

# Trading and Enforcing Patent Rights

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# Motivation (1/2)

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The **market for innovation** –the licensing and sale of patents- is an important source of R&D incentives, especially for small firms and individuals (Arora, Fosfuri and Gambardella, 2001; Gans, Hsu and Stern, 2002)

**Growing concern** in academic and policy debates that patent transactions can deter innovation if they take place for the purpose of extracting rents through **patent litigation**, and not associated with technology transfer (U.S. FTC 2011 report and U.S. Supreme Court)

**Disagreement** among economists and legal **scholars** about the scope and severity of this problem (Mann, 2005; Lemley and Shapiro, 2007)

Despite the importance of the issue, there are **no large scale empirical studies** of the impact of the market for patents on patent litigation

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## Motivation (2/2)

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**Research Question:** *How does the market for innovation affect patent litigation? What does this teach us about the sources of gains of trade?*

Possible countervailing effects:

- If transactions are driven by **commercialization gains** (Arora, Fosfuri, and Gambardella, 2001; Arora and Ceccagnoli, 2006), litigation increases
- If the market re-allocates patents to entities that are more effective at resolving disputes without resorting to courts (**enforcement gains**), litigation decreases (previously unnoticed)

*Which of these effects is empirically stronger?*

Another more controversial motivation for patent transactions is trolling

- If transactions are driven by **patent trolling**, litigation increases
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# Empirical Challenge

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- Big challenge is endogeneity of trade

Identification strategy:

- Exploit a provision in the US tax law: **for individuals**, profits from the ***sale of the patent*** are taxed as ***capital gains*** while ***damage awards*** are taxed as ***ordinary income***
  - State and time variation in capital gain taxes allows to identify the causal effect of trade on litigation (not possible for corporations)
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# Findings

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1. **Capital Gains Taxation** significantly **affects** the decision to **trade** patent rights
  2. **Changes in patent ownership reduce *on average*** the probability of **litigation** for patents originally owned by individuals
  3. **Heterogeneous effects:** magnitude of the effect depends on characteristics of the patent and the buyer
    - Efficient reallocation
    - Sorting
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# Outline

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- Trade, litigation and tax data
  - Results: average effect of trade on litigation, heterogeneous effect and role of transaction characteristics
  - Examine litigation risk due to patent assertion entities
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# Data (1/3)

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Focus on Individually Owned Patent: either (i) owned by original inventor at grant date or (ii) assigned to US individuals

**Trade Data:** USPTO Patent Assignment Database to identify transfers from re-assignments as in Serrano (2010). Info on buyer, seller and date of private agreement between parties. Data covers period 1983-2001

Strong incentives to record - US Patent Act: *assignment protects owner against previous unrecorded interest*

Distinguish trade from other re-assignments: drop assignments recorded at grant date, transfers to financial institutions, etc.. as in Serrano (2010). Drop if evidence that seller is inventor working for buyer

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# Data (2/3)

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**Litigation Data:** patents litigated from 1975-2000 (details in Lanjouw and Schankerman, 2001, 2004)- all patent cases filed in US federal district courts (not appeal)

**Tax Data:** NBER TAXSIM Data-Income and Capital Gains Tax Rates by year and state for a representative household

Corporate Tax Rates manually collected from Significant Features of Fiscal Federalism (1982-1995) and Book of the States (1996+)

For each patent we construct combined (State + Federal) income and capital gains tax rates in state of individual assignee (or primary inventor)

Corporate tax rates linked to patents: (i) weighted average of all states (weights=applications in tech-class) and (ii) only assignee state

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# Data (3/3)

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Focus on first trade: subsequent owners are generally not individuals (only 5% of transactions dropped)

Final panel: 299,356 patents and 2,436,649 observations (patent-age), years 1983-2000

Capital Gains Tax Rates				
Period	Mean	Std. Dev.	Min.	Max.
1982-1986	21.4	1.2	20	27
1987-1991	31.6	2.1	28	37
1992-1996	32.4	1.9	28.9	37
1997-2001	26.9	5.6	21.2	40.3

