Patent Litigation: Empirical Analysis

Bernhard Ganglmair  
*ZEW – Leibniz Centre for European Economic Research*

Christian Helmers  
*Santa Clara University*

Brian Love  
*Santa Clara University School of Law, blove@scu.edu*

Follow this and additional works at: [https://digitalcommons.law.scu.edu/facpubs](https://digitalcommons.law.scu.edu/facpubs)

Automated Citation

Patent Litigation: Empirical Analysis

Bernhard Ganglmair  Christian Helmers  Brian J. Love

11 September 2019
Overview

- Policy interest

- Empirical questions

- Empirical challenges and ways to address them
Policy interest

- Strength of patent rights
- Interplay with post-grant review systems (e.g. PTAB in U.S.)
- Lots of litigation especially in information and communication technology (ICT) industry
- Litigation due to so-called patent assertion entities (PAE) aka patent trolls
- Patent litigation involving standard essential patents (SEPs)
How should the system be designed?

- Allow patent owners to enforce a patent if infringement is detected
- Allow defendants to challenge patent’s validity
- But also:
  - Discourage strategic behavior
  - Deter plaintiffs from seeking ‘overly broad’ injunctions or ‘excessive’ damages
  - Deter nuisance lawsuits
  - Discourage defendants from driving up enforcement costs to deter assertion or force settlements

- System should strike balance between allowing patent owners to enforce their rights and to obtain appropriate remedies while avoiding incentives for excessive litigation

- Is the litigation system achieving that objective?
Empirical questions

• How much litigation is there?

• Can we test validity of assumptions made by different theoretical models of litigation (Shavell, 1996; Gelbach, 2018; Helland et al., 2018)?

• Design of litigation system – specific aspects:
  - Bifurcation and sequential trials
  - Fee shifting
  - Forum shopping

• Evaluate effect of specific litigation activity: NPEs, SEPs

• Legal, institutional, legislative changes:
  - Frequent changes in the law and its application especially in common law jurisdictions (e.g. in U.S. Mayo v. Prometheus 2012, CLS Bank v. Alice 2014)
  - Institutional changes (e.g. reform of IPEC in UK including SCT, introduction of opposition procedures in Japan and Korea in 2015 and 2017 respectively)
  - Legislative changes (AIA in the U.S.)
Empirical analysis

• **Challenges for quantitative analysis of patent litigation:**

  (1) Complexity of patent litigation (see Lecture 1)

  (2) Observability of information

    • Some information unobservable (private information exchanged between parties)
    • Information in principle observable, but unavailable (e.g. terms of private settlement)
    • Information in principle observable, but missing at random or not (e.g. only judgments published, pre-trial motions are not)

  (3) Large heterogeneity among court cases (see Lecture 3)

  (4) Any observable information is the outcome of non-random choice: selection
Selection

- **Selection** biggest problem in cause-effect analysis

- Observed data **outcome of optimizing behavior by the parties:**
  1. Selection into court filing
  2. Selection conditional on claim filing
  3. Selection into settlement/judgment
  4. Selection into appeal

- Why does it matter?

- How would you answer the following research question:
  *What was the impact of a specific legal/institutional change on litigation behavior (claims filed, plaintiff win rate, etc.)?*
Reminder: Selection

• Define:

\[ D_i = \begin{cases} 
1 & \text{if } i \text{ files claim} \\
0 & \text{otherwise.} 
\end{cases} \]

• 2 “potential” outcomes for individual \( i \) (only 1 outcome realized)
  • Outcome if does not file claim: \( Y_{0i} \)
  • Outcome if files claim: \( Y_{1i} \)

• Causal effect of filing claim:

\[ \kappa = Y_{1i} - Y_{0i} \] \hspace{1cm} (1)

• Rewrite:

\[ Y_{1i} = Y_{0i} + \kappa \] \hspace{1cm} (2)
Reminder: Selection

• This means we can write:

$$Avg_n[Y_{1i} | D_i = 1] = \kappa + Avg_n[Y_{0i} | D_i = 1]$$ (3)

