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Patent Litigation: Empirical Analysis

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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:

$$\kappa = Y_{1i} - Y_{0i} \tag{1}$$

- Rewrite:

$$Y_{1i} = Y_{0i} + \kappa \tag{2}$$

Reminder: Selection

- This means we can write:

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

- Subtract $Avg_n[Y_{0i}|D_i = 0]$:

$$\underbrace{\{Avg_n[Y_{1i}|D_i = 1] - Avg_n[Y_{0i}|D_i = 0]\}}_{\text{Difference in group means}} =$$

$$\kappa + \underbrace{\{Avg_n[Y_{0i}|D_i = 1] - Avg_n[Y_{0i}|D_i = 0]\}}_{\text{Selection Bias}}$$

- This means:

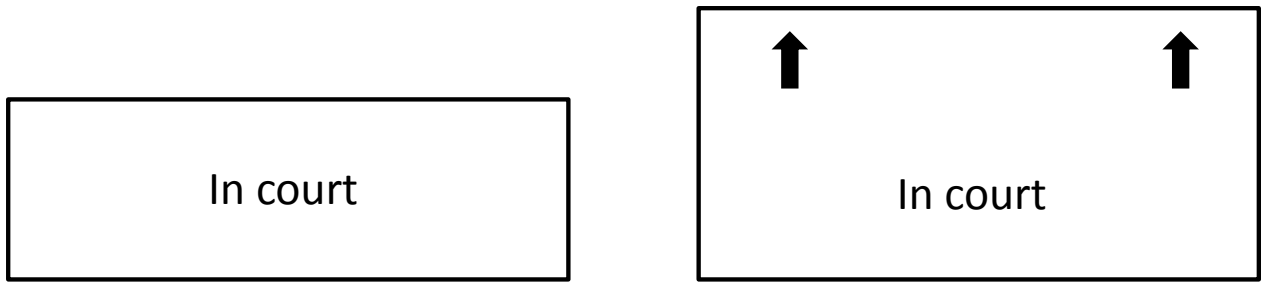
  difference in group means $=$ average causal effect $+$ **selection bias**

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**



Before After

1: Selection into court filing: implication

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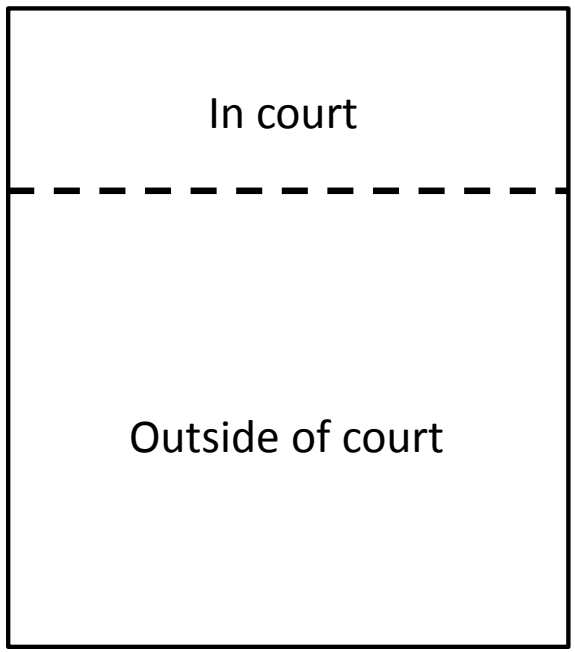

