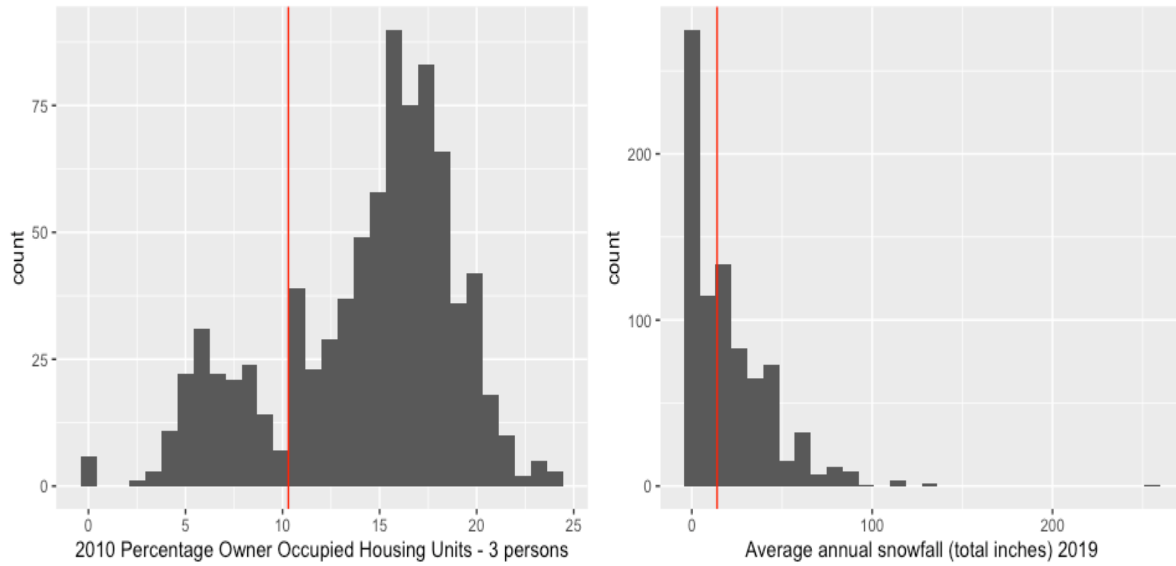
FIGURE 1 WFA Examiner Locations



Notes. This figure illustrates the spatial distribution of WFA examiners at the USPTO as of August 2016. Each dot corresponds to a single unique examiner. Alexandria, VA (USPTO headquarters) is denoted by a red star.

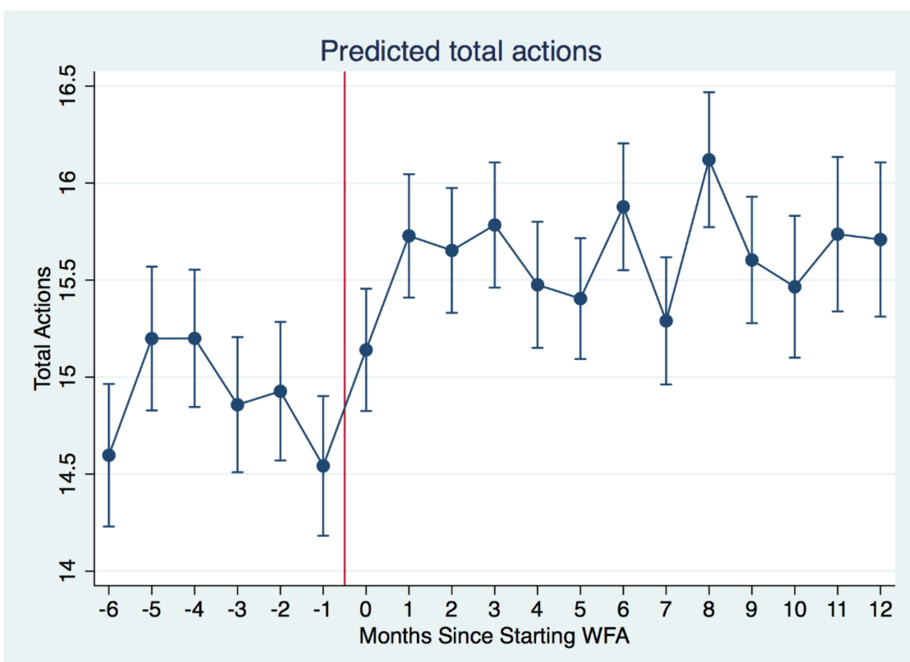
FIGURE 2 Distribution of Characteristics of Locations Chosen by WFA Examiners





