Knowledge Spillovers, Peer Effects, and Telecommuting: Evidence from the U.S. Patent Office

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Highlights

- This paper find strong evidence of peer influence in granting behaviors among patent examiners.
- U.S. patent examiners' granting styles are strongly shaped by peer examiners.
- Examiner peer effects, in part, reflect knowledge flows among examiners.
- Teleworking diminishes examiner peer effects and knowledge flows.
- Knowledge transmissions within firms may also contribute significantly to the productivity outcomes of individual firms.
- Examiner granting decisions are of critical social welfare significance.
- The importance of knowledge spillovers among co-workers —whether in public or private settings —is of great significance during the early stages of the COVID-19 pandemic.

Outline

Introduction

- Patents play an important role in both promoting innovative activity and shaping the direction of technological growth.
- Not all inventions, however, merit the award of patent protection.
- It is the job of examiners at the U.S. Patent and Trademark Office (Patent Office or Agency) to scrutinize applications and apply the legal patentability standards in order to strike the proper balance between spurred innovation and static deadweight losses.

Introduction

- Scholars and policymakers have sounded alarms over the quality of this review process.
  - Issuance of excessive numbers of **invalid patents**.
  - Substantial **heterogeneity** in key application outcomes across examiners.
- The Patent Office itself has just recently undergone a two-year Enhanced Patent Quality Initiative aimed at improving the quality of the U.S. patent examination process.
- Understanding how to address these concerns and improve the examination process, of course, requires first understanding the fundamental determinants of **patent examiner behavior**.

Literature

- A growing literature has begun to take up this task.
  - Investigating the **economic incentives** and **constraints** facing key actors in the Patent Office, either focusing on **top-down**, **Agency-centric decisionmaking** (Frakes and Wasserman, 2013, 2015).
  - Or on **bottom-up**, **examinercentric decisionmaking** (Frakes and Wasserman 2017).

This paper

- This paper will build upon this **latter approach** and explore **the determinants of examiner behavior**.

- This paper will move beyond an investigation into the economic incentives facing examiners and instead explore **how an examiner's social interactions with her peers** in the Patent Office **shape her application of the patentability standards** and thus **the key economic outputs of her efforts**.

This paper

- The Patent Office does present a robust environment to study peer effects within an administrative agency.
  - The **institutional features** of the Agency (including its robust telecommuting program)
  - The availability of **rich application-level data**
  - The relatively **homogenous nature of examiners' jobs**.
  - U.S. patent examination is a **predominantly isolated, individual task**.

This paper

- The main goal with this paper is to contribute to the burgeoning literature on the **determinants of outcomes at the Patent Office specifically**.
- This investigation does contribute to the similarly burgeoning literature on **peer effects within the workplace**, particularly with respect to **high-skilled workplace settings**.
- It also presents novel evidence of **peer effects among bureaucrats within an administrative agency**.
- Provide evidence on the degree to which such social influences weaken when bureaucrats (or employees more broadly) work from home.
  - A question of particularly timely interest given the changing work arrangements—both in the private and public sector—arising from the COVID-19 pandemic and that may potentially endure, in part, following the pandemic.

Patent examination process

- Incoming **patent applications** are first routed to an **Art Unit**, *an organizational unit consisting of eight to fifteen patent examiners who review applications in the same technological field*. Upon arrival, the Supervisory Patent Examiner (**SPE**) of that Art Unit assigns the application to a **specific examiner**.

- The assigned examiner then conducts a **"prior art" search** and then **assesses the patentability** of the invention in light of the criteria outlined in the Patent Act.

Patent examination process

- Two of these key criteria are the **novelty** and **non-obviousness** requirements.
  - **Lack of novelty**: the claimed invention is covered, in its entirety, by a single prior art reference.
  - **Obviousness rejection**: requiring an examiner to **start with a prior art reference** that covers only a portion of the invention and then **piece together additional references** or **rely upon what is known** to one of ordinary skill in the art in order to **determine whether it would be "obvious" to modify any one of the cited prior art references to achieve the claimed invention**.

Patent examination process

There are two types of examiners working within each Art Unit, along with two types of parties with supervisory functions.

- **"assistant" examiners**: Examiners at pay grades **GS-13 and below** on the General Schedule pay scale.
  - they must have their reviews and decisions approved by a supervisor—either by a primary examiner or by their SPE.
- **"primary" examiners**: **GS-14**.
  - Primary examiners attain **full authority to sign off on all aspects of their reviews** without the need for supervisory review. Though primary examiners continue to review their own applications, they also serve as **quasisupervisors** for assistant examiners.
- **SPEs no longer review applications of their own**. However, the supervisory functions of SPEs go beyond **checking the work of assistant examiners**, as SPEs are also tasked with **overseeing all aspects of their Art Units.**

Learning versus peer pressure

- **Peer pressure model of behavior**
  - Examiners place disutility on the social stigmatization that may arise from failing to conform to the behavior of their peers.
- **Learning and knowledge flows**
  - Something other than learning about peer norms for the sake of conforming to avoid social stigma.