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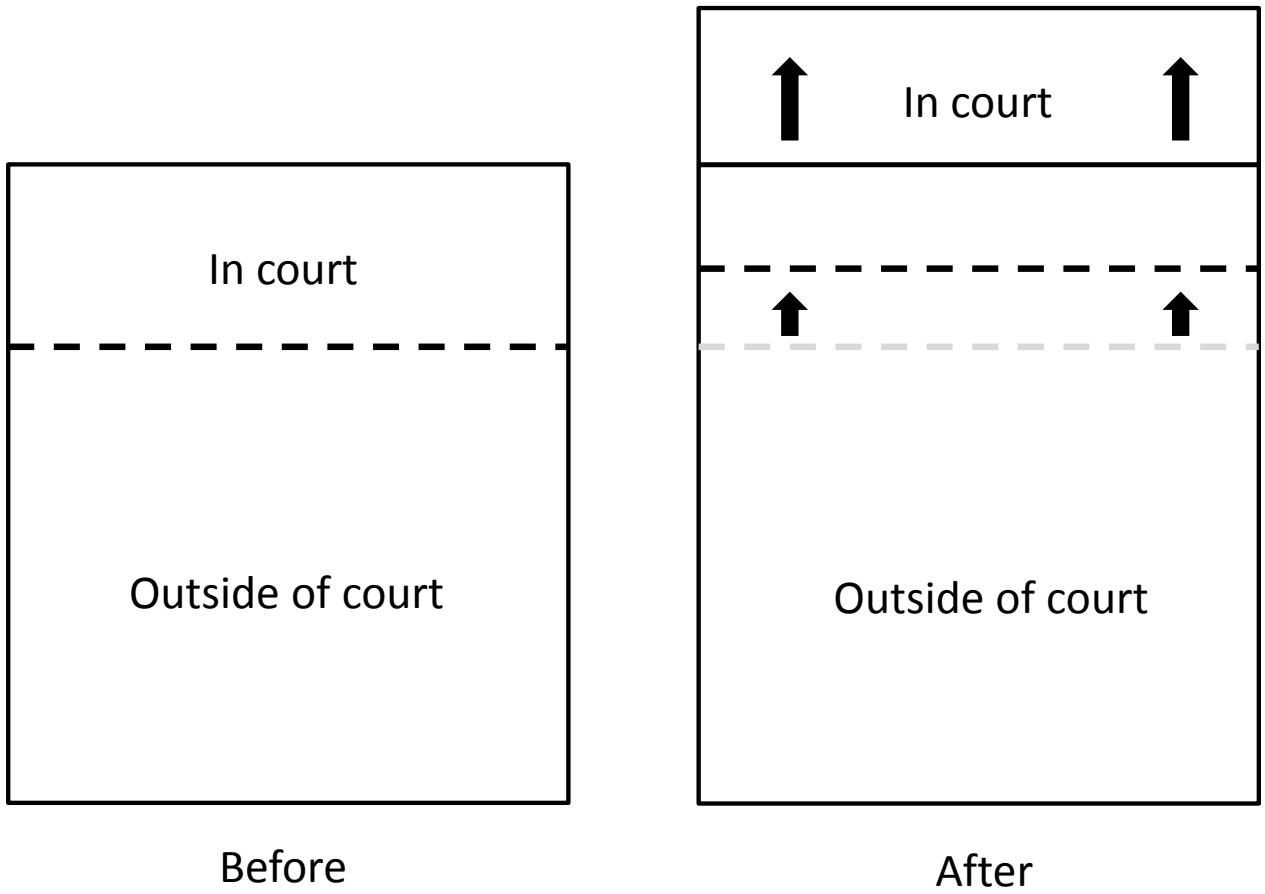