ANOVA:

89% variation over time and 11% variation across states

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# Econometrics (1/2)

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Linear Probability regression model:

$$Litigated_{it} = \alpha NewOwner_{it} + \theta_i + \lambda_\tau + a_t + u_{it}$$

$Litigated_{it}=1$  if at least one suit is filed involving patent  $i$  at age  $t$

$NewOwner_{it}=1$  if patent  $i$  is not owned by original inventor at age  $t$

$a_t, \lambda_\tau$  age and time-period effects

$\theta_i$  patent fixed effects

$\alpha$  effect of trade on litigation

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# Econometrics (2/2)

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$$Litigated_{it} = \alpha NewOwner_{it} + \theta_i + \lambda_\tau + a_t + u_{it}$$

$\alpha$  impact of change in (unobserved) ownership characteristics on patent litigation

If we observed all characteristics of the owner that affect litigation  $\alpha = 0$

$\alpha \neq 0$  if (i) unobservable owner characteristics affect litigation and (ii) trade reallocates patents to entities with different characteristics

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# Trade and Litigation: Correlations

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Dependent Variable	Litigated	Litigated	Litigated
NewOwner	0.039*** (0.003)	-0.025*** (0.004)	-0.019*** (0.004)
Age Effects	NO	NO	YES
Time Period Effects	NO	NO	YES
Patent Fixed Effects	NO	YES	YES
Obs.	2,436,649	2,436,649	2,436,649

Coefficients and std. errors multiplied by 10.

Similar results for smaller sample of traded and litigated patents

Hausman test rejects random effects

Rivers-Vuong rejects exogeneity of NewOwner

# Endogeneity of Trade - Instrument

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Potential bias arises if unobservables are correlated both with litigation and new ownership (example: positive shock in value of technology increases likelihood of litigation and trade)

We need an instrument that affects likelihood of trade and does not belong directly in litigation equation

We use variation in capital gains tax rates across states and over time as IV

US Internal Revenue Code:

- ❑ **transfer of a patent** is treated as sale of an asset and taxed with **capital gain taxes**
- ❑ **patent litigation damages** are taxed as **ordinary income**

This distinction *does not* apply to patent sales by corporations

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# Impact of Taxes on Patent Trading

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	Probit – Marg. Eff. X 1000	Linear Prob. Model- Coeff. X 1000
DEP VARIABLE	Trade	Trade
<b>Capital Gains Tax Rate</b>	<b>-0.204*** (0.05)</b>	<b>-0.313*** (0.08)</b>
<b>Income Tax Rate</b>	<b>0.132** (0.05)</b>	<b>0.196*** (0.07)</b>
<b>Corporate Tax Rate</b>	<b>-0.063*** (0.02)</b>	<b>-0.147*** (0.05)</b>
Citations Received	0.061*** (0.001)	0.187*** (0.001)
Generality	0.193* (0.10)	0.052 (0.15)
Age, Year, Tech dummies	YES	YES

We drop all observations that follow first change in ownership

Results robust to using OLS with FE and logit

Similar results in smaller sample of patents that are both traded and litigated

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# Findings Impact on Taxation

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- Elasticity of the probability of trade with respect to the capital gains tax rate is -1.62
  - Elasticities for the personal income tax rate and corporate tax rate are 1.22 and -0.77
  - For patents that are litigated and traded still find a negative and significant coefficient for capital gains tax rates
  - Results are similar if we use a linear probability model
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# Instrumental Variable Estimation

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Construct the probability that a patent is traded at age  $t$  as function of capital gains taxes,  $Z$ ,  $\hat{p}_{it} = p(Z_{it})$

The probability that patent  $i$  is not owned by the original assignee at age  $t$  is:

$$\hat{P}_{it} = \hat{P}_{it-1} + (1 - \hat{P}_{it-1}) \hat{p}_{it}$$

$\hat{P}_{it}$  is non-linear estimate of  $E[\text{NewOwner} \mid Z, X]$

2SLS with  $\hat{P}_{it}$  as IV identifies the effect of a change in patent ownership on litigation under the **constant-effect assumption** (no heterogeneous responses based on unobservables) - see Angrist (2001) and Wooldridge (2002)

