Too hot to reject: The effect of weather variations on the patent examination process at the United States Patent and Trademark Office

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ABSTRACT

This paper documents a small but systematic bias in the patent evaluation system at the United States Patent and Trademark Office (USPTO): external weather variations affect the allowance or rejection of patent applications. I examine 8.8 million reject/allow decisions from 3.5 million patent applications to the USPTO between 2001 and 2014, and find that on unusually warm days patent allowance rates are higher and final rejection rates are lower than on cold days. I also find that on cloudy days, final rejection rates are lower than on clear days. I show that these effects constitute a decision-making bias which exists even after controlling for sorting effects, controlling for applicant-level, application-level, primary class-level, art unit-level, and examiner-level characteristics. The bias even exists after controlling for the quality of the patent applications. While theoretically interesting, I also note that the effect sizes are relatively modest and may not require policy changes from the USPTO. Yet, the results are strong enough to provide a potentially useful instrumental variable for future innovation research.

1. Introduction

For an innovation system to work efficiently, an unbiased patent examination system is essential. On the one hand, patent applications that should be granted should be granted; if they are not granted, inventors who deserve patent protection will not be able to exercise their legal rights. High-quality patent applications should also be granted at the appropriate stage of the examination process: if a high-quality patent application is unduly rejected, then even if it is eventually granted, the delay in granting may take years. The delay comes with serious consequences, especially for small entity inventors and start-ups (Farrer-Mensa et al., 2016). On the other hand, allowing patent applications that should not be granted because of obviousness or lacking novelty, has detrimental consequences. This results in higher legal costs, which burden the legal system and place often unbearable legal and financial costs on inventors (Jaffe and Lerner, 2004; Lemley and Sampat, 2008).

In an ideal world, the United States Patent and Trademark Office (USPTO) would evaluate patent applications based on merit only. It is, however, operated by humans, therefore decisions may be subject to the numerous of cognitive shortcuts and environmental influences documented in the psychology and behavioral economics literatures (Kahneman, 2011). Just as parole judges are influenced by the time of day when a decision is made (Danziger et al., 2011), one should also expect patent examiners to be at risk of cognitive biases and environmental influences.

This paper investigates one possible factor that may affect the behavior of patent examiners, and asks: does weather variation affect decision processes at the USPTO? The research question is motivated by a significant body of research that demonstrates that weather variations affect human decision making. Weather influences stock market returns (Hirshleifer and Shumway, 2003; Saunders, 1993), tipping (Rind, 1996), consumer spending (Murray et al., 2010), aggression in sports (Larrick et al., 2011), art auction prices (Kliger et al., 2015), college entry decisions (Simonsohn, 2007, 2010), and willingness to help (Cunningham, 1979). Variations in weather influence not only how people decide, but also how much they work (Lee et al., 2014). The primary mechanism behind these findings is the effect weather has on people’s mood, and consequently, their behavior in terms of optimism, risk-taking, frame of thinking, and preferences (Cao and Wei, 2005; Goldstein, 1972; Kamstra et al., 2003; Wyndham, 1969). Other proposed mechanisms include weather’s effect of expectations (Hirshleifer and Shumway, 2003) and availability of alternative activities (Lee et al., 2014).

One may expect weather variations not to influence behavior at the USPTO. While most extant research discusses the effect of weather in individual decision settings or in unstructured and unregulated settings, the USPTO is a bureaucratized government office. Decisions often are an outcome of a multi-day process. Examiners work indoors in a temperature-regulated environment with not much direct view of the external weather variations. Yet, there are pathways through which
Table 1 illustrates the decision process patent applications go through. After the inventor(s) submit a patent application, the USPTO assigns the patent application to an Art Unit and then to an examiner, and it is the task of the examiner to evaluate the specific patent application. After evaluating the patent application (and after possible other actions, such as requesting additional information from the applicant or interviewing the applicant), the examiner decides whether to allow the patent application, to give a non-final rejection, or to give a final rejection. In almost all cases after “allowance,” the patent examination process is over. A non-final rejection is a decision that invites applicants for further refinement of the application and its claims (this is similar in function to a revise and resubmit in academia). A final rejection, as the name suggests, should be final – applicants, however, can file a Request for Continued Examination (see §706.7 of the Manual of Patent Examination Process (MPEP) (USPTO, 2015)). This requires a formal appeal process with substantial additional fees and delays. Yet, the data indicate that 75% of the applications get back to the review process after a final rejection. As Table 1 illustrates, in the first round of decisions, most applications receive a non-final rejection decision (82.8%) or are allowed (17%). Only very few applications receive a “final rejection” decision in the first round. The review process then continues on, often taking multiple rounds (and often multiple years – the average length of the review process is 3–4 years). The data show that roughly 70% of the original applications will eventually be allowed. For more information about the review process, see the Manual of Patent Examination Process (MPEP) (USPTO, 2015).

2. Setting and data sources

2.1. Data on decisions by patent examiners

I obtained data from the Public Pair System on all publicly available patent application decisions at the USPTO from 2001 to 2014, in total of over 8.7 million decisions made by over 12,000 patent examiners regarding 3.5 million patent applications (for a detailed description of the dataset, see Carley et al. (2015)). Importantly, the Public Pair dataset contains the date on which the decisions were made, which I can then link to the weather data.

The paper is structured as follows. First, I introduce the setting, the datasets, and the main variables used in the analyses. Second, I demonstrate that weather variations have a significant effect on decisions at the USPTO, even after controlling for a wide range of heterogeneities at the application-level, the examiner-level, and art-unit-level. Specifically, I include in the models examiner fixed effects, art unit fixed effects, technology class fixed effect, and to control for seasonality, I include year, week-of-year, and day-of-week fixed effects. I further control for the examiner’s experience, the examiner’s workload, the decision stage, the technological width of the application, whether

<table>
<thead>
<tr>
<th>Decision order</th>
<th>Final Rejection</th>
<th>Non-final Rejection</th>
<th>Allowance</th>
<th>Total</th>
</tr>
</thead>
<tbody>
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<td>3,053,123</td>
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<td>1,344,510</td>
<td>310,173</td>
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<td>651,850</td>
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<td>226,564</td>
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<td>68,861</td>
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<td>10</td>
<td>5777</td>
<td>3989</td>
<td>15,093</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2,059,169</td>
<td>4,421,483</td>
<td>8,763,626</td>
<td></td>
</tr>
</tbody>
</table>

* 0.02% of the patent applications take more than 10 rounds, these are not included in this table.

1 Except the “Hoteling” examiners. I conducted additional analyses regarding the Hotelling examiners, see the results in Section 6.5.
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