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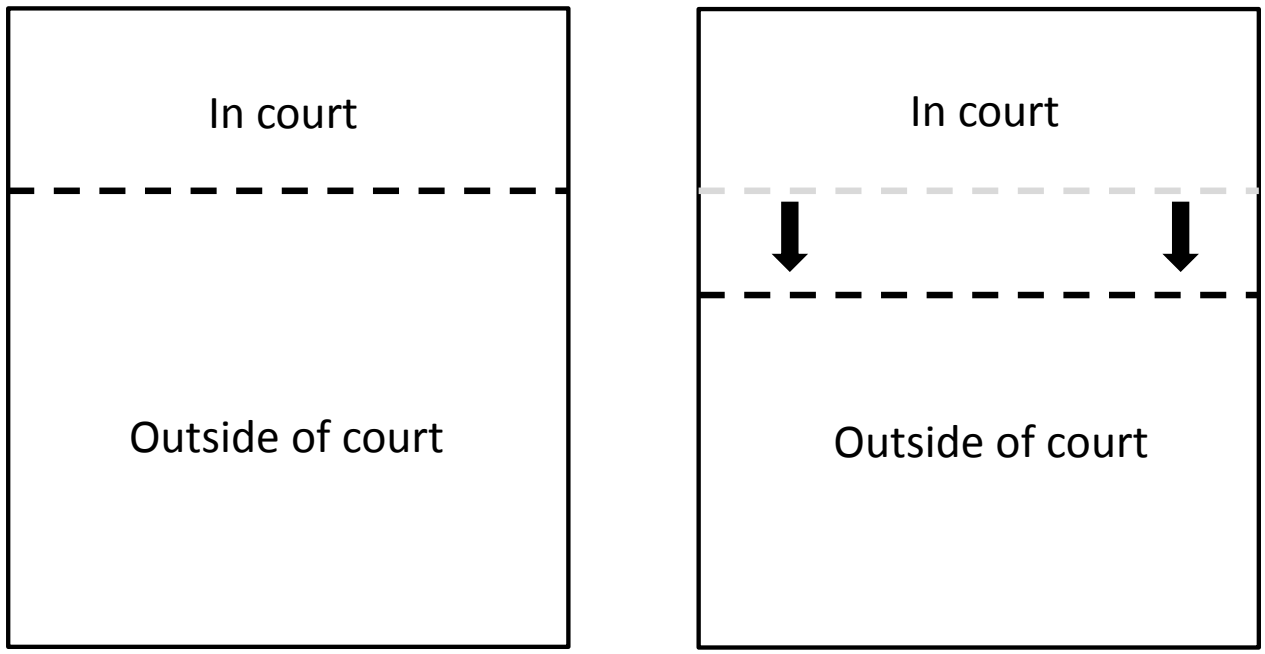
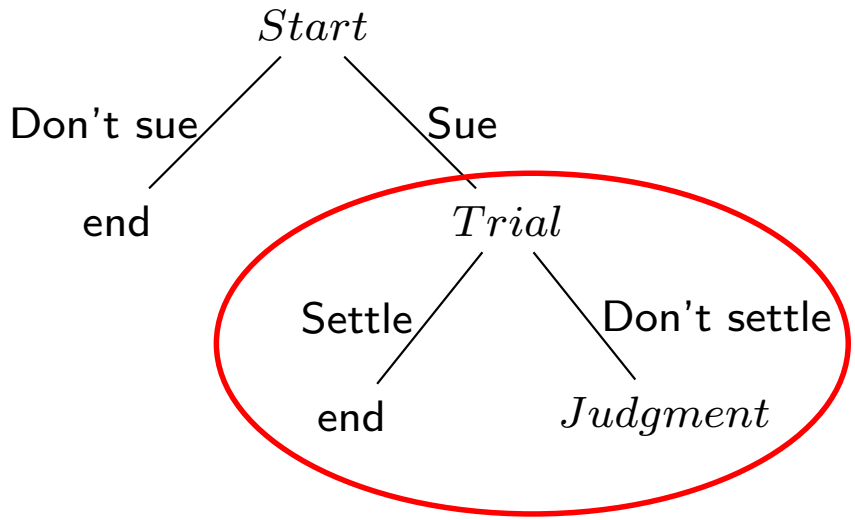


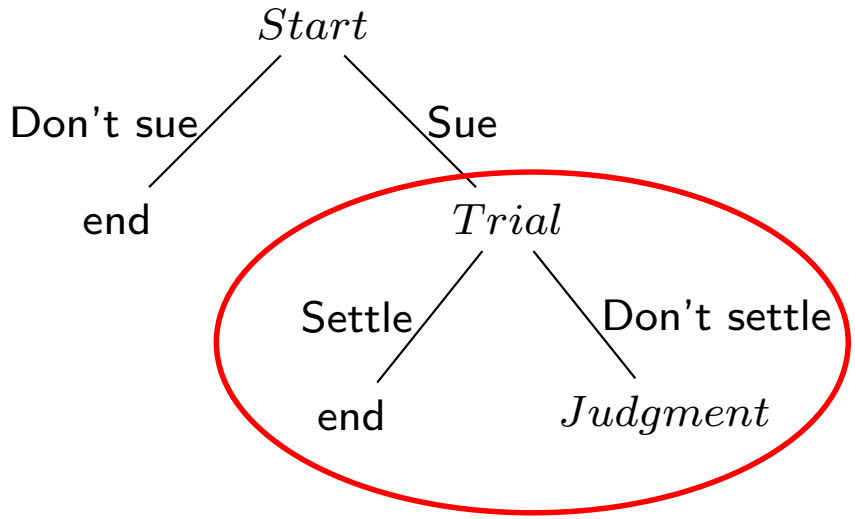
2: Selection conditional on court filing

