



Partisan patent examiners? Exploring the link between the political ideology of patent examiners and patent office outcomes

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ARTICLE INFO

Keywords:

Patents
Patent examiners
Political ideology
Innovation

ABSTRACT

Patents are key strategic resources which enable firms to appropriate innovation returns and prevent rival imitation. Patent examiners – individuals who may be subject to various sources of bias – play a central role in determining which inventions are awarded patent rights. Using a novel dataset, we explore if one increasingly prevalent source of bias – political ideology – manifests in examiner decision-making. Reassuringly, our analysis suggests that the political ideology of patent examiners is largely unrelated to patent office outcomes. However, we do find evidence suggesting politically active conservative-leaning examiners are more likely to grant patents relative to politically active liberal-leaning examiners, but only for patent applications where there is ambiguity regarding what constitutes patentable subject matter and hence examiners have greater discretion.

1. Introduction

Patent protection has long been viewed as an important component to firms' ability to appropriate returns from innovation efforts (Teece, 1986). Patents function as isolating mechanisms which help firms build and sustain competitive advantages (Peteraf, 1993; Rumelt, 1984) and provide incentives for firms to invest in innovation (Arora et al., 2004), a key driver of economic growth (Grossman and Helpman, 1994; Romer, 1986; Schumpeter, 1934; Solow, 1956). Yet patents are just one of a variety of mechanisms (e.g., secrecy, complementary assets, etc.) through which firms can capture value from their innovations (Teece, 1986). The decision to seek patent protection comes with potential risks, such as imitation (Png, 2017), particularly if patent rights are not awarded because applying for patent protection entails "disclosing technical details of R&D" (James et al., 2013: 1126). Accordingly, it is important to ensure that the patent granting process operates fairly and without bias (Arora et al., 2004).

That said, the determination of whether a patent application filed with the U.S. Patent and Trademark Office (USPTO) satisfies the statutory criteria for the granting of patent rights is ultimately made by *individuals* working as patent examiners (Graham et al., 2018; Kortum and Lerner, 1999). Thus, individual patent examiners play a key role in determining which patent applications are granted (Cockburn et al., 2002; Lemley and Sampat, 2012; Sampat and Williams, 2019), an observation worth underscoring in light of growing evidence that ideological beliefs – particularly political ideology or partisan identity – strongly influence individual evaluations, behaviors, judgement, and decision-making (Jost et al., 2009). However, while strategy scholars have linked political ideology – conceptualized on a liberal-conservative or left-wing-right-wing spectrum¹ – to outcomes ranging from firm risk-taking (Christensen et al., 2015) and compensation structures (Carnahan and Greenwood, 2018) to corporate social responsibility (Gupta et al., 2017) and resource allocation (Gupta et al., 2018), we know surprisingly little about how political ideology may relate to patent office and

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¹ In the U.S., liberal or left-wing beliefs tend to be aligned with the Democratic political party while conservative or right-wing beliefs tend to be reflected in the Republican political party (Bonica, 2013). The liberal-conservative distinction is a parsimonious way to cluster beliefs and values, which political ideologies ultimately reflect (Jost, 2006). Empirically, Barberá et al. (2015) demonstrate that measures of political ideology correlate strongly with partisan affiliation i.e., Democrats tend to have liberal ideologies and Republicans tend to conservative ideologies.

innovation outcomes. That said, a better understanding of if (or when) the political ideology of patent examiners is systematically associated with patent office outcomes carries potentially important implications for patent strategy, given the central role examiners play in the patent granting process (Frakes and Wasserman, 2017; Lemley and Sampat, 2012), the growing concerns of heterogeneity in patent examiner decision-making (Frakes and Wasserman, 2018; Mann, 2014), the rising polarization in political beliefs (Pew Research Center, 2014, 2017), and, ultimately, the strategic importance of patents for firms (Balasubramanian and Sivasadan, 2011; Farre-Mensa et al., 2020).

In this study, we take a first step in evaluating if the political ideology of patent examiners is systematically related to their patent granting behaviors. While scholars have long recognized that ideological political beliefs are reflected in behavioral choice (Solow, 1970), there is theoretical debate as to whether political ideology should conceptually correlate with views regarding intellectual property (IP). Theoretically, this debate arises in part because one could deduce that conservatives should be more supportive of patents if IP protection is viewed as an extension of private property rights, which conservatives staunchly support, but less supportive of patents if IP protection is viewed as the introduction of a governmental friction to the free market, which conservatives generally oppose (Mandel, 2014). Accordingly, Bartow (2007) argues that IP and patent positions are not subject to partisan divide and there is a view among legal scholars that, unlike issues such as capital punishment or abortion (Sunstein et al., 2004), judicial decisions in IP cases are more immune from the influence of political ideology – something referred to as “IP exceptionalism” (Sag et al., 2009). Yet others, such as Wittlin, Ouellette, and Mandel (2018: 1217) argue that “IP policy preferences might have some political valence”, citing surveys of laypersons conducted by Mandel (2014) and Mandel et al. (2015) which report positive correlations between self-reported conservative political ideology and preferences for stronger patent protection, a result largely consistent with surveys capturing the views of practicing IP attorneys (Wittlin et al., 2018). In the judicial and legal context, Sag et al. (2009) find that conservative judges and judges appointed by Republicans are more likely than liberal judges and judges appointed by Democrats to vote in favor of recognizing and enforcing IP rights, although the small number of other studies examining judicial ideology and IP do not detect any significant relationship between the two (Beebe, 2006; Moore, 2001).

Taken together, these findings suggest that conservative views, on the margin, tend to correlate with a more positive take on IP protection. In the context of patent examiners, this implies that patent applications handled by conservative-leaning examiners might have a higher probability of being granted relative to applications handled by liberal-leaning examiners. That said, the USPTO has instituted checks and balances to help ensure a fair evaluation of patent applications, but, by construction, such processes work best when what constitutes patentability is objective. Therefore, to the extent that ideology plays a role in patent granting behavior, it should be most observable when what constitutes a patentable invention is inherently subjective/abstract and hence examiners have more discretion in their decisions.

To distinguish between situations where patent examiners have more or less discretion, we evaluate the role of ideology in patent granting decisions for software patent applications relative to non-software

patent applications. We focus on software patenting because it is a notoriously controversial domain (Bessen, 2012; Kuhn, 2007; Nichols, 1998), as software is “an abstract technology” with naturally “unclear boundaries” (Bessen and Meurer, 2008: 187). As described by Bessen and Hunt (2007: 157–158), “The traditional view in patent law is that abstract ideas are not in themselves patentable. Yet computer software can be quite abstract, sometimes being little more than an algorithmic representation of mathematical principles.”² At the same time, empirical patterns suggest that intellectual property pertaining to software has become increasingly important from a competitive standpoint. For example, Hall and MacGarvie (2010) and Chung et al. (2019) find that, on average, firms with software-related patents have a higher market value than firms without software patents. Likewise, Bessen (2020) shows firms are spending more than twice as much on proprietary information technology as physical capital investment, and Bessen and Frick (2018) argue “that technology, and specifically software, is behind the growing dominance of big companies”. Software thus not only represents a situation where a lack of clarity regarding patentable subject matter is likely to result in greater examiner discretion and hence greater possibility of ideological influence, but also a situation where the outcome of patent examiner decisions is likely to have an increasingly important competitive effect on firms and markets.

