

Abstract

We use a compound real options model to investigate firms' strategic interactions in intellectual property litigation. Subject to financing constraints, an alleged infringer firm (challenger) and an infringed firm (incumbent) pay for their ongoing litigation cost using operating cash flows from product market profits. We consider the challenger's strategy to exit the market during litigation due to shortage of funds, the incumbent's strategy to withdraw from value-reducing litigation or to force the challenger to exit the market by a threat to litigate, and firms' strategies to set up royalty payments to avoid a lawsuit, or to settle with each other after a lawsuit is filed. By focusing on each firms' ability and willingness to pay for litigation costs, we find that the challenger's profit relative to the incumbent's loss of profits due to the alleged infringement (gain-to-loss ratio) has to be high enough for settlements to be possible. Settlements are also more likely in less volatile product markets, with more questionable patent validity, and when litigation costs are similar for the two firms. Our model generates new testable implications regarding IP litigation with financing considerations.

Research Questions

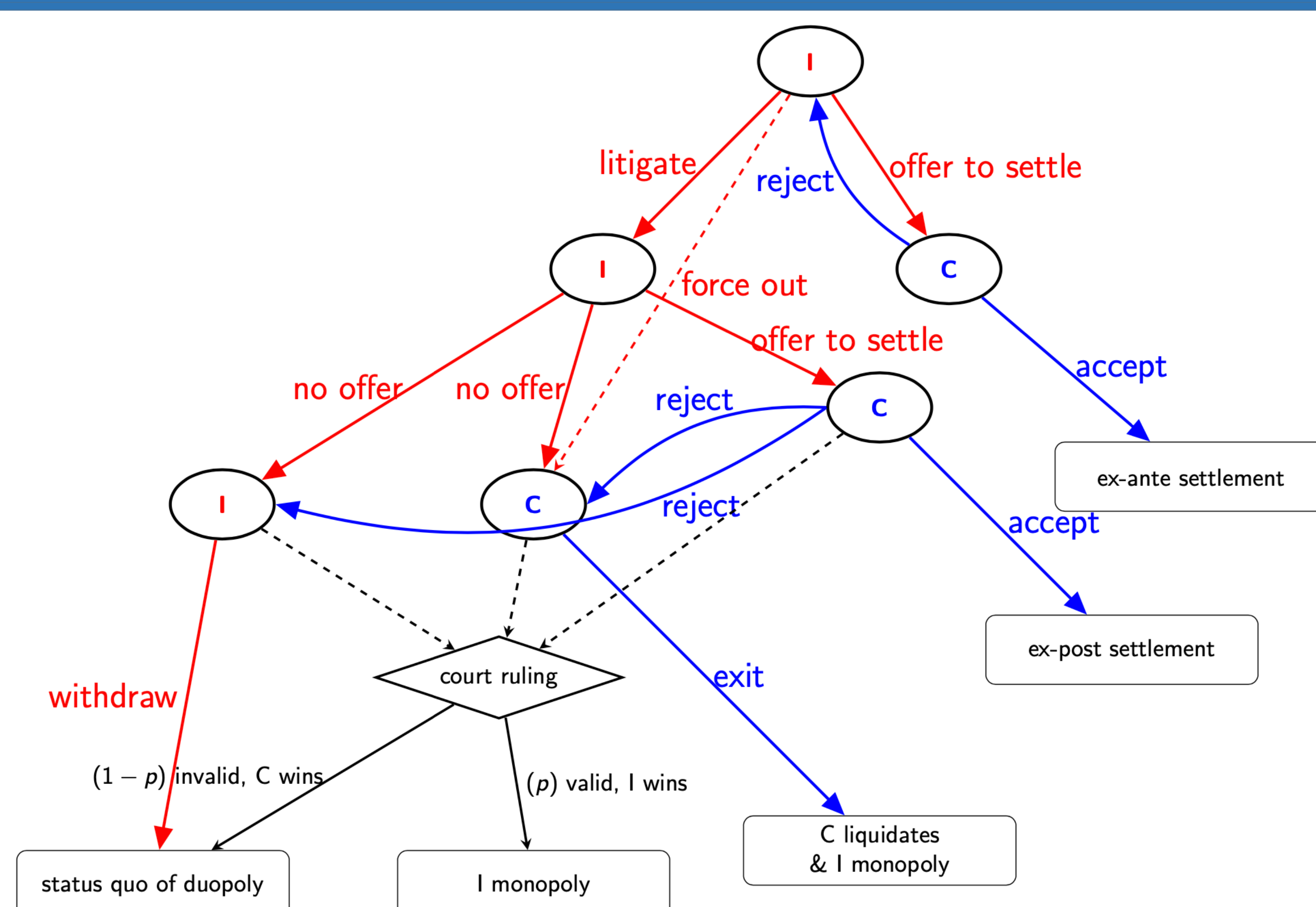
How do product market characteristics impact patent litigation outcomes?