- 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



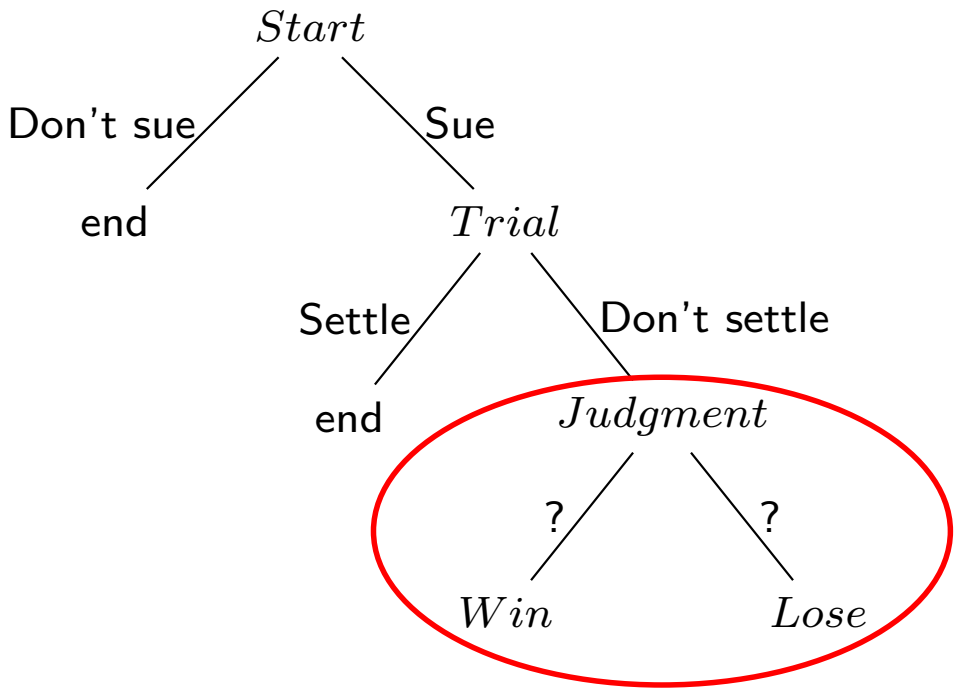
2: Selection conditional on court filing

- 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 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



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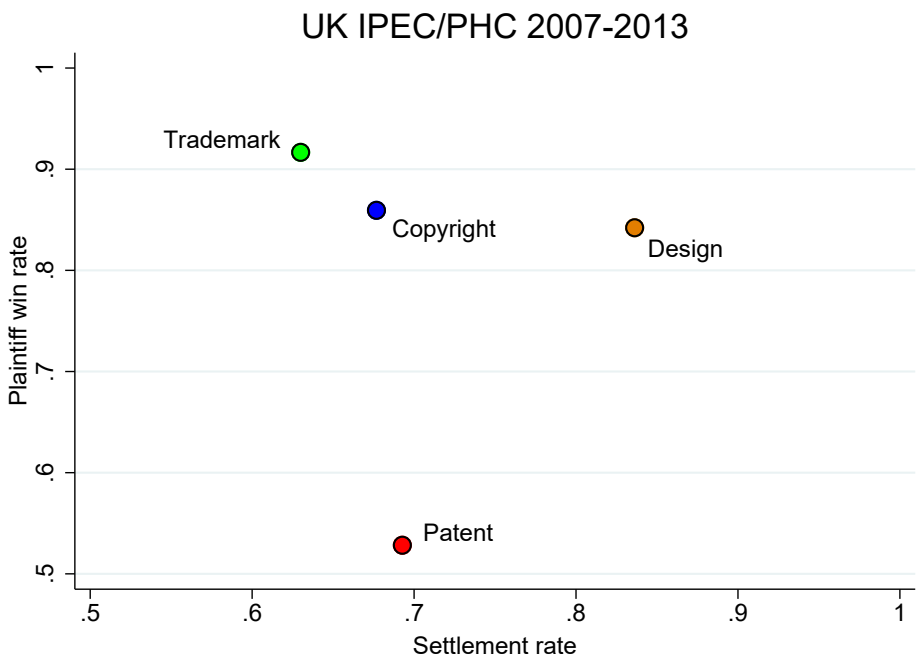
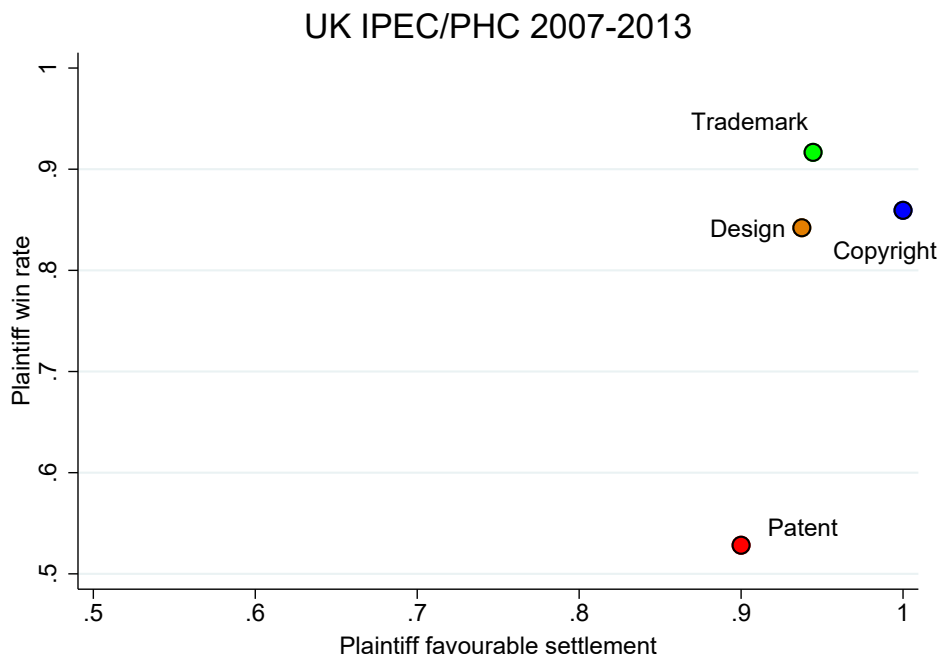