We begin with the Patent Examination Research Dataset (Patex), a comprehensive database which contains detailed data on patent examiners and the patent applications they are assigned (Graham et al., 2018). To capture political ideology, we use the national voter file provided by the commercial data provider L2 which contains partisan affiliation for all registered voters in the U.S. as reflected in voter registration records. This allows us to infer the political ideology for a substantially larger number of patent examiners than would be possible if we relied solely on the common approach of measuring political ideology through political donations (Bonica, 2014). While the national voter file forms the basis of our sample, we also take advantage of political donations to leverage the fact that individuals who donate to political campaigns tend to be systematically more passionate about political issues and typically represent relative extremes on the political spectrum (Francia et al., 2003; Johnson, 2010). Thus, using contribution data in conjunction with the national voter file allows us to explore the potential existence of average differences between liberal and conservative examiners using voter registration records, and then explore if any such differences are more salient (or solely exist) among the subset of patent examiners who donate and hence are likely to have stronger interests in politics.

We first investigate the relationship between examiner political ideology and their propensity to grant patents. We then explore several other aspects of the patent evaluation process, such as changes in claim length, the time-length to patent granting, and the number of internal appeals. The intuition behind this approach is that, even if patent applications handled by liberal and conservative examiners exhibit no differences in the likelihood of being granted, more stringent examiners may add more contingencies in patent claim text thus lengthening it and narrowing patent scope (Kuhn and Thompson, 2019), delay the process by taking more time to issue patent granting decisions (Cockburn et al., 2002), and/or evaluate patent applications in a perceived unfair way that invites internal appeals (Frakes and Wasserman, 2017).

² We focus on software patent applications following extensive discussions with, and at the suggestion of, patent office experts. While a degree of ambiguity in what constitutes patentable subject matter may exist for other technologies (e.g., DNA-related patent applications), we are unaware of any equally robust evidence of similar or higher ambiguity with respect to patentability in other technological domains (Bessen, 2012; Bessen and Hunt, 2007). This tension has led to a long standing “software patent debate” and blurred lines of what constitutes patentability in the software domain (Nichols, 1998), an issue raising bipartisan concerns regarding patent reforms (Tillis and Coons, 2019).

Reassuringly, we largely confirm a null relationship between the political ideology of patent examiners and patent examination outcomes. On average, patent applications handled by conservative and liberal-leaning patent examiners do not differ in terms of grant likelihood, change in patent scope, time to issuance, or internal appeals. This pattern holds for both non-software and software patent applications, suggesting that the political ideology of examiners does not play a major role in patent office outcomes, even in situations where examiners have a fair amount of discretion. However, when we restrict our analysis to the subset of examiners who donate to political campaigns and hence are likely to be more politically active (Johnson, 2010), we find some evidence suggesting the possibility that examiner ideology plays a role in examiner decisions, but only in the case of software patents where discretion is relatively high. In these cases, we find that, relative to software applications handled by liberal-leaning examiners, software applications handled by conservative-leaning examiners have a higher likelihood of being granted, receive less narrowing of patent scope, and have a shorter time to issuance.

Taken together, our results are encouraging in that they suggest political ideology is unlikely to play a major role in determining patent office outcomes. At the same time, our results also suggest the possibility the patent office may not be completely immune from ideological interference, particularly when examiners have strong political interests and discretion in their decisions – a result consistent with growing evidence suggesting heterogeneity in how examiners evaluate patents (Frakes and Wasserman, 2017, 2018; Lemley and Sampat, 2012; Mann, 2014). We hope that our study sets the stage for a deeper dive into the study of how political ideologies may relate to patent office and other innovation outcomes.

2. Data

We start with the Patent Examination Research Dataset (Patex), a comprehensive database which contains detailed information on over 9.2 million patent applications filed with the USPTO (Graham et al., 2018). The Patex database tracks patent applications through 2016 and lists the names of examiners assigned to each application along with their patent granting decision. Patent examiners are assigned a unique identifier, which enables us to track examiners over time. A detailed description of Patex is found in Graham et al. (2018). We restrict the dataset to published utility patent applications that do not exercise the opt-out provision of the American's Inventor Protection Act (AIPA) to avoid including patent applications that are subject to special processing considerations (Lemley and Sampat, 2012).

Next, we employ data provided by Frakes and Wasserman (2017) which includes details on the examiners' role in the patent office. To maximize coverage, we supplement this data with our own data derived from USPTO administrative personnel records that we obtained from the U.S. Office of Personnel Management (OPM). These longitudinal records allow us to control for factors which may influence an examiner's decision-making (e.g., tenure, pay, art unit, etc.) (Lemley and Sampat, 2012; Mann, 2014) along with an examiner's broader experience working for U.S. governmental agencies. In addition, we employed a leading commercial multi-cultural marketing firm, Ethnic Technologies, which uses a proprietary name classification algorithm to assign examiners' gender.

To measure political ideology, we use two data sources. First, we utilize partisan affiliation recorded in the national voter file provided by the commercial data supplier L2 which sources voter registration records from individual states, cleans and standardizes the data, and sells it to congressional offices, research institutions, media outlets, among others. The voter file provided by L2 is commonly used in political science research (e.g., Brown and Enos, 2021) and trusted by major media outlets (e.g., New York Times, CBS, etc.). In most states, voter registration records allow voters to self-identify their partisan affiliation when registering to vote. However, in Virginia, the location of the

USPTO headquarters, voters do not register by political party. For states such as Virginia, L2 provides a predicted partisan affiliation using a proprietary partisan classification algorithm which uses primary ballot selections, voter turnout, and extensive consumer/household information – including spending patterns derived from credit card transaction data – to model affiliation.³ Our second data source for political ideology is Bonica's (2014) Database on Ideology, Money in Politics, and Elections (DIME). The DIME database is the most comprehensive dataset of political contribution activity, containing over 130 million contributions made to local, state, and federal elections. In addition to aggregating individual monetary contributions to political campaigns in all cycles (i.e., every two years), the DIME also generates ideological point estimates (CFscores) for donors which approximates the views of politicians and donors on the liberal-conservative continuum (ranging from –2 to 2) (Bonica, 2013, 2014).⁴

To match examiners listed in Patex with voter registration records in the national voter file provided by L2, we must overcome a key challenge resulting from the fact that these two databases contain limited overlapping information aside from individual names. Specifically, we lack a high-quality discriminating variable – such as employer – which can be used in conjunction with individual names to facilitate record-linking. To overcome this challenge, we follow Raffiee et al. (2022) and leverage recent advances in probabilistic matching to link Patex with voter registration records via the Expectation Maximization (EM) algorithm, a matching approach which facilitates record-linking in the presence of limited overlapping information (Enamorado et al., 2019). We provide a more detailed explanation of our matching approach in Appendix B. The lack of a high-quality discriminating variable is not an issue when matching the Patex data with the DIME, as the DIME data includes self-reported employer and occupation. Thus, we match Patex with DIME using conventional string matching where we match on first name, last name, and employer. Details of our string matching are in Appendix C.

We restrict our dataset to years between 2002 and 2012 for several reasons. First, a significant share of patent applications filed in the years prior to 2001 are not captured by Patex because, prior to the American Inventor's Protection Act of 1999 (which came into effect in late 2000), the USPTO published only applications of granted patents. Second, prior to the 2001–2002 election cycle, the DIME coverage of contributions is sparse (Bonica, 2014). Third, the data we use to measure changes in patent scope (change in claim length) is only available until 2012 (Kuhn and Thompson, 2019).

In total, we are able to match 6926 patent examiners to voter registration records. This represents an effective match rate of 91.8 % of the total 10,783 examiners listed in Patex, when considering that approximately 70 % of eligible voters are registered to vote (U.S. Census, 2021). We are able to match 324 patent examiners to the DIME data. This represents approximately 3 % of the total number of patent examiners, consistent with the donation rate of the general U.S. population (Bonica, 2014; Bonica et al., 2015).

2.1. Sample construction and empirical strategy

Our estimation sample covers 11 years (between 2002 and 2012,

³ For more information about L2, we refer readers here: <https://l2-data.com/>. For information about L2's affiliation modeling, which is widely used by political campaigns, we refer readers here: <https://l2-data.com/states/virginia/>. While our L2 data includes voter registration data as observed in 2016, we note that extant research has demonstrated individuals' political preferences tend to be largely stable over time (Prior, 2010; Sears and Funk, 1999).