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# 2SLS Estimates

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Dependent Variable	Litigated	Litigated
<b>NewOwner (instrumented)</b>	<b>-0.012** (0.005)</b>	<b>-0.011** (0.004)</b>
Age Effects	YES	YES
Time Period Effects	YES	YES
Patent Fixed Effects	YES	YES
Observations	2,436,649	2,436,649
Instrument	$\hat{P}$ from Probit	$\hat{P}$ from OLS

2SLS estimates are six times larger than OLS correlations

Endogeneity generates large downward bias (positive correlation between  $u$  and NewOwner)

# Robustness 2SLS

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- Results robust to inclusion of income and corporate taxes
  - Results robust to controlling for macroeconomic variables (e.g. GSP per capita)
  - Similar results in smaller dataset with only patents assigned to individuals at grant date
  - Probit on Corporate Transfers: no effect of income and capital gains tax rates
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# Local Average Treatment Effect

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Heterogeneous responses likely in our setting. Need to estimate the **Local Average Treatment Effect** (Imbens and Angrist, 1994): the average effect of a change in ownership for patents traded because of a change in capital gains taxation.

2SLS differs from LATE when there are covariates and/or continuous instruments – see Angrist and Imbens (2005), Lileeva and Trefler (2010)

We generate alternative IV: **HighDiff** dummy =1 if difference between income rates and capital gain rates is high enough. Once dummy=1 it remains equal to 1.

- LATE estimates do not differ substantially from the 2SLS in our setting
  - LATE estimates imply a **reduction** in annual **litigation rate** of about **32%** for patents at “risk” of trading
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# Heterogeneous Effects

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Extend econometric model and allow for different effects of trade:

$$Litigated_{it} = \alpha_{it} NewOwner_{it} + \theta_i + \lambda_\tau + a_t + u_{it}$$

where  $\alpha_{it} = \bar{\alpha} + \psi_{it}$  is decomposed into common and random component

We follow Carneiro, Heckman and Vytlacil (Ecta, 2010) and estimate (semi-parametrically and non-parametrically) the Marginal Treatment Effect:

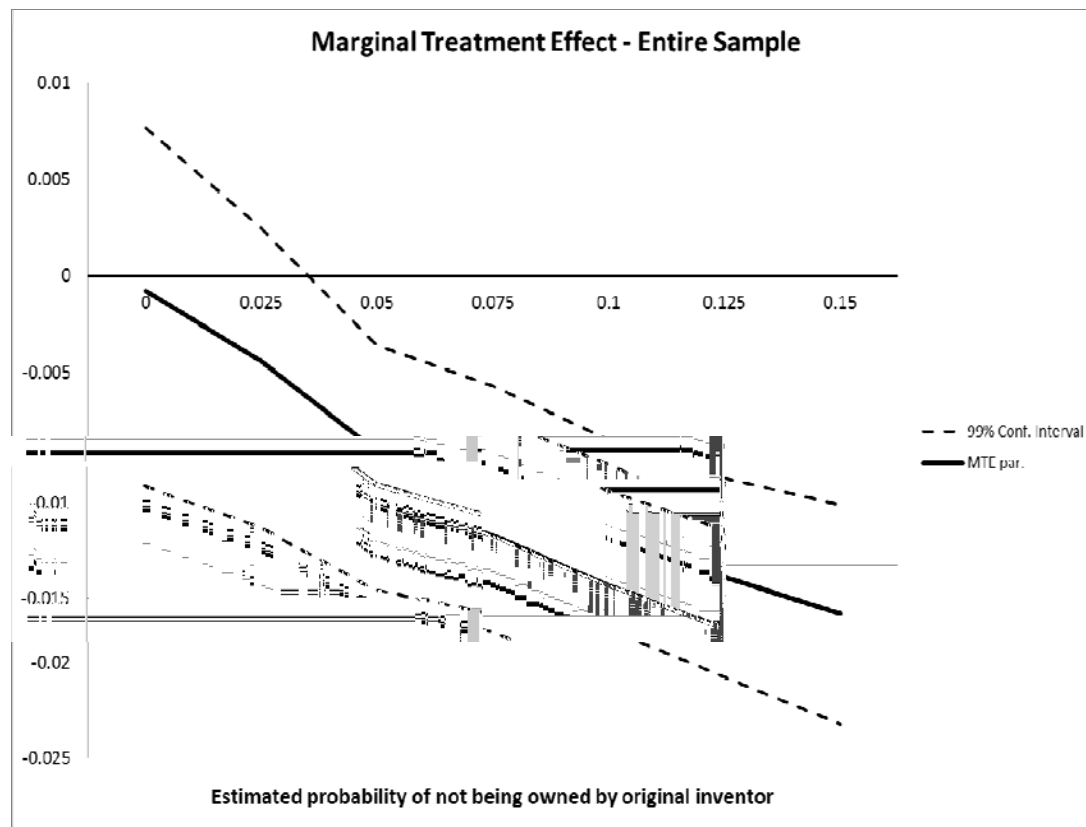
$$E(\bar{\alpha} + \psi_{it} \mid P(X_{it}, Z_{it}))$$