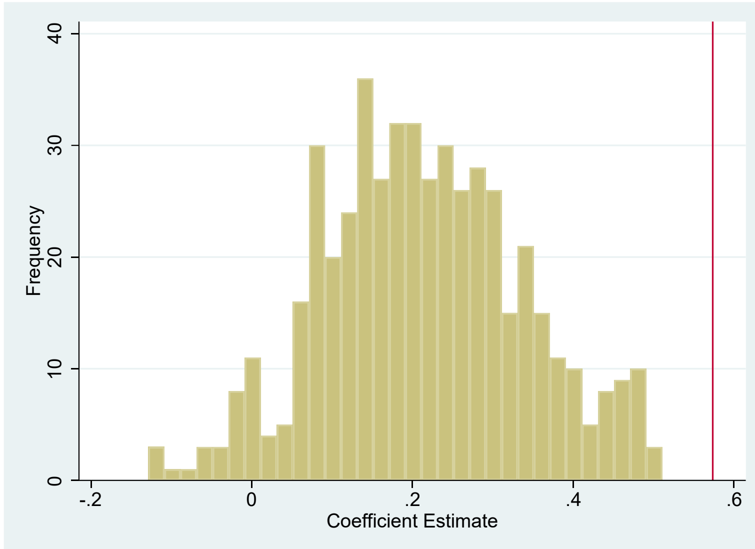
Notes. For the locations chosen by WFA examiners, this graphic plots data on quality of life index (top left), cost of living (top right), 2010 percentage owner-occupied housing units for three-person households (bottom left), and average annual snowfall in inches (bottom right). The underlying data are collected from the SimplyAnalytics (2019) database. The vertical red line in each panel represents data for Alexandria, VA, i.e., the location of the USPTO office headquarters.

FIGURE 3 Predicted Total Actions by Month



Notes. This figure plots the month-specific fixed effect coefficients estimated from a regression of total actions on controls for examiner, expectancy, grade level, and year. Treatment (WFA) is indicated with the red vertical line.

FIGURE 4 Placebo Test



Notes. The analyses conducted here are as follows: There are 831 patent examiners in our dataset. For each of these examiners, we know the month they started participating in WFA. To perform one iteration of the placebo test, we shuffle the start month for all examiners—that is, we randomly assign, without replacement, when each examiner starts WFA. We merge these placebo treatments back into the panel dataset and recompute the WFA dummy that indicates whether the current month t is greater than or equal to examiner i's start month. We re-estimate the regression associated with Table 2, Column 2 with this new dummy variable (all other variables are the same), and we record the coefficient estimate associated with the synthetic treatment variable. We do this 500 times with different random shuffles of start date. Finally, we calculate a p-value by computing the proportion of the 500 iterations that yield coefficient estimates larger than what we find using the true data. None of the 500 estimates are greater than 0.574 ($p < .002$).

Table 1 Descriptive Statistics and Correlation Matrix: Causal ("WFA") Sample

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1)	Total Action	1.000	0.444	0.575	0.760	0.478	0.205	-0.252	0.053	0.061	0.272	0.259
(2)	Total RCE		1.000	-0.062	0.265	0.239	0.138	0.002	-0.011	-0.030	0.099	0.040
(3)	FOA			1.000	0.453	0.194	-0.042	-0.267	0.077	0.092	0.126	0.195
(4)	Reject				1.000	0.713	0.283	-0.168	0.019	0.024	0.188	0.148
(5)	Examiner Cites					1.000	0.173	-0.072	-0.041	-0.031	0.018	-0.040
(6)	WFA(TEAPP)						1.000	0.026	0.022	0.022	0.422	0.313
(7)	Mean Expectancy							1.000	-0.105	-0.149	0.031	-0.005
(8)	Nearby Examiners								1.000	0.492	0.085	0.095
(9)	Distant Examiners									1.000	0.082	0.093
(10)	GS										1.000	0.724
(11)	Primary Examiner											1.000
	Mean	12.974	1.643	4.642	7.293	16.886	0.474	23.346	14.326	168.366	12.904	0.439
	Std Dev	7.246	1.736	3.891	4.589	14.458	0.499	4.915	59.638	510.943	1.404	0.496
	Min	1	0	0	0	0	0	6.6	0	0	5	0
	Max	76	16	66	45	174	1	31.6	600	2,244	15	1
	n (non-missing)	65,694	65,694	65,694	55,791	55,791	65,694	65,694	65,499	65,499	65,694	65,694

Notes. Observations are at the examiner-month level. The causal ("WFA") sample refers to examiners who transitioned to WFA in 2012 or 2013. Descriptive statistics of the full sample, using all examiners in our dataset regardless of their remote work status, can be found in the Appendix.