⁴ An overview of the CFscores is provided in Appendix A. Bonica (2018) provides a compendium of the validation exercises which demonstrate predictive validity, external validity, and internal validity of the estimated CFscores.

inclusive) of patent applications. Our sample and hence our analysis is conditional on published patent applications, excluding applications which exercised the opt-out provision of AIPA. We follow [Lemley and Sampat \(2012\)](#) and [Frakes and Wasserman \(2017\)](#) and restrict our analysis to applications which received a final disposition.

To explore the relationship between a patent examiner's political ideology and the likelihood the application results in a granted patent, we estimate the following equation:

$$Grant_{a,i,k,t} = \alpha Conservative_i + X_{i,t} + Z_{a,t} + I_i + \delta_k + \gamma_t + \varepsilon_{i,t} \quad (1)$$

where a indexes the individual patent application, i indexes the individual patent examiner, k indexes the technology class corresponding to the patent application, and t indexes the year in which the patent examiner disposed the patent application. Our dependent variable, $Grant_{a,i,k,t}$, is a binary indicator which takes the value of 1 if the patent application is granted and zero otherwise (i.e., abandoned).⁵ We estimate this equation separately using our sample of examiners where we use voter registration records to measure partisan affiliation and our sample of examiners where we use political donations to measure political affiliation. For our main sample which uses voter registration, our independent variable of interest is $Conservative_i$, which is a dummy equal to 1 if patent examiner i is registered as a Republican and zero if the patent examiner is Registered as a Democrat.⁶ For our sample which uses political donations, the variable $Conservative_i$ takes a value of 1 if the DIME point estimate of ideological leaning (CFscore) of patent examiner i is above zero (i.e., conservative, and zero otherwise, i.e., liberal).⁷

To account for factors that might confound our results, $X_{i,t}$ includes a set of time-variant examiner attributes comprised of examiners' yearly GS pay-levels, art unit i.e., technological expertise, experience working for a government agency, experience working for the USPTO, and, to account for the customer's experience with the patent examiner, the number of applications the examiner has previously handled and granted for the customer. A customer in Patex refers to the correspondent managing the patent application, usually the law firm or legal department of the firm assigned to the application. $Z_{a,t}$ captures a set of attributes for application's a filer which includes a dummy variable equal to one if the filer is flagged as a small entity by the USPTO (individual inventors, non-profits, and firms <500 employees), a count of patent applications previously filed by the focal customer, the number of patents previously granted to the focal customer, and if the application is a continuation. Additionally, I_i captures the examiner's gender which is time invariant, δ_k are patent application technology class fixed effects (based on USPTO USPC codes), and γ_t are year fixed effects.

⁵ For abandoned applications, Patex includes more detailed status codes which categorize the reason for abandonment. The predominant code in the Patex data is status code 161: "Abandoned – Failure to Respond to an Office Action". According to the USPTO, "An Office action is written correspondence from the patent examiner that requires a properly signed written response from the applicant in order for prosecution of the application to continue. Moreover, the reply must be responsive to each ground of rejection and objection made by the examiner." Our results are obtained through an analysis which only includes abandoned applications with status code 161, thereby ensuring that applications are abandoned in response to examiner actions (e.g., failure to respond to an examiner's rejection or objection), rather than abandoned for other reasons unrelated to actions of the patent examiner (e.g., wrong form filed etc.).

⁶ A small number of examiners register as Independents. We exclude these examiners from our main analysis to facilitate comparability with our donation-based proxies which are restricted to donations to liberal and conservative-leaning candidates. That said, the patterns persist when we include Independent examiners in our analysis.

⁷ We collapse the CFscores into a dummy variable to maintain comparability and consistency with our voter registration indicator which is a dummy. That said, the results remain robust when we use the continuous version of the CFscores.

As we described above, we separately estimate the role of political ideology in granting of non-software and software patent applications because we want to take into account the fact that some patent applications are more clear-cut than others, and hence harder to permit political ideology interference within the constraints of the checks and balances of the USPTO processes, assuming ideology is an influential factor. In software patenting, the boundaries of what qualifies for patentable subject matter are generally considered fuzzier than many other types of patent applications ([Kuhn, 2007](#); [Graham and Somaya, 2004](#)). Thus, if patent granting likelihood differs between applications handled by liberal- and conservative-leaning examiners, it may be more visible for software patent applications where what constitutes something patentable is more subjective and hence examiners will have more discretion.⁸ We identify software patent applications by using the patent classes and class-subclass pairs listed in [Graham and Vishnubhakat \(2013: 75\)](#), which were vetted by patent office experts who studied all patent classes and subclasses and identified "classes in which patents with software claims are most likely to be found".

To further probe the possibility that liberal and conservative patent examiners differ in their patent evaluation behaviors, we explore three additional aspects of the patent granting process: changes in claim length, the time-length to patent granting, and the number of internal appeals. We collect data on the percentage change in patent claim length from [Kuhn and Thompson \(2019\)](#), calculated as the percentage difference in independent claim length (words) at the time of first patent application and independent claim length (words) at the time of patent grant, a measure of patent scope extensively validated with patent office experts and practitioners. The data covers only a subset of our sample and is restricted to granted patents by construction of the measure. We are careful to keep this limitation in mind when interpreting our results. The results we report are robust when we use an absolute value of change in claim length. We calculate the time-length to patent granting as the number of days to patent issuance from the time of application using the application and grant dates recorded in the Patex database. Finally, we obtain the number of internal appeals filed for each application from the Patex database. These additional dependent variables allow us to explore if the ideology of examiners is related to variation in outcomes of the patent application process beyond simple patent granting.

We modify our estimating equation to estimate a linear model for our claim length dependent variable and negative binomial models for the time-length to patent granting and the number of internal appeals dependent variables. We evaluate the three outcome variables separately in the context of software patent applications and non-software applications, using both our voter registration and donation-based measures of political ideology which reflect examiners likely more politically active.

When interpreting our results, it is important to note that political ideology is an endogenous outcome which likely reflects one's past life experiences and upbringing (e.g., [Jost, 2006](#)) and that the liberal-conservative spectrum is a parsimonious way to proxy for an underlying set of beliefs ([Jost et al., 2008](#)). From this perspective, political ideology cannot be randomly assigned to patent examiners. Thus, we interpret our results under the assumption that individuals do not choose their life forming experiences and hence their political ideology

⁸ As [Bessen and Meurer \(2008: 23\)](#) write, "software is inherently more abstract than other technologies", which means that "the technology claimed in a patent can be difficult to distinguish from alternatives; it might be hard to know whether a given patent claims an invention that is different from previous inventions". To put the level of abstraction in perspective, [Bessen and Meurer \(2008: 23\)](#) argue, "if computer scientists cannot unambiguously make these distinctions, there is little hope that judges and juries can do better". Note also that individuals with liberal political ideologies may tend to be more supportive of free software ([Coleman, 2004](#)), which may manifest in them being more stringent when evaluating software patent applications.

in expectation of later influencing patent office outcomes. From this perspective, we argue that our analysis is informative because it speaks to the natural process through which ideology might manifest in patent granting behavior: People form political ideologies and select into working for the USPTO; our analysis is set to inform on the consequences of this process. To do so robustly, we also control for several attributes that might influence the process of patent application assignment among examiners, as described earlier.⁹

3. Results

Table 1 presents logistic regression results investigating the impact of examiners' political ideology on the likelihood a patent application is

Table 1
Relationship between patent examiner political ideology and patent granting.

