

Who Feeds the Trolls?

Patent Trolls and the Patent Examination Process

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Research Questions

- Debate over the role of non-practicing entities (NPEs) in the IP system
 - Standard economic intermediaries
 - Nuisance litigators
- Re-frame debate in terms of NPE patent purchasing behavior:
 - 1 On average, do NPEs provide useful innovation incentives by buying patents covering **good technology**?
 - 2 Or do they buy **weak patents**?
- If NPEs buy weak patents:
 - 1 Do weak patents create a more widespread problem beyond NPEs?
 - 2 Policy: can USPTO reforms deal with problems?

Answering the Questions

- Why not just compare NPE-purchased patents to other patents based on traditional quality measures?
 - Suffer from endogeneity concerns
 - e.g. NPE purchase increases exposure and inflates citation counts
 - Don't provide measures of patent weakness
- Our approach
 - Make use of the random assignment of patent applications to examiners within art units
 - Are NPE-purchased patents granted by a specific set of examiners?
 - Infer average quality and weakness of NPE patents from examiner prosecution behavior

Answering the Questions

1 **Empirical Fact 1:** large examiner causal effects (some outcomes)

- Large NPE purchase effect: 1 SD = 51% baseline rate
- Large non-NPE litigation effect: 1 SD = 62% baseline rate
- Small non-NPE purchase effect: 1 SD = 14% baseline rate

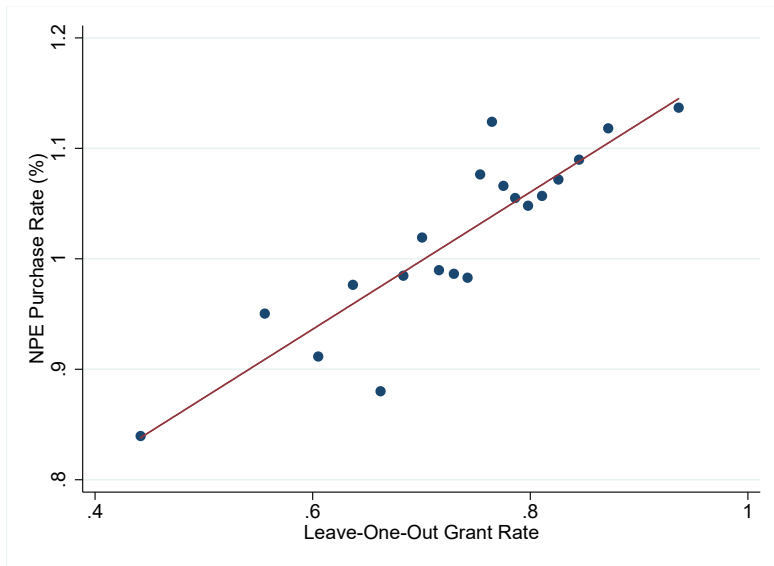
2 **Empirical Fact 2:** High NPE effect examiners tend to issue incremental patents with vague claims

- Similar patterns for non-NPE litigation

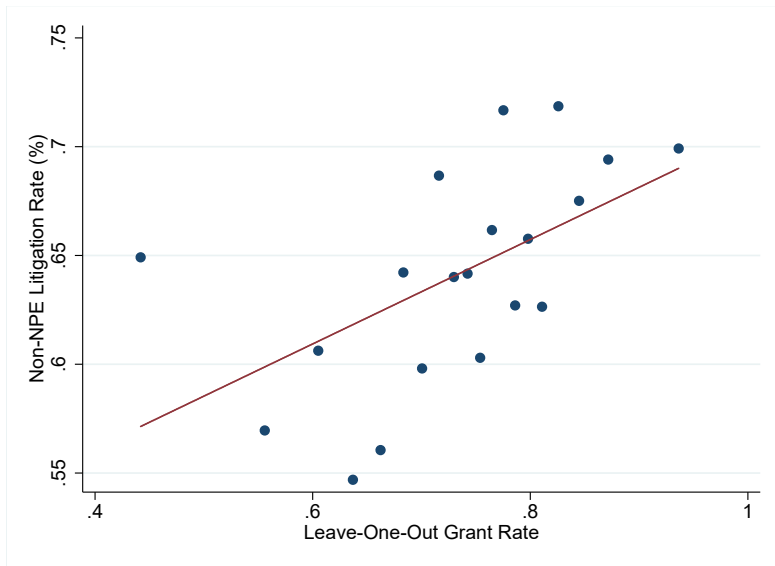
3 **Answers based on analysis**

- NPEs, on average, purchase weak patents
- Non-NPE litigated patents point to a broader weak patents problem
- Large examiner causal effects: high returns from USPTO reforms