Basic terminology

- **Art Units**:

  An organizational unit consisting of **eight to fifteen** patent examiners who review applications in the **same technological field**.

- **GS-Level**:

  Administrative levels of the United States federal government.

- **Assistant Examiners**:

  Grades **GS-13 and below** on the General Schedule pay scale as **"assistant" examiners**.

  - Assistant examiners independently review, and complete the bulk of the work, but their reviews and decisions must be **approved by a supervisor** — either by a primary examiner or SPE.

- **Primary Examiners**:

  Examiners may be promoted to become **"primary" examiners**, generally reaching **GS-14**.

  - Primary examiners attain **full authority** to sign off on all aspects of their reviews without the need for supervisory review.

- **Supervisory Patent Examiners (SPEs)**:

  SPE of that Art Unit assigns the application to a specific examiner.

  - SPEs **no longer review applications** of their own.

    Checking the work of assistant examiners and overseeing all aspects of their Art Units.

Data: **Individual patent applications** - March 2001 - July 2012

- **Patent Application Information Retrieval** (PAIR) database:
  Over **1 million** utility patent applications.
  - Information on **whether or not the application was granted**
  - The **name of the examiner** charged with reviewing the application
  - The **Art Unit** to which the application was assigned
  - The **bases of rejections** associated with the application

  - Textual analysis of office actions uploaded to the PAIR database.

Obviousness rejection:

- The claimed invention is covered, in its ***entirety***, by a ***single*** prior art reference.

Lack-of-novelty rejection: (More complicated)

- Start with a prior art reference that covers ***only a portion*** of the invention and then **piece together additional references** or **rely upon what is known to one of ordinary skill in the art** to determine whether it would be "obvious" to modify any one of the cited prior art references to achieve the claimed invention.

Data: **Information about examiners**

- **Freedom of Information Act (FOIA)** requests:
  - The **year** in which the examiner joined the Patent Office (left censored at 1992)
  - Examiners' **GS-level** over each year in our sample
  - Information on the **precise day** in which the examiner started to **telecommute**

    (For examiners participating in the Patents Hoteling Program, **PHP**)

- **Patents Hoteling Program** (PHP):

  Start with **2006**, which allows examiners to work from home **at least 4 days** a week.

  Patent examiners must have achieved a **GS-12 level**, have **positive performance ratings**, and have worked at the Agency for **at least two years**.

  Over **86%** of those eligible to participate in the Patent Office's teleworking programs in fact elect participation.

  - Merged examiner's specific fields with the application-level data.

    (Using a **fuzzy-name matching** application)

Data: **Information about SPEs**

- **Supervisory Patent Examiner (SPEs)**:
  - The identity of the SPEs for the Art Unit associated with that application
  - Calculate **pre-SPEs grant rates**:

    Proxy for their **general granting dispositions**.

    - The applications information that those SPEs, were promoted to that position during sample, reviewed while they were patent examiners prior to such promotions.

- **Data summary**:
  - Across all applications and all examiners, applications are granted roughly **70%** of the time throughout the sample.
  - The mean of assistant examiner peer score (grant rate) is **0.651**, the standard deviation is **0.178**.

Summary statistics

Table 1
Summary statistics.

	(1) Mean	(2) SD
Grant	0.695	0.461
Any Obviousness Rejection	0.855	0.352
Any Lack-of-Novelty Rejection	0.662	0.473
Examiner Experience: 1–2 Years	0.102	0.302
Examiner Experience: 3–4 Years	0.155	0.362
Examiner Experience: 5–6 Years	0.158	0.365
Examiner Experience: 6 + Years	0.585	0.493
Assistant Examiner	0.447	0.497
Assistant Examiner Peer Score (Grant Rate)	0.651	0.178
Primary Examiner Peer/Supervisor Score (Grant Rate)	0.772	0.303
SPE Score (Grant Rate)	0.782	0.192
Incidence of Large Entity Applicant	0.728	0.445
Incidence of Citation to "Pet" Prior Art of Peer Assistant Examiner	0.072	0.258

Each observation is a given application from the PAIR database that reached a final disposition and that was published in the PAIR records between March, 2001 and July, 2012.