	DV = patent granted dummy			
	(1) Voter registration Non-software	(2) Voter registration Software	(3) DIME Non- software	(4) DIME Software
Conservative	0.989 (0.022)	0.994 (0.024)	0.831 (0.119)	1.444** (0.213)
Experience at USPTO	1.006*** (0.002)	1.009*** (0.003)	1.017* (0.008)	1.011 (0.010)
Experience in government	1.000 (0.001)	0.998 (0.002)	0.989** (0.006)	1.000 (0.008)
Small entity indicator	0.490*** (0.006)	0.308*** (0.004)	0.570*** (0.027)	0.310*** (0.017)
Filer prior number of patent applications (in thousands)	1.011*** (0.001)	1.018*** (0.002)	1.012*** (0.003)	1.018*** (0.005)
Filer prior number of granted patents (in thousands)	0.986*** (0.001)	0.979*** (0.002)	0.986*** (0.004)	0.980*** (0.007)
Filer prior number of patent applications (by examiner)	1.042*** (0.003)	1.282*** (0.022)	1.053*** (0.015)	1.267*** (0.056)
Filer prior number of granted patents (by examiner)	0.968*** (0.002)	0.807*** (0.012)	0.958*** (0.011)	0.813*** (0.032)
Continuation application	1.004 (0.008)	1.131*** (0.010)	0.867*** (0.031)	1.136*** (0.040)
GS pay level, art unit, gender, USPC code, year FEs	Yes	Yes	Yes	Yes
LL	-502,312.27	-276,458.18	-32,490.58	-13,642.23
Pseudo R- squared	0.147	0.205	0.171	0.231
Observations	874,372	551,466	57,373	29,637

Notes: the data is a time series at the patent application level, restricted to decisions of patenting made between 2002 and 2012, inclusive. All models are logit with robust standard errors, clustered by examiner ID. Displaying odds ratios, and standard errors in brackets. *at 10 %, **at 5 %, ***at 1 %.

⁹ Righi and Simcoe (2019) warn that the assignment of patent applications to examiners is not entirely random but rather influenced by examiners' accumulated application evaluation expertise. In general, patent examiners are assigned patent applications within their art units as described in the Manual of Patent Examination Procedure (MPEP) 903.8 "Applications: Assignment and Transfer": "examiners have full authority to accept any application submitted to them that they believe is properly classifiable in a class in their art unit".

granted using voter registration. In columns 1 and 2, we use voter registration as our measure of political ideology. In columns 3 and 4, we restrict our sample to patent examiners who donate to political campaigns and use a donation-based measure to proxy examiner ideology. As demonstrated in columns 1 and 2, the estimated coefficient for our conservative indicator has a high *p*-value, meaning that we are unable to reject the null hypothesis. Political ideology does not appear to be correlated with patent granting, for both non-software (column 1, *p*-value = 0.639) and software (column 2, *p*-value = 0.801) patent applications. In columns 3 and 4, we replicate columns 2 and 3 but restrict our sample to examiners who donate to political campaigns. We fail to detect a statistical difference between liberal and conservative examiners for non-software patent applications (column 3, *p*-value = 0.196), however, the coefficient estimate for our conservative indicator is positive with a low *p*-value (*p*-value = 0.013) in column 4 when we focus on software patent applications. The coefficient indicates that a software patent application is 44 % more likely to be granted when the assigned examiner is conservative-leaning relative to the case when the assigned examiner is liberal-leaning. Stated differently, the odds of a software patent application being granted is 1.44 larger if the application is handled by a conservative-leaning examiner instead of a liberal-leaning examiner. This means that, for example, for roughly 16 software patent applications submitted, 10 will be granted if handled by conservative-leaning examiners whereas 7 will be granted if handled by liberal-leaning examiners.¹⁰ Together, these results suggest that the political ideology of examiners is unlikely to play a major role in the granting of patent rights, although examiners who are strongly conservative (e.g., donators) are potentially more likely than examiners who are strongly liberal to grant patent rights, but only when they have a fair amount of discretion (e.g., software patent applications).¹¹

Next, we turn our attention to our other outcomes of interest that might reveal an influential role of political ideology in the patent evaluation process. We start with changes in claim length. We modify our main estimating Eq. (1) by replacing the dependent variable with the percent change in claim length associated with each patent application, as provided by Kuhn and Thompson (2019), which is log transformed. We report the results from this linear specification in Table 2. The

¹⁰ We lack an objective baseline to estimate if the difference is economically significant. Moreover, we do not observe the type of firm for which patent applications would have been accepted if handled by conservative-leaning examiners. For example, in our data, we can distinguish between applications filed by small entities, which include individual inventors, teams of individual inventors, not-for-profit organizations, or firms with <500 employees. Although we find that the impact on the likelihood of granting software applications is not different for small entities than for all other filers, this does not exclude the possibility that some of the applications with a higher likelihood of being granted because they are assigned to conservative-leaning examiners do not belong to start-ups. If some of these patent applications were to belong to a start-up, extant literature suggests that the difference could be economically significant given the pivotal role of patents in helping start-ups secure funds and succeed in the market (e.g., Cockburn and MacGarvie, 2009; Farre-Mensa et al., 2020; Kuhn and Teodorescu, 2021). Even if start-ups are not part of the affected filers, extant literature suggest the difference we identify could have economically meaningful consequences. For example, in the context of more established firms, Balasubramanian and Sivadasan (2011) use census data to show that patenting is positively correlated with firm outcomes such as growth and total factor productivity. Software patents are also commonly part of a firm's broader patent portfolio or so-called patent thicket (Cockburn and MacGarvie, 2009; Noel and Schankerman, 2013), which may alter the economic value of a random software patent relative to patents in more discrete product industries where thickets may be less common. We leave evaluation of the impact of patenting outcomes – both software and non-software – for firms to future work.

¹¹ Given that we find evidence of a difference in patent granting behavior only for this subset of patent examiner, we include additional analyses about this group in Appendix D.

Table 2
Patent examiner political ideology and narrowing of patent scope.

DV = increase in claim length (logged plus one)				
	(1) Voter registration Non- software	(2) Voter registration software	(3) DIME Non- software	(4) DIME Software
Conservative	0.003 (0.002)	−0.000 (0.003)	0.000 (0.012)	−0.029** (0.012)
Experience at USPTO	−0.001*** (0.000)	−0.002*** (0.000)	−0.000 (0.001)	−0.002** (0.001)
Experience in government	0.000 (0.000)	0.000** (0.000)	−0.000 (0.001)	0.000 (0.000)
Small entity indicator	−0.001 (0.001)	−0.004*** (0.002)	−0.002 (0.007)	0.004 (0.008)
Filer prior number of patent applications (in thousands)	−0.000*** (0.000)	−0.000 (0.000)	−0.000 (0.000)	−0.000 (0.000)
Filer prior number of granted patents (in thousands)	0.001*** (0.000)	0.000 (0.000)	0.001 (0.001)	0.001 (0.001)
Filer prior number of patent applications (by examiner)	−0.001*** (0.000)	−0.001*** (0.000)	−0.000 (0.000)	−0.000 (0.001)
Filer prior number of granted patents (by examiner)	0.000*** (0.000)	0.001*** (0.000)	0.000 (0.000)	0.000 (0.001)
Continuation application	−0.017*** (0.001)	−0.014*** (0.001)	−0.011** (0.005)	−0.010** (0.005)
GS pay level, art unit, gender, USPC code, year FEs	Yes	Yes	Yes	Yes
R-squared	0.057	0.122	0.087	0.153
Observations	278,394	248,400	14,637	13,956

Notes: the data is a time series at the patent application level, restricted to decisions of patenting made between 2002 and 2012, inclusive. All models are OLS with robust standard errors, clustered by examiner ID, standard errors in brackets. *at 10 %, **at 5 %, ***at 1 %.

pattern of results in Table 2 mirror those reported in Table 1, in that the political ideology of patent examiners is unrelated to changes in claim length in all specifications (column 1 p -value = 0.213, column 2 p -value = 0.874, column 3 p -value = 0.990) except column 4, which focuses on software applications handled by examiners who donate to political campaigns. Here, we find that the percentage change in claim length is estimated to be 13.6 % lower (p -value = 0.020), on average, if the software application is granted by a conservative-leaning examiner when compared to software applications granted by liberal-leaning examiners. Together, the pattern of results indicate that the political ideology of examiners is not likely to correlate strongly with a tendency to narrow the scope of patents granted, although it appears as if conservative examiners who donate to political campaigns engage in less narrowing of patent scope than do donating liberal examiners, a pattern restricted only to situations where examiner discretion is high.