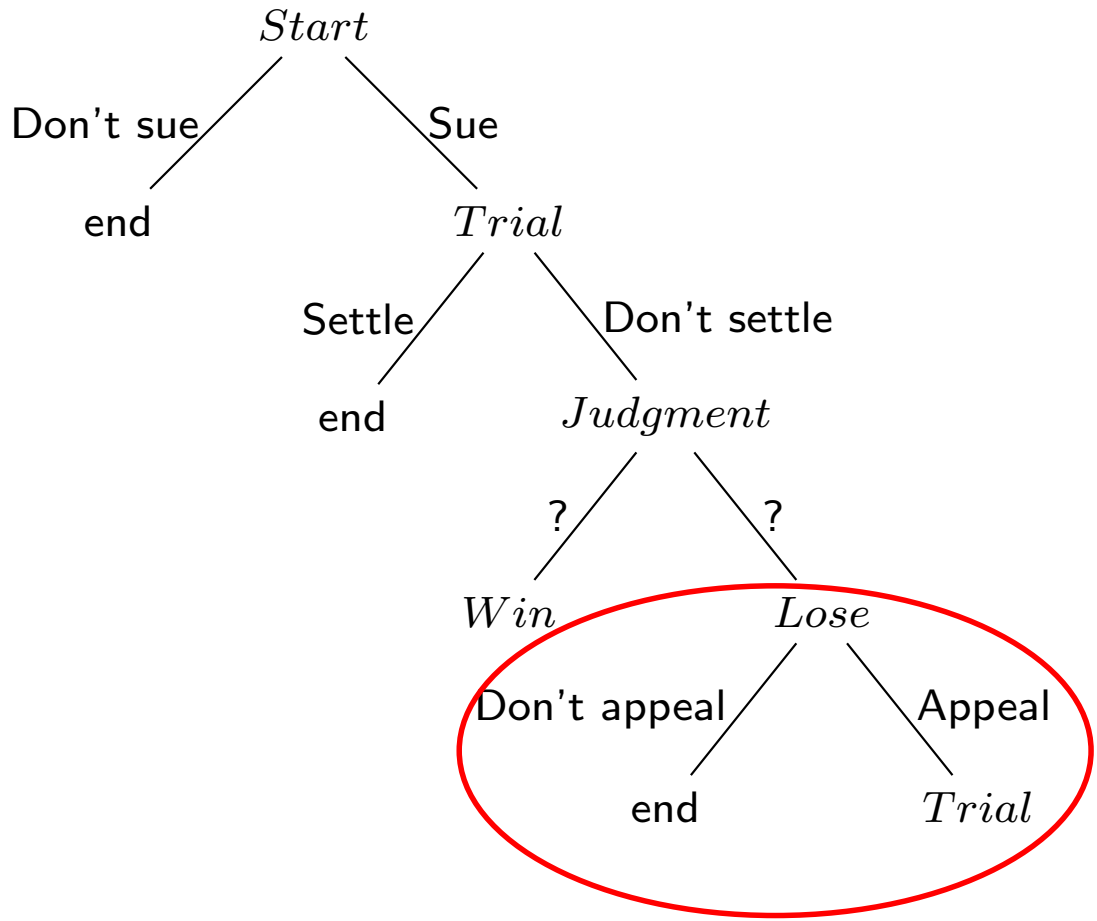


3: Selection into judgment – no settlement

- **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):