Methodology: **How patent examiners are impacted by their peer examiners**

$$GRANT_{aikt} = \alpha + \gamma_{\mathbf{i}} + \partial_{\mathbf{k}} + \delta_{\boldsymbol{t}} + \beta_1 \left(PEER_{ikt}\right) + \beta_2 \mathbf{X}_{aikt} + \varepsilon_{aikt}$$

- $GRANT_{aikt}$: Whether or not the given application was **allowed** by the examiner.
- $PEER_{ikt}$: The **peer score** of interest for analysis.
- $\mathbf{X}_{aikt}$: Other *application characteristics*.
  - Whether the applicant is a **large or small entity** (for fee-setting).
  - Whether the application has **foreign priority**.
  - The **duration** of the examination period (and its square).
  - The **GS level** and **experience level** of the examiner at the time of disposition.
- a: The *individual application*.
- i: The *individual examiner*. – $\gamma_{\mathbf{i}}$: Examiner fixed effects.
  - Account for endogenous allocations of examiners with characteristics to peer groups.
- k: The *Art Unit* to which the application is assigned. – $\partial_{\mathbf{k}}$: Art-Unit effects.
- t: The *year* in which the application is disposed of by the examiner. – $\delta_{\boldsymbol{t}}$: Year effects.

Stylized facts: **Examiner heterogeneity & peer influence**

Estimated Examiner Fixed Effects (γ_i):

- The substantial degree of **examiner heterogeneity** underlying the methodological.
- The potential for substantial **peer influence** in the first place.

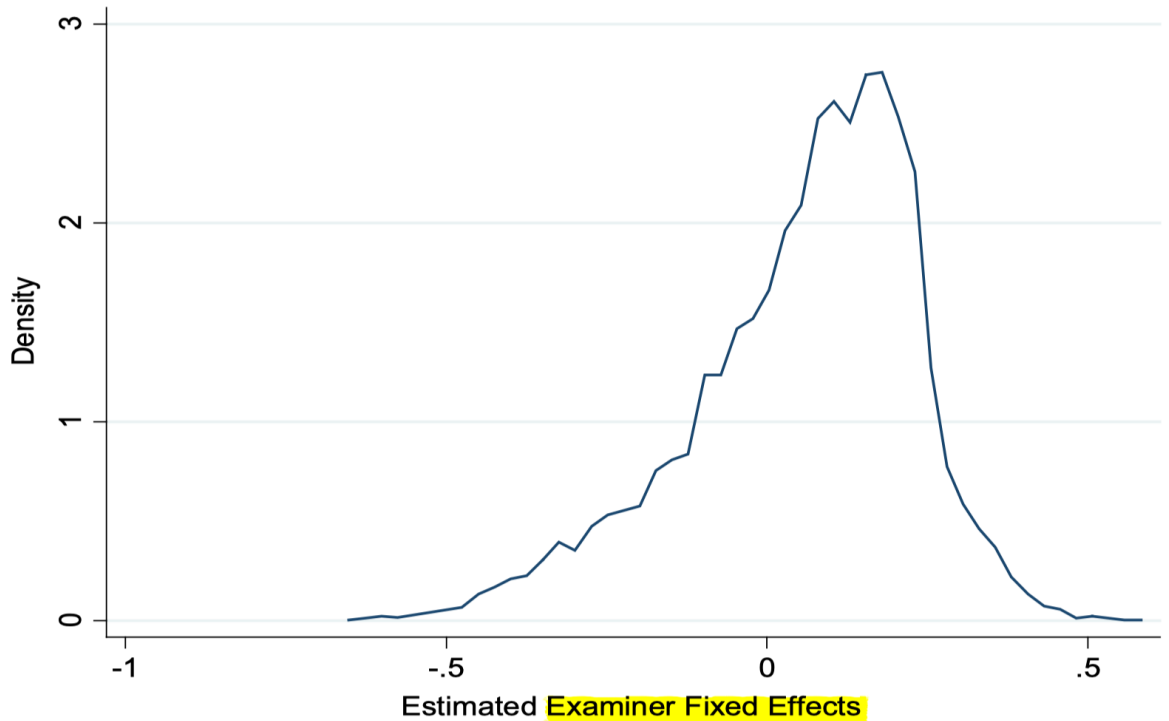

Fig. 1. Distribution of Estimated Examiner Fixed Effects. Note: this figure presents a kernel density plot (Epanechnikov kernel with "optional" bandwidth) of estimated examiner fixed effects across all examiners in the sample. Examiner fixed effects are derived from the predicted values from a regression of the incidence of the application being granted on a series of an examiner fixed effects, along with Art-Unit-by-year effects, examiner GS levels, examiner experience levels and various application-level characteristics (large entity status of applicant, foreign priority status of applicant, and duration of examination and its square).