In Table 3, we explore the time it takes for a patent application to be issued. Patent examiners vary in the time they take to issue patents (Cockburn et al., 2002) and thus the intuition underlying our analysis is that, even if patent examiners ultimately grant patent rights, examiners who are stringent may drag the application process for extended periods or, conversely, lenient examiners may issue patents in a relatively shorter period of time. We modify estimating Eq. (1) to implement a negative binomial given that our dependent variable is count (days). We do not detect statistical differences in time to patent issuance for patents granted by liberal and conservative examiners (column 1 p -value = 0.233, column 3 p -value = 0.610), except for the subsample of examiners handling software patents where discretion is high (column 2 p -value = 0.083, column 4, p -value = 0.000). As in Table 1, the effect is strongest in our subsample of donating examiners. Here, the coefficient estimate indicates that software patents granted by conservative-leaning

examiners take, on average, 12 % less time to issue (approx. 150 less days or 5 months) when compared to software patents granted by liberal-leaning examiners. The results remain robust to considering an OLS estimation with a logged dependent variable.

Lastly, we explore potential differences the number of internal appeals each type of examiner receives. Internal patent appeals are filed when patent applicants are unsatisfied with the examiner's decision (Frakes and Wasserman, 2018). Thus, if political ideology is to influence the application evaluation process, it might also manifest in the number of internal appeals filed. It is important to note that the number of internal appeals would only catch situations where examiners appear tough – they do not grant the application and their evaluation is perceived as unfair – because presumably, filers do not complain if the examiner grants the patent. We report the results in Table 4, and, as in the case of time-length to issue, we estimate a negative binomial model because our outcome of interest is a count variable. As with the results presented in Tables 1–3, we do not detect any statistical difference between conservative and liberal examiners when focusing on the subset of examiners for whom we measure political ideology with voter registration, both for software and non-software patent applications (column 1 p -value = 0.120, column 2 p -value = 0.387). When we restrict our sample to donating examiners, we find that conservative leaning examiners appear more likely to be appealed relative to liberal leaning examiners for non-software patents (column 3 p -value = 0.003) but not software patents (column 4 p -value = 0.091). The results remain robust to considering an OLS estimation with a logged dependent variable. We believe this finding is aligned with our other results suggesting that political ideology has the potential to play a role in the likelihood of granting patents for politically active examiners when ambiguity of what qualifies as patentable is high. Specifically, the fact that, outside software, applications handled by conservative-leaning examiners are more likely to be appealed than those handled by liberal-leaning examiners, but the same does not hold for software application, suggests that the ambiguity of software applications either allows conservative-leaning examiners to be more lenient than their colleagues, and hence their decisions challenged less, or, conversely, allows liberal-leaning examiners to be more stringent because the ambiguity of what is something patentable in the case of software makes it difficult to challenge examiners' ruling.

4. Discussion and conclusion

Using a newly constructed database that pairs patent examiners with multiple measures of political ideology, this study explored the possibility the political ideology of patent examiners may correlate with patent office outcomes. Reassuringly, our analysis largely confirms a null relationship between patent examiner ideology and their propensity to grant patents. In general, we do not detect statistical differences between liberal and conservative patent examiners, even in situations where examiner discretion is high. That said, for the subset of examiners who donate to political campaigns, we find some evidence suggesting that conservative examiners are more likely than liberal examiners to grant patents, although this finding is restricted to software patents where examiners have more discretion. Here, patents granted by conservative-leaning examiners also tend to experience less narrowing of patent scope and are granted quicker than patents granted by liberal-leaning examiners. Overall, our results suggest that the political ideology of patent examiners is unlikely to play a major role in determining patent office outcomes, while also providing evidence suggesting that ideology may potentially manifest in patent office outcomes in circumstances where politically active examiners have more discretion.

Before discussing our contributions, we note that our analysis is subject to several limitations. First, we are careful in interpreting our results as providing causal evidence of the effects of political ideology on patent evaluation behavior. Although we take several steps to reduce endogeneity concerns, including estimating models that control for

Table 3
Relationship between patent examiner political ideology and time to patent issuance.

DV = days to issue				
	(1) Voter registration Non-software	(2) Voter registration Software	(3) DIME Non-software	(4) DIME Software
Conservative	0.994 (0.005)	0.992* (0.005)	1.013 (0.027)	0.889*** (0.016)
Experience at USPTO	1.000 (0.000)	0.999 (0.000)	0.997 (0.002)	0.998 (0.002)
Experience in government	1.000 (0.000)	1.000 (0.000)	1.003 (0.002)	0.997 (0.001)
Small entity indicator	0.995*** (0.002)	1.002 (0.003)	1.006 (0.007)	1.035*** (0.010)
Filer prior number of patent applications (in thousands)	1.000*** (0.000)	1.000 (0.000)	0.999 (0.001)	1.000 (0.000)
Filer prior number of granted patents (in thousands)	0.998*** (0.000)	1.000 (0.000)	1.001 (0.001)	0.999 (0.001)
Filer prior number of patent applications (by examiner)	1.000*** (0.000)	0.996*** (0.000)	0.998** (0.001)	0.998 (0.001)
Filer prior number of granted patents (by examiner)	1.001*** (0.000)	1.003*** (0.000)	1.002** (0.001)	1.001 (0.001)
Continuation application	0.891*** (0.002)	0.855*** (0.002)	0.895*** (0.008)	0.847*** (0.008)
GS pay level, art unit, gender, USPC code, year FEs	Yes	Yes	Yes	Yes
LL	−3,821,851.90	−2,771,391.90	−244,284.73	−155,801.46
Pseudo R-squared	0.026	0.031	0.030	0.034
Observations	526,012	374,274	33,416	21,298

Notes: the data is a time series at the patent application level, restricted to decisions of patenting made between 2002 and 2012, inclusive. All models are negative binomial with robust standard errors, clustered by examiner ID. Displaying incidence rate ratios and standard errors in brackets. *at 10 %, **at 5 %, ***at 1 %.

attributes identified in the literature as influencing patent granting behaviors, our analysis is conditional on selection into working for the USPTO. Second, our analysis is restricted to a comparison of patent applications handled by liberal-leaning and conservative-leaning patent examiners, either as reflected in voter registration or donations. In this sense, we lack an ideological-free baseline which would enable us to explore and quantify the degree to which ideology introduces potential systematic bias into the patent system i.e., absent a neutral baseline, it is unclear if our results are driven by liberal-leaning examiners being too stringent or conservative-leaning examiners being too lenient. Third, to identify situations where examiners have more discretion, we focused on software patent applications, given that software is an inherently abstract and thus a subjective domain (e.g., [Bessen and Meurer, 2008](#)). A limitation of this approach is that it remains unclear to what degree our result generalizes beyond software and applies more broadly to individual patent applications which exhibit similar levels of subjectivity in other technology classes. Future research can explore this, perhaps by investigating how examiner ideology correlates with patent office outcomes for marginal inventions, in the spirit of [Palangkaraya et al. \(2011\)](#) and [de Rassenfossé et al. \(2021\)](#). Last, we are limited by the small number of examiners that both donate to political campaigns and are active at the USPTO during our observation period. While we use these individuals to proxy for examiners who have more extreme political views ([Johnson, 2010](#)), we recognize that the small sample of these examiners prevents us from more detailed analysis and robustly rejecting the null.