MTE captures the heterogeneous effects of trade on litigation for patents that are traded because of a change in capital gains tax rate

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# Marginal Treatment Effect

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**Efficient reallocation:** patents with larger effects from enforcement gains have the highest probability of changing ownership

**Sorting:** patents with *low*  $P$  are more likely to be in transactions where *commercialization gains* have greater bite, those with *high*  $P$  in transactions with *enforcement gains* have greater bite

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# Unbundling the Marginal Treatment Effect

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Need transaction characteristics. Buyer names in Assignment data are not standardized, manual match is required (traded and litigated patents)

Two new variables:

**LargeBuyer** = 1 if buyer has at least 8 patents (20 years window)

Hypothesis: *enforcement gains* are greater when LargeBuyer=1 (Lanjouw and Schankerman, 2004)

**TechFit**=1 if acquired patent is in technology area in which buyer has more patents

Hypothesis: *product market gains* are larger when patent is a good match for technology profile of the buyer

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# Role of Portfolio Size and Patent Fit

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	Linear Probability Regression
NewOwner	-0.238*** (0.081)
NewOwner x LargeBuyer	-0.365* (0.196)
NewOwner x TechFit	0.461*** (0.137)
Age Dummies	YES
Time Period Dummies	YES
Patent Fixed Effects	YES
Observations	6810

Patents traded to *small entities with high fit* experience an *increase* in litigation rate

Patents traded to *large buyers with low fit* experience a *reduction* in litigation rate

Similar results in a variety of robustness checks (see paper for details)

# Product Market Gains or Patent Trolls?

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- Unbundling exercise shows a positive association between trade and litigation only for patents traded to small entities with high-fit (consistent with product market gains)
  - Possible alternative explanation is that the patents in this sub-sample are acquired by small, specialized patent assertion entities
  - We look at industry specialization, serial buyers, and serial litigants, find no evidence that the increase in litigation is driven by patent trolls
    - No industry specialization in the Small-Buyer/High-Fit sub-sample
    - Observed increase in the Small-Buyer/High-Fit sub-sample is not driven by serial buyers
    - Observed increase is not driven by a few serial litigants
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# Conclusions

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Three key empirical findings:

1. Taxes have substantial impact on re-allocation of patent rights
2. On average, reallocation of individually owned patents reduce litigation risk
3. Market re-allocates patents efficiently and enforcement gains depend on the characteristics of the transaction

A well-functioning market for innovation generates private and social gains by allocating patent rights efficiently ***ex-post***, and taxation affects this process

As long as small innovators can appropriate part of these gains, market will also increase their ***ex-ante*** incentives to innovate

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Thank you!