Variable description: **The peer score** ($PEER_{ikt}$)

- The examiner's **general disposition towards** allowing patents (Sampat and Williams, 2019).
- For each application, calculate $\mathbf{PEER}_{ikt}$ by taking the **average of the lifetime grant rates** for all examiners in the **same Art-Unitby-year cell** as the application in question.
- The **inherent granting** practices of the particular group of peers that happen to be in the relevant Art Unit at the time in which the focal application is disposed of.
  - As **distinct** from the contemporaneous behavior of those peers at that time.
  - Identifies the influences by drawing on **changes** in the composition of the peer group **over time within an Art Unit** (Cornelissen et al., 2017).
- **Alleviating concerns**:
  - Peer-to-focal-examiner associations in behavior are driven by **common unobservable shocks**.
  - Such associations may focal examiners affecting peers, rather than the **other way around**.

- **Most** of the variation explained by granting differences **across Art Units**.
- Roughly **20%** can be explained by changes in this score **within Art Units** over time.
  - Driven by **changes in peer composition** within those units (through hiring, attrition and Art-Unit transfers).

Methodology: **Address concerns over common unobservable shocks**

Explore the effects of **telecommuting** on peer influences:

$$GRANT_{aikt} = \alpha + \gamma_{\mathbf{i}} + \partial_{\mathbf{k}} + \delta_{\boldsymbol{t}} + \beta_1 \left(PEER\_NON\_TELE_{ikt}\right) + \beta_2 \left(PEER\_TELE_{ikt}\right) + \beta_3 \mathbf{X}_{aikt} + \varepsilon_{aikt}$$

- $PEER\_NON\_TELE_{ikt}$: The examiner's behavior and a peer score based on **non-telecommuting peers**.
- $PEER\_TELE_{ikt}$: The examiner's behavior and a peer score based on **telecommuting peers** within Art Unit.

- 1. Limit the applications reviewed by **assistant examiners**, construct the peer score at time t based on the **composition of other assistant examiners in Art-Unit** at time t.
  - Picking up **pure peer effects** since none of the examiners in this group would be serving any supervisory function over the others.
- 2. Replace with a similar measure:
  - The **mean inherent grant rates of primary patent examiners** practicing in the Art Unit at year t.
  - The **inherent grant rates of the SPE** overseeing that Art Unit in year t.

  - Explore **quasi-supervisory** and **supervisory** influences, respectively.

Methodology: **Applications completed during an examiner's first six years**

If peer influences arise due to **knowledge flows**:

$$\begin{aligned}\text{GRANT}_{aikt} =& \alpha + \gamma_{\mathbf{i}} + \partial_{\mathbf{k}} + \delta_{\boldsymbol{t}} + \beta_1 \left(\text{PEER}_{ikt}\right) \\ &+ \beta_2 \left(\mathbb{1}\left(\text{EXPER}_{ikt} = \{3{,}4\}\right)\right) + \beta_3 \left(\mathbb{1}\left(\text{EXPER}_{ikt} = \{5{,}6\}\right)\right) \\ &+ \beta_4 \left(\mathbb{1}\left(\text{EXPER}_{ikt} = \{3{,}4\}\right) \cdot \left(\text{PEER}_{ikt}\right)\right) \\ &+ \beta_5 \left(\mathbb{1}\left(\text{EXPER}_{ikt} = \{5{,}6\}\right) \cdot \left(\text{PEER}_{ikt}\right)\right) + \beta_6 \mathbf{X}_{\text{aikt}} + \varepsilon_{aikt}\end{aligned}$$

- β_1: The degree of examiner's grant rate affected with peer's granting tendencies during **first two years**.
- β_2 and β_3: The **inherent grant rates** of examiner during **(3,4)** and **(5,6)** years respectively.
- β_4: The degree to which subsequent changes in peer composition during **third and fourth year**.
- β_5: How changes in peer composition during **fifth and sixth year**.

- The examiner would be most responsive to peers during **early** (Jackson and Bruegmann, 2009).
- Estimate such progressions separately for **telecommuting** and **non-telecommuting** peers.
- If there exists a **declining peer effect with experience**, it lends support to a **learning story** and the existence of **true peer influences** in general.

Effects of **assistant examiner' peer granting tendencies on own grant rates**

- A change from 0 to 100 percent in the **mean inherent grant rate** of an examiner's peer group is associated with a roughly **26%** increase in own grant rate.
- Peer influence is even **stronger at the start** of an examiner's career.
  - **43%** increase in the focal examiner's grant rate during first two years.
  - The grant rate of peers is association with a **17%** lower increase in own grant rate during the **(3,4)** year.
  - The grant rate of peers is association with a **18%** lower increase in own grant rate during the **(5,6)** year.

Table 2
Effects of assistant examiner (i.e., peer) granting tendencies on assistant examiner grant rates.