The limitations notwithstanding, our study offers several contributions to the literature. First, from a competitive standpoint, understanding potential sources of bias within the USPTO and nuances in the patent granting process is important because it has implications which can inform firm decisions regarding when or under what conditions to seek patent protection, use other value capture mechanisms, or bundle patents with other types of mechanisms (e.g., secrecy, complementary assets, etc.) to attempt to appropriate and capture value from innovation efforts. Indeed, it is perhaps not surprising that firms which have in-house expertise in patent law and a more refined understanding of the patent granting process tend to have better patenting performance ([Somaya et al., 2007](#)). While natural variation exists across examiners in

terms of the likelihood to grant patents ([Sampat and Williams, 2019](#)), our findings largely suggest that this variation does not systematically vary with an examiners political ideology and hence firms should feel comfortable seeking patent protection for their inventions if they feel patenting is the best mechanism to ensure value capture ([James et al., 2013](#)) – a reassuring finding in a world becoming increasingly polarized politically ([Pew Research Center, 2017](#)).

While our results suggesting a lack of ideological influence in the USPTO is worthy of cheer, the notion that more extreme ideological beliefs may be at play in the context of software patent applications is particularly interesting given the proliferation of software patenting by large firms ([Bessen and Frick, 2018](#)). Such firms typically have legal departments and resources necessary to appeal unfavorable patent examination decisions, a process designed to disincentive appeals as it typically takes multiple years from start to finish and costs tens of thousands of dollars in filing and legal fees ([Stephenson, 2017](#)). Thus, for start-up firms, “randomly” drawing a more extreme liberal-leaning patent examiner may spell doom, as a rejected patent application may leave the start-up with the technical details of their software program disclosed but without legal protection. [Heinze \(2002: 40\)](#) describes this tradeoff as the plight of the software patent attorney working for small and start-up firms: “We all know the drill. A software start-up asks you to write a patent application for their one and only product...you suggest to your client that including a copy of the program listing in the application might not be such a bad idea. Then, after a long pause, your client finally asks, ‘Isn’t there some way to include the essence of the code without making it so easy for my competitors to copy ‘...So there you sit, on the horns of a dilemma. Your client would like to disclose as little as possible about its software, and yet, you know this is just what the best mode and enablement requirements were intended to prevent.’ Drawing examiners systematically harsh when evaluating software patents only amplifies these risks and hence provide an incentive for firms (especially

Table 4
Relationship between patent examiner political ideology and internal appeals.

DV = number of internal appeals				
	(1) Voter registration Non-software	(2) Voter registration Software	(3) DIME Non- software	(4) DIME Software
Conservative	0.957 (0.027)	0.975 (0.028)	1.332*** (0.129)	0.682* (0.155)
Experience at USPTO	1.002 (0.002)	1.000 (0.003)	0.993 (0.006)	1.004 (0.018)
Experience in government	0.995*** (0.002)	0.996 (0.003)	1.010** (0.004)	0.997 (0.012)
Small entity indicator	0.693*** (0.011)	0.557*** (0.012)	0.758*** (0.042)	0.695*** (0.065)
Filer prior number of patent applications (in thousands)	0.999 (0.001)	1.005*** (0.001)	0.999 (0.003)	1.015*** (0.005)
Filer prior number of granted patents (in thousands)	1.001 (0.001)	0.994*** (0.001)	1.001 (0.003)	0.980*** (0.006)
Filer prior number of patent applications (by examiner)	0.989*** (0.001)	0.983*** (0.002)	0.987*** (0.004)	0.999 (0.008)
Filer prior number of granted patents (by examiner)	1.008*** (0.001)	1.015*** (0.002)	1.011*** (0.004)	1.005 (0.007)
Continuation application	0.860*** (0.011)	0.817*** (0.011)	0.840*** (0.041)	0.811*** (0.044)
GS pay level, art unit, gender, USPC code, year FEs	Yes	Yes	Yes	Yes
LL	-215,331.05	-139,099.76	-16,952.81	-6147.69
Pseudo R-squared	0.059	0.060	0.080	0.120
Observations	877,547	553,229	58,053	29,942

Notes: the data is a time series at the patent application level, restricted to decisions of patenting made between 2002 and 2012, inclusive. All models are negative binomial with robust standard errors, clustered by examiner ID. Displaying incidence rate ratios and standard errors in brackets. *at 10 %, **at 5 %, ***at 1 %.

start-ups) to consider alternative value capture mechanisms or alter their patent strategy.¹²

Our study also adds to the growing body of work investigating sources of heterogeneity in patent examiner decision-making (e.g., Lemley and Sampat, 2012). While recent work has demonstrated that factors such as promotions within the USPTO (Frakes and Wasserman, 2017) or experience working in the patent office (Mann, 2014) tend to

¹² For instance, Heinze (2002) argues that firms can reduce the risk associated with the disclosure of software code during the application process by using provisional applications and paper copies of software code as a workaround to the normal application process. In addition, Lampe (2012) suggests that the citations firms make to prior art are “strategic”, with applicants knowingly withholding citations to relevant prior art when it suits them. Cotropia et al. (2013) show that examiners rely on their own searchers for prior art once a patent application has been assigned to them, and Barber IV and Diestre (2022) provide evidence suggesting that citing an existing patent that an examiner reviewed is, on average, associated with a roughly 250 % increase in the likelihood that the cited patent examiner is assigned the patent application. One implication of this work is that firms seeking patents (startups seeking software patents in particular) may consider the benefits of “examiner shopping” (Mehrlle, 2019) and strategically avoid citations to examiners who donate to liberal-leaning candidates or cite relevant art reviewed by examiners who donate to conservative candidates, as donation records are public record and freely searchable through the FEC or DIME.

correlate with examiner decision-making, our study raises the possibility that an examiner’s overarching ideological beliefs may influence patent evaluation behaviors. While it is reassuring that, on average, patent office outcomes do not appear to be influenced by the political ideology of patent examiners, the possibility that patent examiners’ ideological beliefs may be reflected in patent office outcomes – even if restricted to scenarios where examiners have strong political beliefs and more discretion in their decisions – should create at least some cause for concern.

While the U.S. patent system is not without critiques (Lemley, 2013), there is an implicit assumption that patents are issued without systemic ideological bias. As Reitzig and Puranam (2009: 766 *emphasis added*) concisely note, “a patent is granted if the patent examiner, a *non-partisan* employee of the state, is convinced that the claims put forward in a patent application are substantiated by the disclosure of a sufficiently novel and nontrivial invention”. While patent examiners are considered non-partisan in the sense that they are not appointed by politicians, they do have their own partisan preferences and political views. With that said, it is reassuring that we find that the potential tendency of political ideology to interfere with patent granting decisions seems to be, on average, mitigated by the checks and balances at the USPTO, even if it is possible ideology may enter the decision process for certain examiners with strong political beliefs and under scenarios where their discretion is high.

Future research may extend our study and explore additional ways through which examiner ideology may (or may not) manifest in patent office outcomes. While we focused on average differences between conservative-leaning and liberal-leaning examiners in the context of software and non-software patents, future work may explore how ideological match or mismatch between examiner ideology and patent application characteristics (technology class, industry, filer, filer characteristics, etc.) may influence patent application outcomes. Specifically, researchers may explore if patent examiners are more receptive to awarding patent rights to patent applications which align with their political views, particularly those which are controversial or highly partisan. Research exploring if ideological match between examiners and applicants correlates with patent office outcomes is particularly interesting when considering the work of Webster et al. (2014) who provide evidence of “nationalistic” bias in the European and Japanese patent offices where patent applications filed by domestic inventors are more likely to be granted relative to applications filed by foreign inventors, and the work of Desai (2019), who finds that examiners are more likely to grant patents when the applicant is of the same racial and gender group, consistent with the possibility of “in-group biases” within the USPTO.