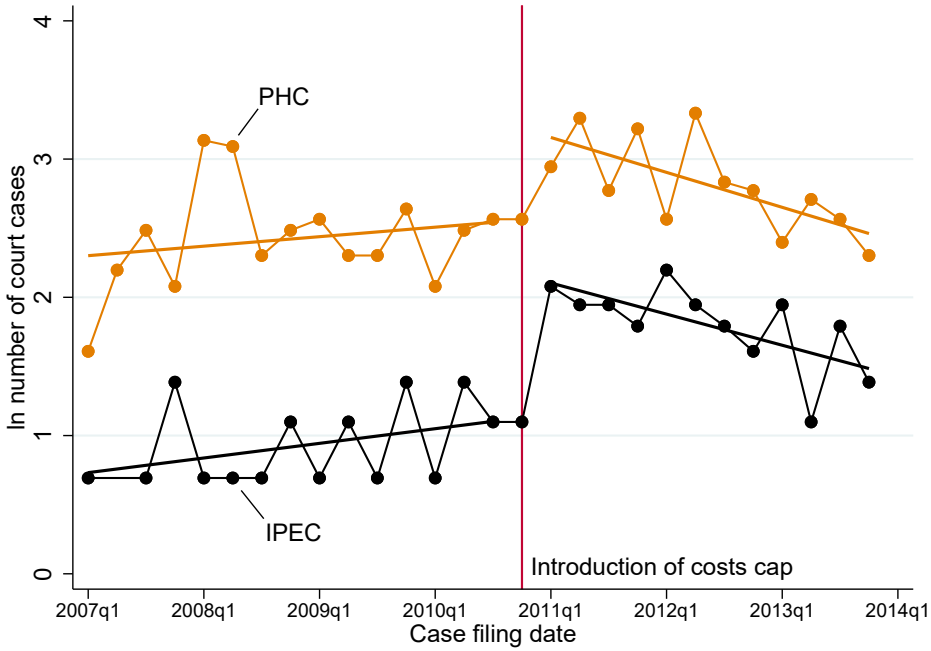
$$Y_{it} = \alpha + \beta T_i + \gamma P_t + \delta_{rDD}(T_i \times P_t) + e_{it} \tag{4}$$

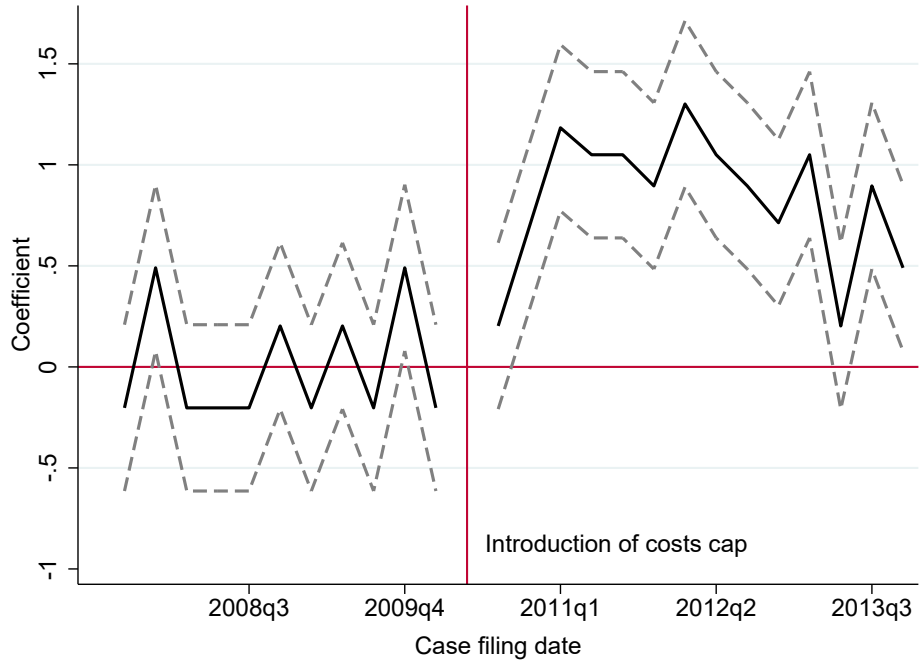
(1) A dummy for the treatment T_i that varies across treatment and control groups – inclusion of T_d controls for fixed differences between the units being compared

(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.