	(1)	(2)	(3)
Peer Score	0.262***	0.426***	0.401***
	(0.047)	(0.075)	(0.057)
(Omitted: Peer Score X 0–2 Years Experience)			
Peer Score X 2–4 Years Experience	-	−0.173***	−0.161***
		(0.031)	(0.022)
Peer Score X 4–6 Years Experience	-	−0.182***	−0.191***
		(0.049)	(0.037)
N	521,275	153,906	415,575
Balanced Sample Over Years of Experience, in Experience Interaction Specifications?	-	YES	NO

Standard errors are reported in parentheses and are clustered to correct for auto-correlation within given Art Units. Coefficients of the experience group dummies are omitted for purposes of brevity in Columns 2 and 3. Each observation is a given application from the PAIR database that reached a final disposition and that was published in the PAIR records between March, 2001 and July, 2012. Column 1 tracks the granting decision of assistant examiners over their entire careers. Each specification in Columns 2 and 3 tracks the granting decisions of assistant examiners (GS-level 13 and below) over the first six years of their careers at the Patent Office. Column 2 focuses on a balanced set of examiners that we can observe practicing at the Patent Office over the entirety of their first six years at the Patent Office. Column 3 presents results from an unbalanced sample that imposes no such restrictions (only that we restrict the sample to observations within the first six years of experience). All specifications include examiner fixed effects, Art Unit fixed effects, year fixed effects and controls for various application-level characteristics. ***Significant at the 1 percent level; ** Significant at the 5 percent level; *Significant at the 10 percent level.

Effects of **assistant examiner' peer experience groups on own grant rates**

How changes in peer composition on the examiner grant rates evolves over career:

- Strong early-career effects that **weaken** but that do **not totally dissipate** throughout the focal examiner's career.

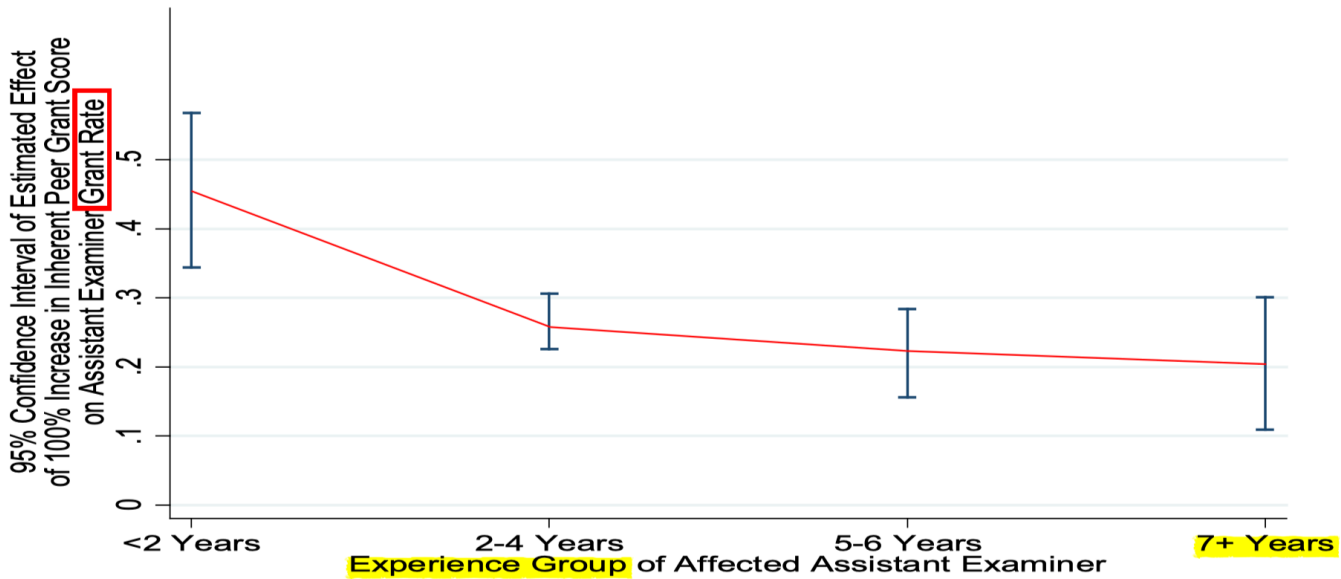

Fig. 2. Effect of Inherent Peer Granting Tendencies on Assistant Examiner Grant Rate, By Years of Experience of the Affected Assistant Examiner. Notes: this figure is derived from an extension of the unbalanced specification estimated in Column 3 of Table 2, where we do not limit our analysis to just the first 6 years of the focal examiners career and where we add an additional experience term (and interaction term) to account for the period of time past an examiner's 6th year. The reported effects represent the effect of a change in the peer composition score at the indicated level of experience. These effects are derived from the appropriate linear combination of estimated coefficients.