Along these lines, future work may also explore how the political ideology of patent examiners may potentially interact with other factors such as gender, particularly for patent applications in areas such as contraception which tends to be associated with strong partisan divide (Pew Research Center, 2022). Additionally, scholars could also explore how the general attitude and political orientation of the federal government and USPTO may mitigate or amplify any impact of examiner ideology. For instance, is it possible that examiner ideology may be reflected to a greater extent in examiner decisions, especially in the case of gray areas like software patents, when the prevailing ideology within the USPTO or the broader federal government is aligned with the individual examiner’s views? That is, are liberal-leaning (conservative-leaning) examiners more likely to exercise their discretion when evaluating software patents and rule more stringently (leniently) if they believe the ideology within the USPTO or the broader political system is congruent with their beliefs, thus amplifying the impact of ideology on patent application outcomes? We encourage future researchers to build on our study and explore the potential for such nuances.

In sum, our study provides a first step in exploring if the political ideology of patent examiners is related to patent office outcomes. We hope our analysis and discussions for future research sets the stage for a

broader evaluation of these issues and spurs follow-on work examining the role of political ideology in patent office outcomes and the role of political ideology in the economics of innovation more broadly.

CRediT authorship contribution statement

All authors contributed equally.

Declaration of competing interest

The authors declare that they have no known competing financial

interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

Acknowledgments

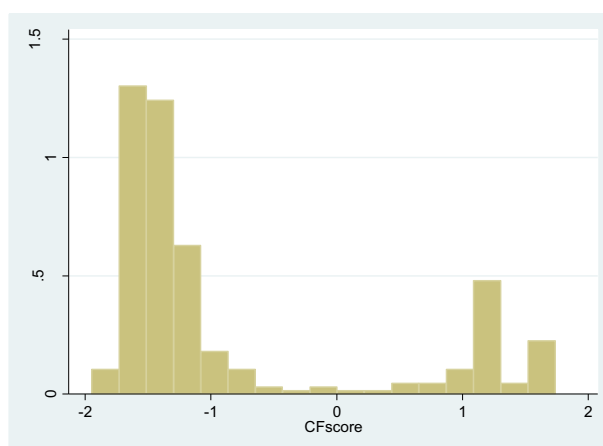
National Science Foundation (NSF) Award Number 2244885. The USC Marshall Institute for Outlier Research in Business (iORB).

Appendix A. DIME Political Point Estimates (CFScores)

The DIME database is the most comprehensive dataset of political contribution activity, containing over 130 million contributions made to local, state, and federal elections through 2014. In addition to aggregating individual monetary contributions to political campaigns in all cycles (i.e., every two years), the DIME also generates ideological point estimates (CFScores). In this appendix we provide a brief overview of the CFScores provided in the DIME database. The CFScores represent ideological point estimates for donors and recipients generated from common-space scaling methodology implemented by Bonica (2014). For a more extensive description of the construction of the CFScores, we refer readers to Bonica (2014) and to Bonica (2018) which provides a compendium of an extensive summary of the numerous validation exercises conducted which demonstrate predictive validity, external validity, and internal validity of the CFScores.

The CFScores included in the DIME are on a continuous scale (between -2 and 2 , with negative values indicating liberal leaning and positive values indicating conservative leaning) which approximates the views of politicians and donors on the liberal-conservative continuum (Bonica, 2013, 2014). To provide context, Bonica et al. (2018) report that U.S. Senator Bernie Sanders has an estimated CFScore of -1.89 , former U.S. President Barack Obama has an estimated CFScore of -1.16 , U.S. Senator Mitt Romney has an estimated CFScore of 0.90 , and former U.S. President Donald Trump has an estimated CFScore of 1.29 . A density plot of CFScores for our matched examiners (see Appendix C) is provided below.

The general intuition underlying the CFScores builds on the work of Poole and Rosenthal (1985, 1991, 2000) who developed the widely used NOMINATE scores to quantify the political leanings of legislators based on roll-call voting records. Bonica's (2014) CFScores are calculated using clustering of campaign contributions rather than roll-call records and hence are estimable for the population of donors, not just legislators who cast votes in congress, the general idea being that more conservative (liberal) individuals will donate to more conservative (liberal) legislators. Bonica (2014) demonstrates the validity of the CFScores by showing that CFScores estimated for legislators correlate with legislators' NOMINATE scores at 0.92 . For a more extensive description of the construction and validation of the CFScores, we refer to Bonica (2018) which provides a compendium of an extensive summary of the various validation exercises demonstrating predictive validity, external validity, and internal validity of the CFScores. All our results persist when employing an analysis based on the intensity of donation amounts per cycle, weighted or not by the CFScore of the recipient party, albeit with a loss in statistical power. Furthermore, our results are robust to an analysis based on the continuous values of the donors' CFScore and to eliminating donors with CFScores close to zero (i.e., examiners with centrist ideologies).



Distribution of CFScores among Donating Examiners

Appendix B. Matching Patex to L2 voter registration records using probabilistic matching

This appendix details the steps we undertook to match the Patex data on examiners to the L2 data on voter registration. In addition to this appendix, we make the code used to create the matches available via an online and publicly-available GitHub repository.¹³ While the next section of this

¹³ To preserve anonymity in the review process, we do not disclose the GitHub link in our submission but will put the URL of the GitHub repository here. If reviewers wish to view the code, we can provide an anonymized version of the code.

appendix provides a brief conceptual overview of the algorithm, the rest of the appendix provides concrete documentation of how the different files in our repository and the steps of the code within them achieve the matching. While the code for the fastLink algorithm described in [Enamorado et al. \(2019\)](#) are already publicly available, the additional documentation in this appendix clarifies the specific steps we took to implement it in our particular setting.

Brief conceptual overview of the FastLink algorithm

When matching the PatEx to the L2 data, we do not have the benefit of high-quality discriminating variables like employer and profession that are available in DIME. In traditional matching approaches, these discriminating variables are used to limit the probability of a false-positive match being included in the final data used for analysis as they limit the pool of potential matches to a degree deemed acceptable to researchers. For example, there are hundreds of thousands of individuals named John Smith in the United States, with several in the DC metro area, and likely only very few or one that lives in that area and works as a patent examiner in the USPTO. Without such discriminating variables to limit the consideration set of potential matches, we draw upon the record linkage literature, which lies at the intersection of computer science and mathematical statistics ([Christen, 2012](#)). In particular, we implement an algorithm, named FastLink, developed by political scientists that leverages the Expectation Maximization (EM) Algorithm to create a fully parameterized probability model that generates a probability score of a correct match using the distributions of matching variables ([Enamorado et al., 2019](#)).

The FastLink algorithm builds upon the pioneering work of [Fellegi and Sunter \(1969\)](#) that has become the bedrock of most approaches to record linkage (Winkler cite). [Fellegi and Sunter \(1969\)](#)'s core insight, which the FastLink algorithm builds upon, is that a number of variables which are not able to sufficiently identify high quality matches individually can identify matches with high confidence when considered together when the probability of the joint occurrence of different features of the data are modeled explicitly. A concrete example helps clarify their intuition that underlies the probability model in the FastLink algorithm used in our paper. Compare two names: 1) Tyler M. Smith and 2) Tyler M. Winkeltraub. If FastLink only had this information (first name, last name, and middle initial) to compare across two data sets, it would start by calculating how frequently exact and partial matches are observed between each unique pair of rows of data across the two data sets for each of the variables. This variable-level match rate would tell us the discriminatory value of each variable where the discriminatory value increases with more unique values (i.e. more variety of names) and fewer matches. In the extreme, we are unlikely to observe accidental matches on last name across two data sets if everyone has different last names. The algorithm considers the discrimination value of each variable to assign a probability value of observing the number of variables that match between the rows of the two data sets. In addition, the algorithm weights the probability of a match by the commonness of the first and last names. Matches with a last name like Winkeltraub, which are infrequently observed in the data, are given a higher probability of being a correct match than a last name like Smith.