- **Product market characteristics:** the challenger's profit relative to the incumbent's loss of profits due to the alleged infringement and product market volatility
- **Litigation outcomes:** whether to settle, litigate or drop the lawsuit
- **Our angle:** firms' abilities to finance litigation

Model setup

- Two firms competing in product markets:
Incumbent ("I") - patent owner
Challenger ("C") - allegedly infringed.
- Both earn operating profits linear to market demand $x_t \sim GBM$ (i.e., $dx_t = \mu x_t dt + \sigma x_t dW_t$), and no other revenues.
- The judgement \sim Poisson (λ) and incurs ongoing costs
- A compound real options model: firms exercise their options at threshold points on a common demand shock. They take each other's actions and future actions into consideration when making decisions (Schwartz, 2004; Marco, 2005; De' camps et. al., 2006; Jeon, 2015).

Game tree



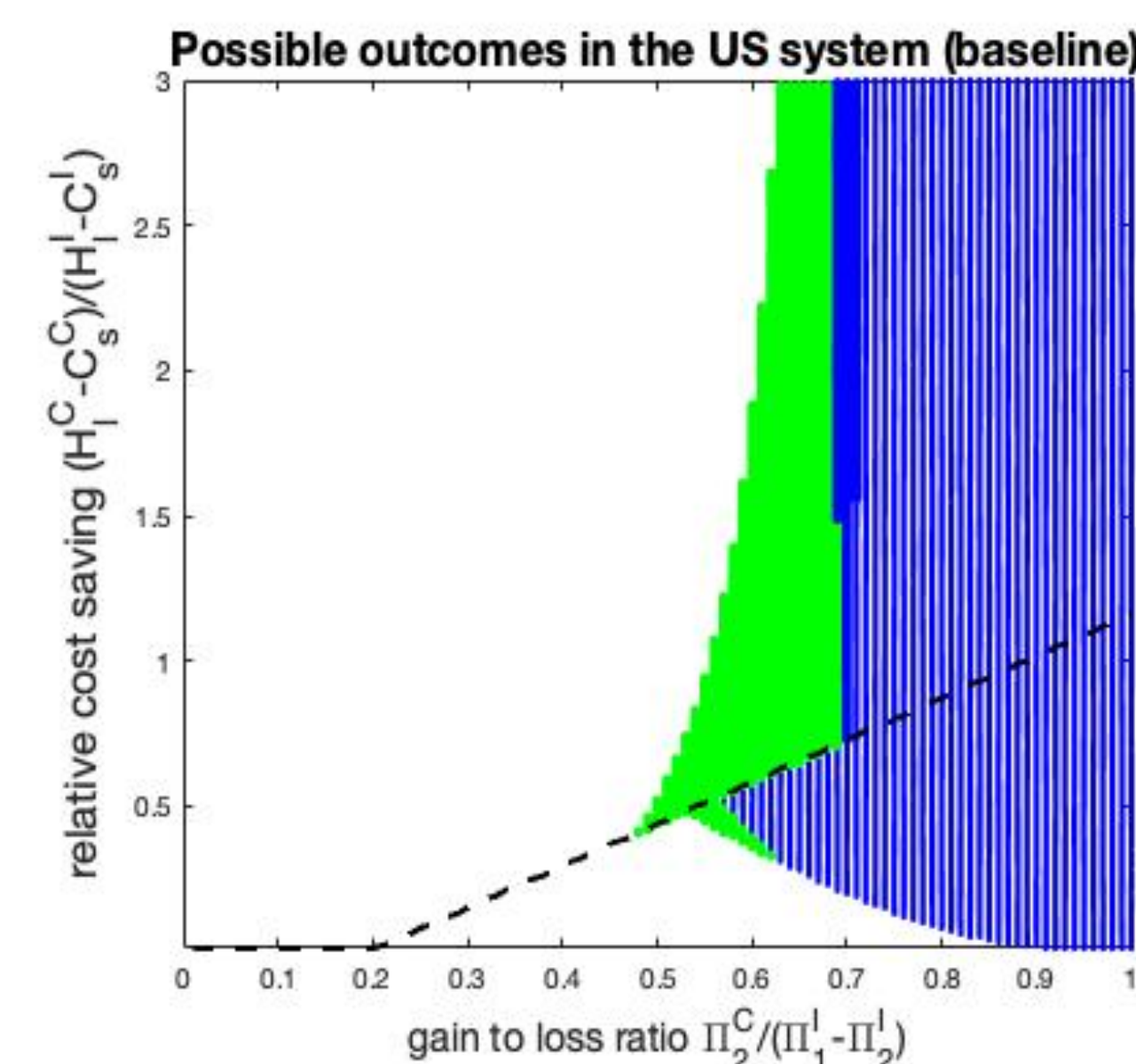
- Determining the order of withdrawal or exit via reservation thresholds (Lambrecht, 2001).
- Determining royalty rates and thresholds in settlements through the method proposed by Lukas and Welling (2012).