• Subtract $Avg_n[Y_{0i} | D_i = 0]$:

$$\{Avg_n[Y_{1i} | D_i = 1] - Avg_n[Y_{0i} | D_i = 0]\} =$$

Difference in group means

$$\kappa + \{Avg_n[Y_{0i} | D_i = 1] - Avg_n[Y_{0i} | D_i = 0]\}$$

Selection Bias

• This means:

difference in group means $= \text{average causal effect} + \text{selection bias}$
1: Selection into court filing

- Only complaints filed with a court are observed
- Disputes resolved or dropped before plaintiff files complaint unobservable
- Survey results for the U.S. suggest 70% of patent infringement claims never reach a court (Lemely et al., 2017)
- Unclear how to account for this type of selection
1: Selection into court filing: implication

- Assume some legal or institutional change
- **Observable: increase in the number of cases litigated in court**
1: Selection into court filing: implication

- Assume some legal or institutional change
- **Observable**: increase in the number of cases litigated in court
1: Selection into court filing: implication

- Assume some legal or institutional change
- **Observable:** increase in the number of cases litigated in court

![Diagram showing the increase in court filings before and after a change.](image-url)
1: Selection into court filing: implication

- Assume some legal or institutional change
- **Observable:** increase in the number of cases litigated in court
2: Selection conditional on court filing

- Some cases dropped after claim filing (claim form only document)
- Defendant acknowledges service and files response (counterclaim)
- If case proceeds, parties interact and make series of decisions (litigant controlled motions that force exchange of information)
- Amount of information available depends on these decisions
2: Selection conditional on court filing

- Court may dismiss the case
- Parties may settle at any point – decision to settle depends on set of factors
- If case settled, usually no information revealed about terms of settlement (e.g. potential payments, licensing agreements etc.)
- Difficult which party prevailed in settlement
3: Selection into judgment – no settlement

- Theory showed that settlement process acts as a “filter” on filed cases.

- Empirically this means that small and non-random subset of cases not settled (although ultimately ultimately empirical question).

- Decided cases are not representative of all patent disputes filed with court, even less so of all patent disputes that never reach a court.
3: Selection into judgment – no settlement

UK IPEC/PHC 2007-2013

Ganglmair, Helmers, Love

Empirical Analysis

11 September 2019 18 / 33
3: Selection into judgment – no settlement

- **Important implication** (Shavell, 1996; Gelbach, 2018):

- Any plaintiff’s win rate can be observed among litigated cases

- Cannot infer anything about underlying causes from observed win rates

- Interpreting win rates requires theory
4: Selection into appeal

- Cases decided on appeal even more highly selected subset of patent cases and in no way representative of patent disputes more generally.
Selection

• How to address selection?

• In practice often simply ignored ("[W]e do not control for selection. Rather, we ask, given any selection that occurs, is there any remaining association between patent and patentee characteristics and the outcomes?" (Lanjouw and Schankerman, 2004))

• Ways to address selection:
  • Theory
  • Diff-in-diff
  • Regression discontinuity
  • Instrumental variable
Reminder: Differences-in-differences

- **Differences-in-differences (diff-in-diff)** method works when there is selection

- Need ‘treatment’ and ‘control’ groups (e.g. one type of cases affected by Supreme Court decision, another is not)

- But treatment and control groups can differ for many reasons

- **Main assumption:** treatment and control outcomes **move in parallel in the absence of treatment**

- Effect obtained from divergence between treatment and control group post-treatment
Reminder: Differences-in-differences

- Diff-in-diff has 3 ingredients (assuming 1 treatment and 1 control group):

\[ Y_{it} = \alpha + \beta T_i + \gamma P_t + \delta_{rDD} (T_i \times P_t) + e_{it} \]  \hspace{1cm} (4)