Application of the FastLink algorithm to match the PatEx and L2 data

As mentioned above, we make our resulting code applying the fastLink algorithm publicly available via a GitHub repository. The code repository is meant to enable researchers to execute our code directly in their chosen environment. While the code for the fastLink algorithm described in [Enamorado et al. \(2019\)](#) are already publicly available, here we describe the additional steps we take to apply the code to our specific empirical setting. Specifically, we provide a description of the different files in our repository and steps our code takes to achieve the matching.

Commuting region definition

L2 provides the registered home addresses of all voters in the 2016 national voter file as part of the required proof of eligibility to vote in a particular district. We use this data as a matching variable and to reduce the number of comparisons between L2 and Patents by making use of the concept of a commuting region. For each address in our data, we assign a commuting region code derived from the U.S. Census definitions of Core-Based Statistical Areas (CBSA). The U.S. Census Bureau routinely measures the daily commutes of a large representative sample of U.S. workers and uses this commute data to define geographical areas. Based on the results of the survey, each county in the United States is classified by the Bureau as either a Metropolitan Statistical Area (population of 50,000 or more) (MSA), a Micropolitan Statistical Area (a population of at least 10,000 but <50,000) or Rural. MSAs can be comprised of multiple counties. The Bureau groups counties that have substantial economic relationships, defined by having at least 25 % of workers commuting between the counties, into MSAs. Thus, the MSAs can be comprised of one or multiple counties. In addition, the Census Bureau defines Combined Statistical Areas (CSAs) as groupings of MSAs based on wider commuting criteria across MSAs. Not all MSAs are grouped into CSAs.

We leverage this nested U.S. Census Bureau's coding scheme to define our commuting region codes. Since, all patent examiner work in Washington D.C. we have used only the voter population of the counties in the Washington D.C metropolitan area for matching.

Data pre-processing

Before the data can be put through the fastLink algorithm, it needs to be processed from its original raw form to fit the algorithms' required format. We achieved these processing steps through a set of computer programs for each of the two datasets. The programs associated with processing the L2 dataset are contained in the preprocess_l2/ folder of our GitHub repository and they are initiated in sequence by launching the l2-0-master.job batch file in our cluster environment. The programs associated with processing the Patents dataset are contained in the preprocess_data/ folder of our GitHub repository and they are initiated in sequence by launching the process_patent_data.job batch file in our cluster environment. This job file restricts the columns required for the matching, standardizes names and creates the region file.

Executing the fastLink algorithm

The code associated with the execution of the matching algorithm is contained in the fastlink/ folder of our GitHub repository and is initiated by the run_fastlink.job batch file in our cluster environment. The code loads the data into the fastLink algorithm and then processes and outputs the results. The core fastLink algorithm is part of the inherited library downloaded directly from the CRAN Network.

Final crosswalk production

The code associated with the production of the final crosswalks file is contained in the crosswalk/folder of our GitHub repository. The code is initiated and executed by the 0_mk_crosswalk.job batch file in our cluster environment. The output file has multiple candidate matches with a posterior probability above our threshold of choice (0.75). We further process the file to eliminate all names for which the FastLink algorithm produces multiple candidate matches with a posterior probability above our threshold of choice (0.95). Our results remain robust to considering other thresholds.

Final matches production

The results from executing the fastLink algorithm is processed by /analysis/mk_final_match.py to retain the match of highest posterior probability should there be multiple matches with a posterior probability above our threshold of choice (0.95).

Appendix C. Matching Patex to DIME using conventional string matching

To link inventors in PatEx with political donation records contained in DIME, we take advantage of the fact that the DIME database includes self-reported occupation and/or employer. This allowed us to link the two databases using conventional matching approaches by restricting our sample in DIME to donors who are likely to be patent examiners and then using string matching to link records by name.

We started by querying the DIME database for all contributors who reported an occupation of “patent examiner”. Next, we queried the DIME for all contributors who reported an employer of “United States Patent and Trademark Office”, “US Patent Office”, “USPTO”, “Patent Office”, or other related variants. We checked the occupation of these contributors and identified likely patent examiners based on reported occupation. This allowed us to identify patent examiners we missed in our initial query, typically due to spelling errors (e.g., “patent examiner”) or omitted terms (e.g., “examiner”). Next, we matched these individuals to the Patex patent examiner names using a name-matching algorithm. We took a conservative approach to name matching, requiring an exact match on last name and a fuzzy match on first name using the Jaro-Winkler distance. For first names, we required a conservative Jaro-Winkler value of 0.9 to be considered a match (1 is an exact match). We identified 302 matching patent examiner names through this approach. We also tried to relax our restriction on Jaro-Winkler thresholds but found the 0.9 value to generate results with the lowest probability of false positives. Last, we manually checked the names of all contributors returned in our DIME queries which we did not match to the Patex. By checking this list, we matched 22 additional individuals which were not picked up in our name matching procedure (e.g., hyphenated names). Thus, our final sample includes a total of 324 patent examiners matched to the DIME contribution data. Note that while this number may appear low, it is consistent with the base rate of political donations among the U.S. population, which is approximately 3–5 % (e.g., Bonica, 2014), and hence tends to reflect individuals more passionate about political issues and/or individuals with stronger political beliefs/interests (Francia et al., 2003; Johnson, 2010).

Appendix D. Additional analyses for donating examiners

While we do not make claims that donating examiners are representative of the broader patent examiner population, and, in fact argue that donating examiners differ in that they tend to be more interested in politics and have more extreme views (Johnson, 2010), we take several steps to explore to what degree the patterns we find may be impacted by our relatively small number of examiners who donate.

One concern would be that donating examiners assigned a disproportionate number of software patent applications. Within our sample of software applications, we observe 156 liberal-leaning examiners (64.2 % of all liberal-leaning) and 50 conservative-leaning examiners (76.9 % of all conservative-leaning).¹⁴ In the full population of examiners evaluating patent applications over our observation period (2002–2012), 7280 examiners handle software applications (67.5 % out of the total 10,782 examiners). Thus, the fraction of software relative to non-software application in our sample does not appear to be an outlier relative to the full population, both overall and within the sets of liberal and conservative examiners.

Second, given the small sample of DIME-matched patent examiners handling software applications, there might be a concern that certain hard-to-grant (easy-to-grant) applications are coincidentally assigned to liberal-leaning (conservative-leaning) examiners. To test this possibility, we first count the number of software patent applications handled by liberal-vs conservative-leaning examiners across USPC patent classes. We find that the patent applications span 76 patent classes and are approximately equally distributed between liberal and conservative patent examiners, with the exception of five USPC classes.¹⁵ Our result remains robust to excluding each of these five classes one at a time and in all combinations.

Appendix E. Appendix References

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¹⁴ The two subsets exhibit similar patent granting distributions, with no evidence of outlier examiners.

¹⁵ In our sample, the number of liberal-leaning patent examiners is larger than that of conservative-leaning patent examiners. Hence, naturally, the number of software patent applications handled by liberal examiners is, on average, larger than that handled by conservative examiners; the difference is systematic across patent classes. The five patent classes where this difference is the largest in terms of absolute value and percentage are “455: Telecommunications”, “714: Error detection/correction and fault detection/recovery”, “370: Multiplex communications”, “348: Television”, and “250: Radiant energy.”

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