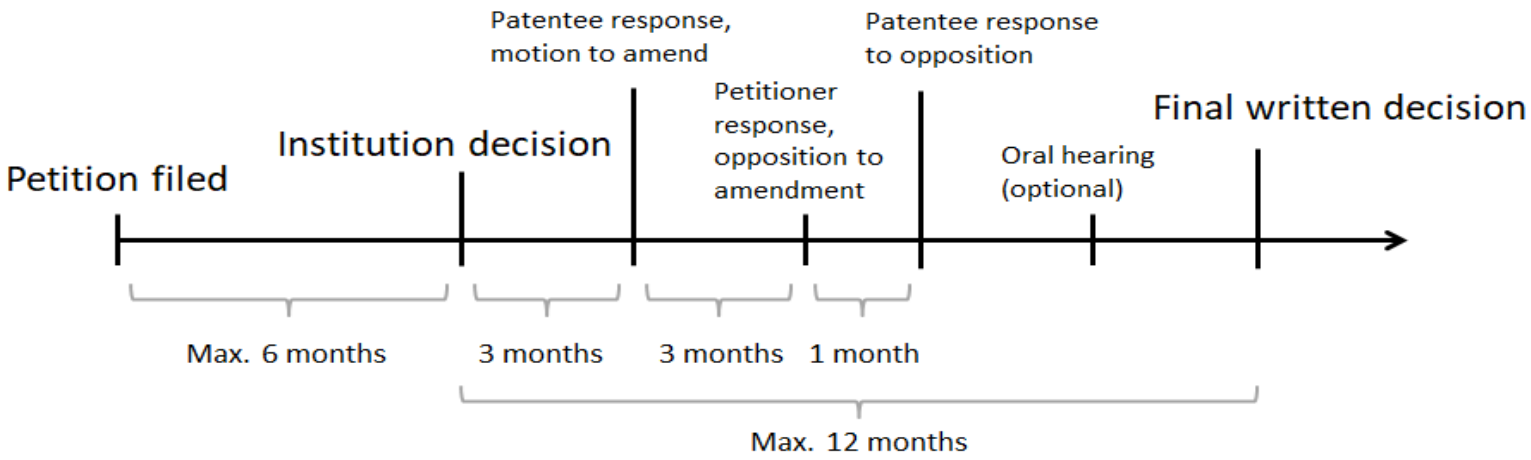
Differences-in-differences





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)