TABLE 2 Causal Estimates of WFA on Productivity

Variables	(1) Total Actions	(2) Total Actions	(3) Total RCEs	(4) Total RCEs
WFA	0.509	0.574	-0.0540	0.00123
	p = 0.026	p = 0.000	p = 0.339	p = 0.975
Controls:				
Expectancy	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Grade Fixed Effects	Yes	Yes	Yes	Yes
Examiner Fixed Effects	No	Yes	No	Yes
Observations	65,694	65,694	65,694	65,694
Adjusted R-squared	0.358	0.553	0.143	0.279

Notes. Standard errors are clustered at the examiner level. Observations are at the examiner-month level and utilize the "WFA sample" of experienced examiners for Columns (1) through (4)—a subset of the main dataset that is limited to examiners who transitioned to WFA in 2012 or 2013. WFA is an indicator variable that turns on for examiner-months that transitioned into the WFA (i.e., TEAPP) program. Controls are indicated in the table above. All columns utilize data from 2007–2015.

.**TABLE 3** Degree of Geographic Flexibility – WFA vs. WFH

Variables	(1) Total Actions	(2) Total Actions
WFH (≤50 Miles)	1.339	1.035
	p = 0.000	p = 0.000
WFH (>50 Miles)	1.131	0.487
	p = 0.000	p = 0.000
WFA	1.792	1.022
	p = 0.000	p = 0.000
Controls:		
Expectancy	Yes	Yes
Year Fixed Effects	Yes	Yes
Grade Level Fixed Effects	Yes	Yes
Examiner Fixed Effects	No	Yes
Observations	576,267	576,267
Adjusted R-squared	0.354	0.562

Notes. Standard errors are clustered at the examiner level. Observations are at the examiner-month level and utilize the full sample of examiners. WFA is an indicator variable that turns on for examiner-months that transitioned into the TEAPP WFA program. WFH ≤50 and >50, respectively, are indicator variables that identify examiner-months that have transitioned into the two PHP programs. The two WFH (PHP) programs are akin to a traditional WFH program, with less geographic flexibility than a WFA program. Controls are indicated in the table above and may include year fixed effects, grade level (GS) fixed effects, expectancy (a measure of expected effort/output on an examiner-month level), and examiner fixed effects.

TABLE 4 Mechanism Test (First Office Actions)

Variables	(1) FOAs	(2) FOAs
WFA	0.220	0.135
	p = 0.001	p = 0.031
Controls:		
Expectancy	Yes	Yes
Year Fixed Effects	Yes	Yes
Examiner Fixed Effects	Yes	Yes
Grade Fixed Effects	No	Yes
Observations	55,791	55,791
Adjusted R-squared	0.320	0.325

Notes. Standard errors are clustered at the examiner level. Observations are at the examiner-month level, where Columns (1) and (2) utilize First Office Actions as an outcome variable. All regressions reflect analyses on the "WFA sample," limited to those with data on rejections and examiner-added citations. WFA is an indicator variable that turns on for examiner-months that have transitioned into the TEAPP WFA program. Controls are indicated in the table above, and include year fixed effects, grade level (GS) fixed effects, examiner fixed effects, and expectancy (a measure of expected effort/output on an examiner-month level).

TABLE 5 Ruling Out Alternative Mechanisms such as Commuting Distance and Monitoring

Variables	(1) Total Actions	(2) Total Actions
TEAPP	-0.0568	0.548
	p = 0.952	p = 0.000
Controls:		
Expectancy	Yes	Yes
Year	Yes	Yes
Grade	Yes	Yes
Adjusted R-squared	0.591	0.550
Observations	2,308	62,960
Sample	Examiners between 50–75 miles	Examiners >75 miles

Notes. Standard errors are clustered at the examiner level. Observations are at the examiner-month level and utilize the "WFA sample" of experienced examiners—a subset of the main dataset that limits to examiners that transition to WFA in 2012 or 2013. That sample is then divided into those residing within 50–75 miles of Alexandria, VA, shown in Column (1), and those residing beyond 75 miles away from Alexandria, VA, shown in Column (2). WFA is an indicator variable that turns on for examiner-months that have transitioned into the WFA (i.e., TEAPP) program. Controls are indicated in the table above, and include year fixed effects, grade level (GS) fixed effects, and expectancy (a measure of expected effort/output on an examiner-month level). All columns utilize data from 2007–2015.

TABLE 6 Robustness Tests Related to Identification Strategy (Exogeneity of Timing of Treatment)

Variables	(1) Months to WFA	(2) Months to WFA	(3) Months to WFA
Total Action	0.00436		
	p = 0.452		
Expectancy		0.0867	
		p = 0.209	
Total RCE			0.0429
			p = 0.147
Controls:			
Grade	Yes	Yes	Yes
Observations	2,771	2,771	2,771
Adjusted R-squared	0.002	0.003	0.003

Notes. All columns reflect regressions with the sample of examiners who received WFA in 2012 or 2013, limited to years prior to 2012 in order to observe pre-WFA performance. Observations are at the examiner year level, where Columns (1)–(3) estimate models testing whether prior output, expectancy, and rework are associated with the time it takes for an examiner to transition to WFA, the key source of causal variation in this study. Standard errors are clustered at the grade level.