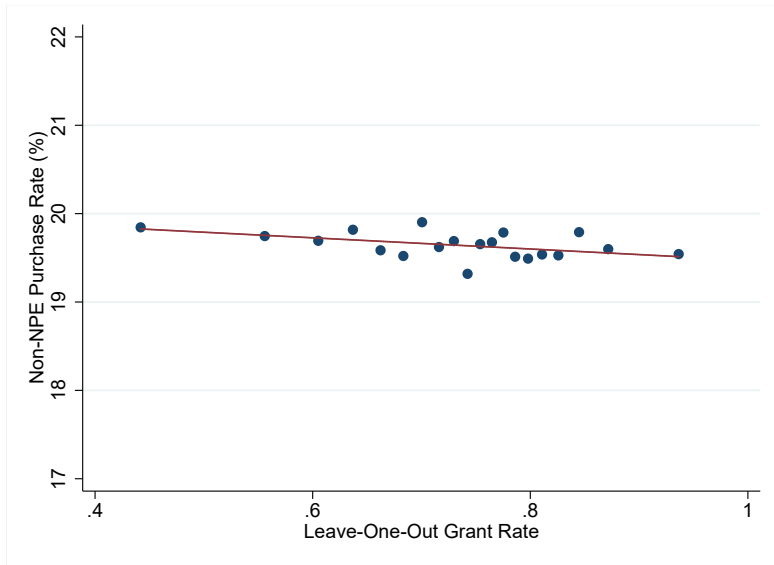
Simple Relationships - Examiners and NPEs



Examiners and Non-NPE Litigation



Examiners and Non-NPE Purchase



Road Map

- 1 Main Analysis
 - Data
 - Examiner Causal Effects
 - Mechanism and Interpretation
- 2 Policy
 - Courts and Examiners
 - USPTO Reforms

Data Overview

- Core sample

- USPTO PatEx merged with Frakes/Wasserman data on examiner blocking actions
- 1.27 million non-continuation granted patents from 2001 to 2012
- 11,401 patent examiners in 643 art units
 - Average tenure: 7 years
 - Average applications reviewed per year: 16

- Subsequent outcomes

- 20% of sample is **purchased** by non-NPEs (USPTO Patent Assignment Dataset)
- 1% of sample is **purchased** by NPEs (RPX, Cotropia/Kesan/Schwartz)
- 0.65% of sample is **litigated** by non-NPEs (LexMachina, Darts IP)

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Estimating Examiner Effects - A Sketch

- Why not compare raw averages across examiners?
 - NPE and litigation outcomes are rare
 - Simple approach overstates the magnitude of the difference across examiners
- Solution: look for persistent differences across examiners
 - 1 Bayesian shrinkage methodology
 - 2 Shrink raw averages by a signal to noise ratio
- Recover estimates that do not overstate the variation

Extracting Residuals

$$T_{ijt} = X_i\beta + a_{ut} + v_{ijt}$$

$$v_{ijt} = \mu_j + \epsilon_{ijt}$$

- i indexes the patent, j the examiner, u the art unit
- Data variables
 - T : outcome (e.g. NPE purchase, litigated, 103 blocking action)
 - a_{ut} : art unit-year fixed effect (**random assignment level**)
 - X_i : observable application characteristics (assignee, applicant history, number of claims at application)
- Other variables
 - μ_j : examiner causal effect
 - ϵ_{ijt} : idiosyncratic noise

Shrinkage Using the Residuals

- 1 Aggregate residuals at examiner x year level:

$$\bar{v}_{jt} = \frac{1}{n_{jt}} \sum_i v_{ijt} \left(= \mu_j + \frac{1}{n_{jt}} \sum_i \epsilon_{ijt} \right)$$