Robustness: **Effects of peer granting tendencies on own grant rates**

The magnitude of the coefficients are **neither meaningfully nor statistically different**.

- **Slightly larger** peer effects when taking Bayesian estimation approach in Column 4.
- **Slightly smaller** by adjusting each peers' lifetime grants rates for all possible combinations of peer groups in Column 5.

  (Cleanse the peer score of peer influences itself, Mas and Moretti (2009) approach)

Table 3
Effects of peer granting tendencies on assistant examiner grant rates: various robustness checks.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Overall peer effects						
Peer Score	0.221***	0.155***	0.291***	0.331***	0.187***	0.279***
	(0.025)	(0.026)	(0.041)	(0.045)	(0.059)	(0.042)
N	518,281	483,583	521,341	521,690	521,464	446,969
Panel B: Experience interactions (balanced sample over first six years of examiner's career)						
Peer Score	0.443***	0.329***	0.486***	0.517***	0.345***	0.416***
	(0.062)	(0.048)	(0.074)	(0.089)	(0.106)	(0.063)
(Omitted: Peer Score X 0–2 Yrs Experience)						
Peer Score X 2–4 Years Experience	−0.122***	−0.177***	−0.121***	−0.140***	−0.115**	−0.133***
	(0.036)	(0.027)	(0.030)	(0.032)	(0.043)	(0.027)
Peer Score X 4–6 Years Experience	−0.216***	−0.199***	−0.127***	−0.136***	−0.117*	−0.128***
	(0.049)	(0.043)	(0.046)	(0.050)	(0.065)	(0.042)
N	152,841	150,504	153,905	153,905	153,917	153,890
Treatment of Art Unit and Time Effects	Art-Unit-by-Bi-Year Fixed Effects	Art Unit and Year Effects	Art Unit and Year Effects	Art Unit and Year Effects	Art Unit and Year Effects	Art Unit and Year Effects
Basis for Construction of Peer Grant Score at Year *t*	Lifetime Grant Rates	Grant Rate for Years Prior to *t*	Lifetime Grant Rates (Adjusted for Time-Varying Examiner Traits)	Empirical Bayesian Estimator	Lifetime Grant Rates (Adjusted for Peer Group Combinations)	Grant Rate in First Two Years of Examiners' Careers

Standard errors are reported in parentheses and are clustered to correct for autocorrelation within given Art Units. Coefficients of the experience group dummies are omitted for purposes of brevity. Each observation is a given application from the PAIR database that reached a final disposition and that was published in the PAIR records between March, 2001 and July, 2012 and that was reviewed by an Assistant Examiner. In addition to the indicated features of the estimated specifications, all specifications include examiner fixed effects and controls for various application-level characteristics. ***Significant at the 1 percent level; ** Significant at the 5 percent level; *Significant at the 10 percent level.

Distributed lag specification: Explore the durability of initial influences

Predict a persistent effect of any stimuli that they **experience in the past**.

- In addition to the various controls included in **Eq. (1)**.
- Regress the incidence of an application being granted on the peer grant score along with a **2-** and **4-year lag** of that peer score.
- **Interpret**: How an examiner at times $t+2$ and $t+4$ will continue to respond to a temporary shock at time t in the peer grant score.
- **Discussion**: How one can interpret the coefficients of this distributed lag specification to illuminate a **hypothetical permanent increase** in the peer grant score.

Leads and lags of examiner grant-rate peer effects

- Increases by roughly **18%** in the period between **0 and 2 years**.
- Still increased **19%** even after an additional **2 and 4 years**.
- Examiner's grant rate continues to **remain elevated** even after the previous peer positive shock has gone away.
- **Persistence** is consistent with examiners learn from peers in developing durable practice styles.
- **Near-zero** of the **4-year** lag coefficient.
- The effect of temporary peer shock may **wear off** at some time.
- **Lagged responses alone are not completely inconsistent with peer pressure**.

Table 4
Leads and lags of examiner grant-rate peer effects.

	(1)	(2)
2-Year Lead Peer Score	−0.011	0.019
	(0.085)	(0.057)
Contemporaneous Peer Score	0.178*	0.253***
	(0.105)	(0.091)
2-Year Lag Peer Score	0.191*	0.243***
	(0.100)	(0.068)
4-Year Lag Peer Score	−0.001	-
	(0.119)	
N	93,644	256,924

Standard errors are reported in parentheses and are clustered to correct for auto-correlation within given Art Units. Each observation is a given application from the PAIR database that reached a final disposition and that was published in the PAIR records between March, 2001 and July, 2012. The reported coefficients in Column 1 are derived from a modification to Eq. (1) that includes, in addition the peer grant score variable, a two- and four-year lag of that variable and a two-year lead of that variable. To ensure balance, this specification is limited to those applications reviewed by examiners that have been at the Patent Office for at least 4 years prior to the focal application and that will remain at the Patent Office for at least two years thereafter. The specification in Column 2 includes only one lead and one lag term and requires a less restrictive balance condition in which we include applications reviewed by examiners that have been at the Patent Office for at least 2 years prior to the focal application and that will remain at the Patent Office for at least two years thereafter. All specifications include examiner fixed effects, Art Unit fixed effects, year fixed effects and controls for various application-level characteristics. ***Significant at the 1 percent level; ** Significant at the 5 percent level; *Significant at the 10 percent level.