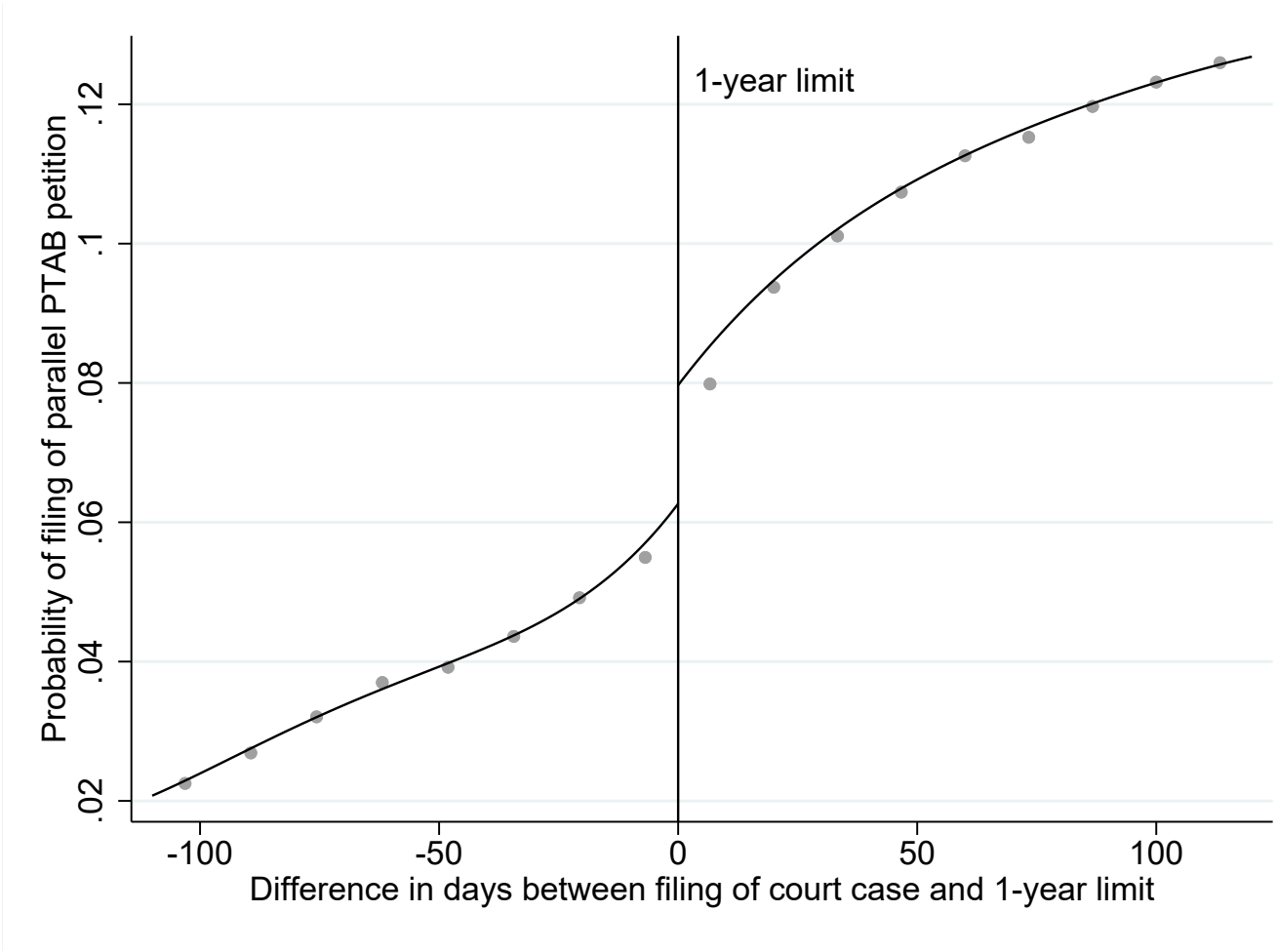
Reminder: Regression discontinuity

- 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



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:

$$D_i = \alpha_1 + \phi Z_i + \gamma_1 X_i + e_{1i} \tag{6}$$

where D_i is the endogenous variable, Z_i is the IV

From the first stage we get:

$$\hat{D}_i = \alpha_1 + \phi Z_i + \gamma_1 X_i \tag{7}$$

Second stage (which includes X_i):

$$Y_i = \alpha_2 + \lambda_{SLS} \hat{D}_i + \gamma_2 X_i + e_{2i} \tag{8}$$

Judge Fixed Effects

- Example: impact of invalidity on forward citations

$$cites_i = \beta_0 + \beta_1 invalid_i + \beta_2 X_i + \epsilon_i \tag{9}$$

  where $cites_i$ forward cites for litigated patent i, $invalidated_i$ equal to one if patent i was invalidated, and X_i are patent characteristics
- OLS estimate of β_1 biased if $E(\beta_1 \epsilon_i) \neq 0$
- Use IV: leave-one-out mean of case outcomes

$$Z_{ij} = \frac{\sum_{k \neq i}^{n_j - 1} invalid_k}{n_j - 1} \tag{10}$$

- 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

- Galasso Alberto and Mark Schankerman (2015): Patents and Cumulative Innovation: Causal Evidence from the Courts, Quarterly Journal of Economics, Vol. 130, No. 1, pp. 317-369.
- Gelbach Jonah B. (2018): The Reduced Form of Litigation Models and the Plaintiff's Win Rate, Journal of Law and Economics, Vol. 61, No. 1, pp. 125-157
- Helland Eric, Daniel Klerman, and Alex Lee Yoon-Ho (2018): Maybe there Is No Bias in the Selection of Disputes for Litigation, Journal of Institutional and Theoretical Economics, Vol 174, No. 1, pp. 143-170
- Lanjouw Jean O. and Mark Schankerman (2004): Protecting Intellectual Property Rights: Are Small Firms Handicapped?, Journal of Law and Economics, Vol. 47, No. 1, pp. 45-74.
- Shavell Steven (1996): Any Frequency of Plaintiff Victory at Trial Is Possible, Journal of Legal Studies, Vol. 25, pp. 493-501