- 2 Compute correlation of residuals across years (variance of examiner effect distribution):

$$\hat{\sigma}_\mu^2 = \text{cov}(\bar{v}_{jt}, \bar{v}_{j(t+1)})$$

- 3 For each examiner: shrink raw average residual by signal-to-noise ratio to recover estimate with **same scale** as μ_j :

$$\text{ExaminerEffect}_j = \bar{v}_j \frac{\hat{\sigma}_\mu^2}{\text{Var}(\bar{v}_j)}$$

Quantifying Examiner Effect Size

Outcome	$\hat{\sigma}_\mu$ /Baseline Rate
NPE Purchase	50.97% [33.7%, 60.7%]
Non-NPE Litigation	62.1% [42.62%, 71.99%]
Non-NPE Purchase	14.01% [10.70%, 14.47%]

Examiner Effects - Discussion

- Interpretation: differences result from how examiners force edits between application and grant
 - “Intensive margin”
- Selection on quality
 - Random assignment is at the *application level*
 - Hypothesis: NPEs purchase more from some examiners because those examiners weed out low quality technology
 - In fact: high NPE effect examiners are *less selective*
- Next section: provide direct evidence on intensive margin

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Mechanism?

- Use behavior of high NPE effect examiners to uncover nature of NPE-purchased patents
- Methodology
 - Compute leave-one-out examiner effects for various prosecution behaviors
 - Predict patent outcomes using these measures (\hat{E}_j)

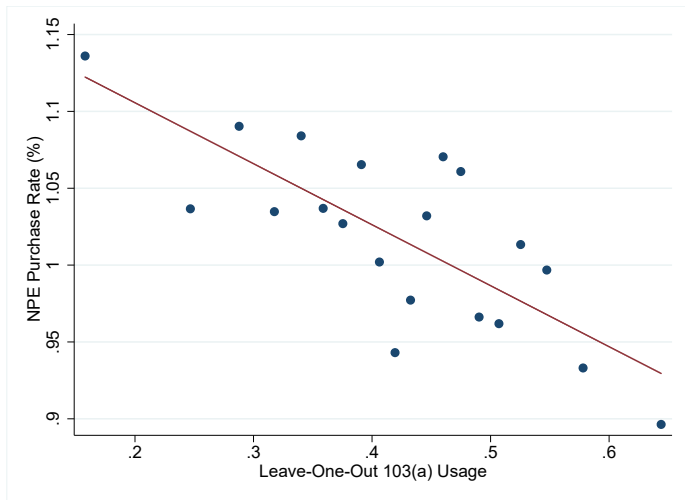
$$NPE_{ijt} = \beta \hat{E}_j + \epsilon_{ijt}$$

- **Equivalent approach:** compute signal correlation of examiner effects (split sample)
 - NPE_j in sample 1 vs. E_j in sample 2

Examiner Prosecution Behavior

- Examiner blocking action usage by type:
 - 101: not patentable subject matter, lacking utility
 - 102: not novel
 - 103(a): obvious
 - 112(a): unclear technological disclosure
 - 112(b): unclear claims language
- Claims text changes between application and grant
 - Edits in response to examiner blocking action critiques

NPE Purchase and 103(a) Usage



Formal Analysis - Pairwise Correlations

	NPE Purchase	Non-NPE Purch.	Non-NPE Lit.
103(a) - Obviousness	-0.099*** (0.023)	-0.013** (0.005)	-0.039** (0.017)
112(b) - Unclear claims	-0.047** (0.023)	0.001 (0.004)	-0.040** (0.018)
Δ Words/Claim	-0.148*** (0.021)	-0.019*** (0.004)	-0.061*** (0.016)
<i>N</i>		1,269,623	

* *p*-value < 0.10, ** *p*-value < 0.05, *** *p*-value < 0.01

Summary

- Main finding: examiners with high NPE and non-NPE litigation effects are “lenient”:
 - Use specific blocking actions less: 103(a), 112(b)
- Evidence consistent with NPEs as nuisance litigators
 - Could it also be consistent with other theories of NPE behavior?