Supervisory effects

Table 7
Effects of supervisor granting tendencies on assistant examiner grant rates.

	(1)	(2)	(3)	(4)	(5)	(6)
	Quasi-Supervisory Effects (Primary Examiner Effects)			Supervisory Effects (SPE Effects)		
Peer Score	0.200***	0.482***	0.341***	0.086***	0.330***	0.217***
	(0.046)	(0.104)	(0.056)	(0.033)	(0.089)	(0.059)
(Omitted: Peer Score X 0–2 Years Experience)						
Peer Score X 2–4 Years Experience	-	−0.219***	−0.210***	-	−0.135***	−0.090***
		(0.041)	(0.029)		(0.049)	(0.029)
Peer Score X 4–6 Years Experience	-	−0.298***	−0.312***	-	−0.179**	−0.164***
		(0.068)	(0.049)		(0.082)	(0.052)
N	552,754	153,584	413,499	308,544	87,060	249,314
Balanced Sample?	-	YES	NO	-	YES	NO

- Column 1-3:exploring the relationship between examiner grant rates and the inherent grant rates of the GS-14 "primary" examiners practicing.
- Column 4-6: examiner grant rates and SPE effects.
- Changes in SPE compositions within Art Units later in an examiner's career are associated with a weaker influence on an examiner's grant rates at those later moments.
- A stronger pure peer influence than a supervisory influence.

Additional tests for learning

Considering two additional exercises to distinguish a learning mechanism from a peer pressure mechanism.

- Breaking down the assistant-examiner peer score into junior assistant examiners and senior assistant examiners.
- We find notably stronger peer effects in the case of the senior peer group relative to the junior peer group.
- The relationship between examiner grant rates and peer grant scores is the strongest especially in the case of new examiners surrounded by more experienced peers.

Table 8
Effects on assistant examiner grant rates of senior peer granting tendencies and of junior peer granting tendencies, separately.

	(1)	(2)
Senior Peer Score (Peers with at least 2 years of experience)	0.380***	0.192***
	(0.083)	(0.048)
(Omitted: Senior Peer Score X 0–2 Yrs Experience)		
Senior Peer Score X 2–4 Years Experience	−0.248***	-
	(0.064)	
Senior Peer Score X 4–6 Years Experience	−0.288***	-
	(0.079)	
Junior Peer Score (Peers with less than 2 years of experience)	−0.059	0.006
	(0.064)	(0.017)
(Omitted: Junior Peer Score X 0–2 Yrs Experience)		
Junior Peer Score X 2–4 Years Experience	0.097	-
	(0.064)	
Junior Peer Score X 4–6 Years Experience	0.128	-
	(0.074)	
N	133,173	451,334
P-value of difference between Non-Telecommuting Peer Score Coefficient and Telecommuting Peer Score Coefficient	0.001	0.000
Experience Restrictions?	First 6 Years of Career (Unbalanced)	No Experience Restrictions
Measure on Which Dependent Variable and Peer Score Are Based	Grant Incidence	Grant Incidence

Specific knowledge flows and further telecommuting analysis

Table 9
Relationship between Likelihood that Assistant Examiner Will Cite to Set of "Pet" Prior Art of Peer Group and the Proximity of that Peer Group.

	(1)	(2)	(3)	(4)
Tele-commuting Peer Group (Omitted: Non-Telecommuting Peer Group)	−0.003***	-	−0.004***	
	(0.001)		(0.001)	
2-Year Lagged Peer Group (Omitted: Contemporaneous Peer Group)	-	−0.017***	-	−0.017***
		(0.000)		(0.000)
N	326,460	724,982	326,460	724,982
Coefficient as a Fraction of Mean of Dependent Variable (Mean = 0.016 for Telecommuting Status Peer Group Comparison; Mean = 0.076 for Temporal Peer Group Comparison)	0.19	0.22	0.25	0.22
GS-Level of Relevant Peer Groups	GS-12 and GS-13	GS-7 through GS-13	GS-12 and GS-13	GS-7 through GS-13
Parameterization of Controls for Counts of Comparison Peer Groups	Relevant Examiner Count and its Square		Dummies for Different Quartiles of Relevant Examiner Count	
Art-Unit-Year Sample	Art-Unit Year Cells with > 0 Telecommuting Examiners	All Art-Unit-Year Cells	Art-Unit Year Cells with > 0 Telecommuting Examiners	All Art-Unit-Year Cells

In attempt to uncover knowledge flows among examiners, we assess whether examiners appear to cite prior art references frequently used by those peer examiners surrounding them.

