

## Discussion of

"Falling into traps? Patent thickets, patent commercialization, and stock returns"

by Po-Hsuan Hsu, Hsiao-Hui Lee, and Tong Zhou

Evgeny Lyandres  
Boston University

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# Overview

# The paper in one slide

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Theory: ✓\* ; Empirics: ✓

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As a result, **patent thickets**  $\downarrow$  volatility, **stock returns**, and **market factor loadings**

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# Impressions

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- The overall logic seems economically important
- Adequate modeling setup
- Impressive data compilation
- Thorough empirics
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I am a discussant...

# Model

# The model's logic

- Investment (real) option exercise is delayed when the cost of exercising the option is higher (i.e. the exercise threshold is higher)
  - Dixit and Pindyck (1988)
- The risk and expected return  $\downarrow$  in the option exercise threshold
  - Carlson, Fisher and Giammarino (2006)
- **This paper:** The cost of exercising the option is endogenous
  - It is shown to be  $\uparrow$  in patent thicket
  - **This is potentially a very important contribution!**
- As a result, risk and expected return  $\uparrow$  in patent thicket

## Endogenous option exercise cost – the idea

- There are  $n$  firms, each owning a patent that the focal firm uses
- Each firm charges the focal firm a price for using its patents (exploitation cost),  $q_i$  for firm  $i$ , and has to pay a private cost,  $c_i$
- The higher the  $q_i$  and the higher the overall exploitation cost,  $\sum_i q_i$ , the longer the GO exercise is delayed, and the lower the value of GO
- Each firm does not fully internalize this reduction in value, leading to a larger  $\sum_i q_i$  than would be charged by a monopolist holding all  $n$  patents
- The larger the  $n$  the higher the total exploitation cost and the lower the value of GO
  - The “**population effect**”
  - More interestingly, the “**coordination effect**”

## Coordination effect – intuition

- The authors liken the coordination effect to Cournot competition
- However,  $q_i$  is price, not quantity, despite notation
- So, this is price competition – a **homogenous product price competition**
- The usual result is that such competition leads to prices equalling (constant) marginal costs
- Why is this not happening here?

## Coordination effect – intuition

- Why doesn't price competition drive  $q_i$  to  $c_i$ ?
  - Because the buyer needs to buy not one product, but **all of them**
  - This makes the products **perfect complements**, not perfect substitutes
  - A very unorthodox setting, not sure I've encountered it

To summarize:

- When the firm has to pay exploitation costs for **all** patents, the total cost  $\uparrow$  in  $n$
- When the firm has to pay exploitation cost for **just one** patent, the total cost is zero or  $\downarrow$  in  $n$  if the marginal private cost is not constant
- **A conjecture:** There is a **threshold fraction** of patents for which the firm needs to pay exploitation costs
  - above which total exploitation cost  $\uparrow$  patent thicket
  - below which total exploitation cost  $\downarrow$  patent thicket
  - Perhaps this could lead to more **nuanced empirical predictions**

## Other comments

- The payoff from exercising GO is perfectly correlated with the cash flows from AP
  - Is it reasonable?
  - Do you need it? (i.e. is it crucial?)
  - Relaxing it could lead to interesting cross-sectional predictions
- The “population effect” needs to be neutralized, you only need the “coordination effect”
  - I would assume  $N$  firms holding  $n$  patents, and do comparative statics w/r to  $N$
- There is a condition in Proposition 2 (that expected return  $\uparrow$  in patent thicket):  $\theta_t < \Omega P_t^I$ 
  - If it is not satisfied then the effect is reversed
  - **Conjecture:** this effect must be satisfied always if GO exercise is optimal, i.e.  $\theta^* < \Omega P^{I*}$

# Empirics

# Measure of patent thicket

- The measure of patent thicket in the model is  $n$
- The empirical measure is  $(1 - \sum_{j=1}^J (\frac{Numcites_{i,t}^j}{Numcites_{i,t}})^2) \frac{Numpats_{i,t}}{Numpats_{i,t} - 1}$
- If firms are symmetric in terms of  $Numpats_{i,t}$  and  $Numcites_{i,t}^j$ , then the measure of patent thicket is one, regardless of  $n$ 
  - I.e., the measure is constructed to be orthogonal to  $n$ 
    - Unlike HHI,  $\sum_{j=1}^J (\frac{Numcites_{i,t}^j}{Numcites_{i,t}})^2$
- In the context of this paper, I am not sure this orthogonalization is appropriate, as  $n$  is a crucial determinant of GO exercise timing in the model
- The authors mention robustness to using HHI
- I would use HHI as a primary measure of patent thicket

## Asset pricing results – Interpretation

- CAPM estimation of portfolio returns shows that:
  - Difference in betas between two extreme patent thicket quintiles equals 0.07
    - This is equivalent to roughly 0.5% annual return spread
  - Difference in (monthly) alphas between two extreme patent thicket quintiles is 0.42%
    - This is equivalent to roughly 5% annual return
  - Does the market not understand the effects of patent thickets on risk?
  - Is there a trading strategy?
    - It would be interesting to think about carefully implementing it
  - Or we have a wrong asset pricing model?
  - I would include additional factors in the return regressions
    - Given the low correlations between patent thicket and size and B/M, I suspect that alphas are robust to Fama-French 3-factor model
    - But are they robust to inclusion of other factors?

## Other comments

- Patent thickets are computed using only citations to patents of public firms
  - I would report results based on patent thickets computed using all patents
- Given that litigation is related to patent citations, can there be endogeneity of citations due to strategic omission of important citations?
- The test of the effect of patent thickets on the time to commercialization uses levels of new product introduction instead of their timing
  - In the model, eventual exercise of GO is a certainty
  - If both patent thickets and commercialization are constant over time, we should not expect a theoretical relation between patent thicket and subsequent commercialization within a given time frame
  - Thus, the test is a test of the time-varying nature of patent thickets and commercialization

A paper with great potential

Thought provoking – a highly recommended read