Mechanism Results and NPE Behavior

1 Are NPEs purchasing just based on patent breadth?

- 103(a) examiner effect may be proxying for breadth
 - Correlated with general leniency
 - Subtleties in usage of 103(a)
- Evidence against
 - NPE vs. non-NPE purchase
 - Non-NPE litigation vs. NPE purchase (disagreement)

Mechanism Results and NPE Behavior

1 Are NPEs purchasing just based on breadth? No

2 **Are NPEs buying based only on firm attributes?**

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- Hypothesis: NPEs buy patents based on firm characteristics
 - A) NPEs buy mostly from small firms or individual inventors
 - Lenient examiners grant a higher rate of small entity apps (selection)
 - B) NPEs purchase whole portfolios from struggling firms
 - Firms are struggling because they have weak IP
 - Evidence against
 - Results remain large and significant after **including assignee FE**
 - NPEs **selectively purchase** within firm portfolios

Mechanism Results and NPE Behavior

- 1 Are NPEs purchasing just based on breadth? No
- 2 Are NPEs buying based only on firm attributes? No
- 3 **Are NPEs screening vague patents for good technology?**

Hypothesis: NPE provide value by screening pool of vague patents for good technologies

- Evidence against: European Patent Office (EPO) decisions
 - Use EPO grant as a direct quality signal
 - Look at near simultaneous filings
 - Negative association between NPE purchase and EPO grant

EPO Evidence

Table : NPE Purchase vs. EPO Decision

	(1)	(2)	(3)	(4)
EPO Grant	-0.461*** (0.056)	-0.211*** (0.057)	-0.199** (0.059)	-0.023 (0.063)
Artunit-Year F.E.	No	Yes	Yes	Yes
Examiner F.E.	No	No	Yes	Yes
Assignee F.E.	No	No	No	Yes
<i>N</i>	218,867	218,867	217,491	197,919

EPO Evidence

	NPE Purchase	Non-NPE Purch.	Non-NPE Lit.
EPO Grant	-0.2144** (0.1001)	0.0037 (0.0133)	-0.0831 (0.1074)
Examiner F.E.		Yes	
Assignee F.E.		Yes	
Artunit-Year F.E.		Yes	
<i>N</i>		109,383	

Sample: patents of examiners with above median NPE Effect

Mechanism Results and NPE Behavior

- 1 Are NPEs purchasing just based on breadth? No
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- 3 Are NPEs screening vague patents for good technology? No

Summary

- Evidence supports view that, on average, NPEs are **nuisance litigators**
- Why might vague patents on incremental inventions be useful to nuisance litigators?
 - *Obviousness*: higher likelihood others take this step when developing products
 - *Vague claims language*: many possible interpretations which can be used flexibly to read on subsequent technology
- **Additional implication**: examiners play an important role as co-producer of intellectual property
 - Affect subsequent usage/outcomes

Robustness and Heterogeneity

- Examiner effects distribution estimates robust to **sample**
 - All patents from 1976-2015, 2001-2015; including continuations
 - Juristat data on blocking actions (2001-2015)
- Results robust to methodology
 - Non-parametric **count model**: test normality assumption
 - Signal correlation year offset: serial correlation concerns
- ... and **list of NPEs**
 - Cotropia et al categories: aggregators and holding companies
 - Intellectual Ventures vs. other NPEs
- Heterogeneity across technology areas
 - NPE and litigation results driven by four **IT-related** technology centers; no effect for biotech/chemicals

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USPTO vs. Statutory Reforms

- Our analysis: NPEs create inefficiencies and examiners matter
 - Points to USPTO reform
- Hypothesis: high NPE effect examiners are following the statutes as defined by the courts
 - Courts may be giving examiners a lot of leeway
 - If so, need to consider statutory reforms
- Evidence: district court rulings, IPR institution
- Results: patents from lenient examiners *more likely* to be deemed invalid by the courts
 - Within set of patents with rulings
 - Caveat: very selected group of patents with ruling

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USPTO Reform Calibration

- Use estimated examiner effects distribution to calibrate social returns USPTO reforms
 - Have second examiner double-check each pending patent grant (Second Pair of Eyes)
- Social costs:
 - \$3-7 billion per year in NPE litigation defense fees
 - Not considered: NPE resources, non-NPE litigation, reduced VC funding and firm R&D
- Results
 - Find that policy would lead to **large reductions** in NPE purchase, non-NPE litigation, NPE litigation rates
 - Social returns on par with USPTO examiner salary budget (\$800 million per year)
 - Caveats: NPEs may adjust behavior in response

Conclusion

- Core results
 - NPEs, on average, selectively purchase **unclear patents on incremental technology**
 - These patents also drive litigation more generally
- Broader takeaway
 - Examiners can have sizable effects on the **nature and subsequent usage of intellectual property**