- Examiners frequently turn to the same set of patents as pieces of prior art when conducting their reviews, a set of personalized information and preferences that examiners may impart to their peers.
- We define an examiner's set of "pet" prior art by the 10 patents that they most frequently cite throughout their career

Specific knowledge flows and further telecommuting analysis

Table 9
Relationship between Likelihood that Assistant Examiner Will Cite to Set of "Pet" Prior Art of Peer Group and the Proximity of that Peer Group.

	(1)	(2)	(3)	(4)
Tele-commuting Peer Group (Omitted: Non-Telecommuting Peer Group)	−0.003***	-	−0.004***	
	(0.001)		(0.001)	
2-Year Lagged Peer Group (Omitted: Contemporaneous Peer Group)	-	−0.017***	-	−0.017***
		(0.000)		(0.000)
N	326,460	724,982	326,460	724,982
Coefficient as a Fraction of Mean of Dependent Variable (Mean = 0.016 for Telecommuting Status Peer Group Comparison; Mean = 0.076 for Temporal Peer Group Comparison)	0.19	0.22	0.25	0.22
GS-Level of Relevant Peer Groups	GS-12 and GS-13	GS-7 through GS-13	GS-12 and GS-13	GS-7 through GS-13
Parameterization of Controls for Counts of Comparison Peer Groups	Relevant Examiner Count and its Square		Dummies for Different Quartiles of Relevant Examiner Count	
Art-Unit-Year Sample	Art-Unit Year Cells with > 0 Telecommuting Examiners	All Art-Unit-Year Cells	Art-Unit Year Cells with > 0 Telecommuting Examiners	All Art-Unit-Year Cells

- Column 1,3: examiners are roughly 0.3 to 0.4 percentage pointsless likely to cite to their telecommuting peers' favorite patents relative to their nontelecommuting peers' favorite patents.
- Column 2,4: examiners is less likely to cite to the pet prior art of the less proximate lagged peer group relative to her present peer group, at a magnitude equal to 1.7 percentage points.

Additional falsification exercises and robustness checks

Table 10
Peer Effects in Obviousness Rejection Rates and in Lack-of-Novelty Rejection Rates.

	(1)	(2)	(3)	(4)
	Incidence of Any Obviousness Rejection		Incidence of Any Lack-of-Novelty Rejection	
Peer Score	0.107***	0.192**	−0.006	−0.035
	(0.039)	(0.073)	(0.037)	(0.079)
(Omitted: Peer Score X 0–2 Yrs Experience)				
Peer Score X 2–4 Years Experience	-	−0.119***	-	0.021
		(0.035)		(0.050)
Peer Score X 4–6 Years Experience	-	−0.133**	-	0.032
		(0.059)		(0.080)
N	467,967	136,654	469,456	136,701

We next consider a falsification exercise based on an evaluation of peer influences on the use of lack-of-novelty rejections versus obviousness rejections.

- Obviousness determinations are commonly perceived as being more indeterminate and subjective than lack-of-novelty rejections.
- In the case of obviousness rejections, the result is very similar to the grant-rate results.
- In the case of lack-of-novelty rejections, we find little evidence of peer effects at any level of experience.

Conclusions

- The demonstrate just how strong of a role that peers can play in administrative agencies (and in high skilled work settings), even when focusing on tasks that are somewhat isolated and non-teambased in nature.
- Examiner granting decisions are of critical social welfare significance, as social influences among examiners could reinforce and encourage positive granting practices.
- As the Patent Office (or Congress) develops rules and programs to encourage higher quality examination practices and more efficient targeting of granting decisions, such social forces interacted with examination quality initiatives may prove valuable to understand just how strong peer are.
- The importance of knowledge spillovers among co-workers is especially salient now given the present transition to working from home during the COVID-19 pandemic.
- From a long-term perspective, telecommuting may reduce a range of other transaction costs for agencies and for their bureaucrats (and for firms and their employees). In this paper, we provide some empirical support for the countervailing costs to knowledge flows and social influence from telecommuting.

Thanks

Questions & Comments?

Reference

Frakesa and Wasserman (2021)
Knowledge spillovers, peer effects, and telecommuting: Evidence from the U.S. Patent Office
Journal of Public Economics 198, 104425.