1. A dummy for the treatment \( T_i \) that varies across treatment and control groups – inclusion of \( T_d \) controls for fixed differences between the units being compared

2. A dummy for post-treatment periods \( P_t \) that varies over time – inclusion of \( P_t \) controls for the fact that conditions change over time for everyone, whether treated or not

3. Interaction term \( T_d \times P_t \) – the coefficient on this term is the diff-in-diff causal effect.
Differences-in-differences

- PHC
- IPEC

Introduction of costs cap

ln number of court cases

Case filing date

Coefficient

Case filing date
Reminder: Regression discontinuity

- Often changes in legal system occur on a specific date or decisions happen within fixed time periods (e.g. institutional/legal change takes effect on specific date; institution decision at PTAB)

- This means that treatment is a deterministic function of time

- If change generates a discontinuity in the data, can use Regression Discontinuity Design (RDD)
Reminder: Regression discontinuity

• Define treatment as

\[ D_i = \begin{cases} 
1 & \text{if time } t \geq t^* \\
0 & \text{otherwise.} 
\end{cases} \]  \tag{5}

• Treatment status is a deterministic function of \( t \)

• Treatment status is a discontinuous function of \( t \), no matter how close \( t \) gets to cutoff \( t^* \), \( D_i \) remains unchanged until cutoff is reached

• Sharp v fuzzy RDD
Regression discontinuity

Ganglmair, Helmers, Love

Empirical Analysis

11 September 2019
Instrumental Variable (IV): Judge Fixed Effects

- Individual judges affect outcomes
- Heterogeneity among judges
- Key institutional feature: random assignment of cases to judges (exclusion restriction)
- Key idea: binary outcome of cases \( i \neq j \) valid IV for outcome of case \( i \) if same judge in \( i \) and \( j \)
- Widely used in analysis of court decisions for a long time
- Application to patent litigation: Galasso and Schankerman (2015)
Reminder: Instrumental Variable

- **IV requires:**
  - IV has a causal effect in first-stage (*direct effect of IV on treatment*)
  - IV is unrelated to the omitted variables (*independence assumption*)
  - Single channel through which the IV affects outcomes (*exclusion restriction*)
  - Instrument pushes treatment only in one direction (*monotonicity*)
Reminder: Instrumental Variable

First stage:

\[ D_i = \alpha_1 + \phi Z_i + \gamma_1 X_i + e_{1i} \]  \hspace{1cm} (6)

where \( D_i \) is the endogenous variable, \( Z_i \) is the IV

From the first stage we get:

\[ \hat{D}_i = \alpha_1 + \phi Z_i + \gamma_1 X_i \]  \hspace{1cm} (7)

Second stage (which includes \( X_i \)):

\[ Y_i = \alpha_2 + \lambda_{SLS} \hat{D}_i + \gamma_2 X_i + e_{2i} \]  \hspace{1cm} (8)
Judge Fixed Effects

- Example: impact of invalidity on forward citations

\[ \text{cites}_i = \beta_0 + \beta_1 \text{invalid}_i + \beta_2 X_i + \epsilon_i \] (9)

where \( \text{cites}_i \) forward cites for litigated patent \( i \), \( \text{invalid}_i \) equal to one if patent \( i \) was invalidated, and \( X_i \) are patent characteristics

- OLS estimate of \( \beta_1 \) biased if \( E(\beta_1 \epsilon_i) \neq 0 \)

- Use IV: leave-one-out mean of case outcomes

\[ Z_{ij} = \frac{\sum_{k \neq i}^{n_j-1} \text{invalid}_k}{n_j - 1} \] (10)

- where \( n_j \) is the total number of cases decided by judge \( j \)
Summary

• Lots of interesting questions (testing theory, policy, etc.)

• Selection poses fundamental problems to any type of analysis of patent litigation data

• Good idea to combine empirical analysis with theory

• But you can still use standard empirical tool set to address selection
References