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Baseline litigation outcomes



Gain-to-loss ratio:

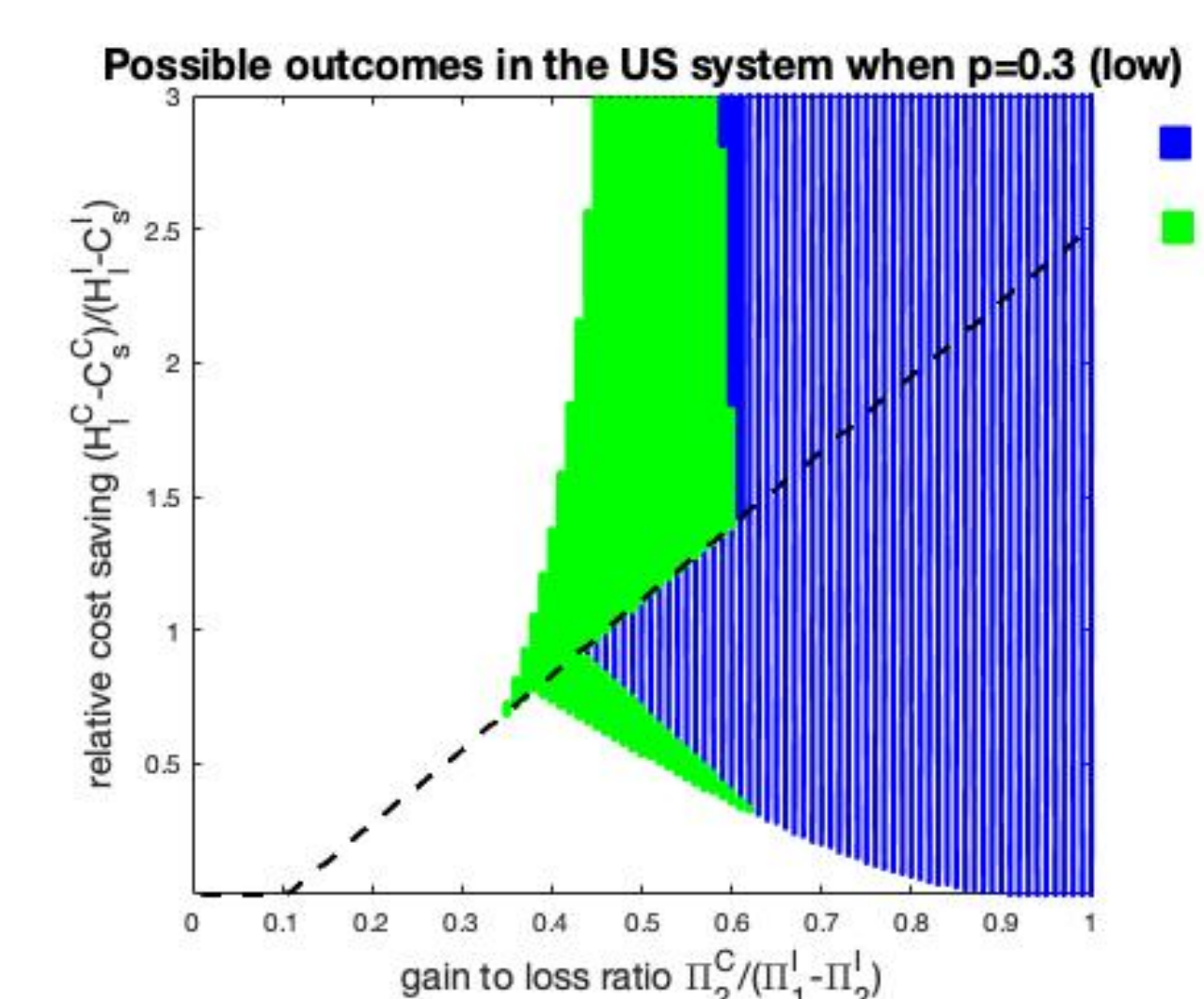
$$\Phi = \frac{C's \text{ profit gain}}{I's \text{ loss of profit}}$$

Relative cost saving:

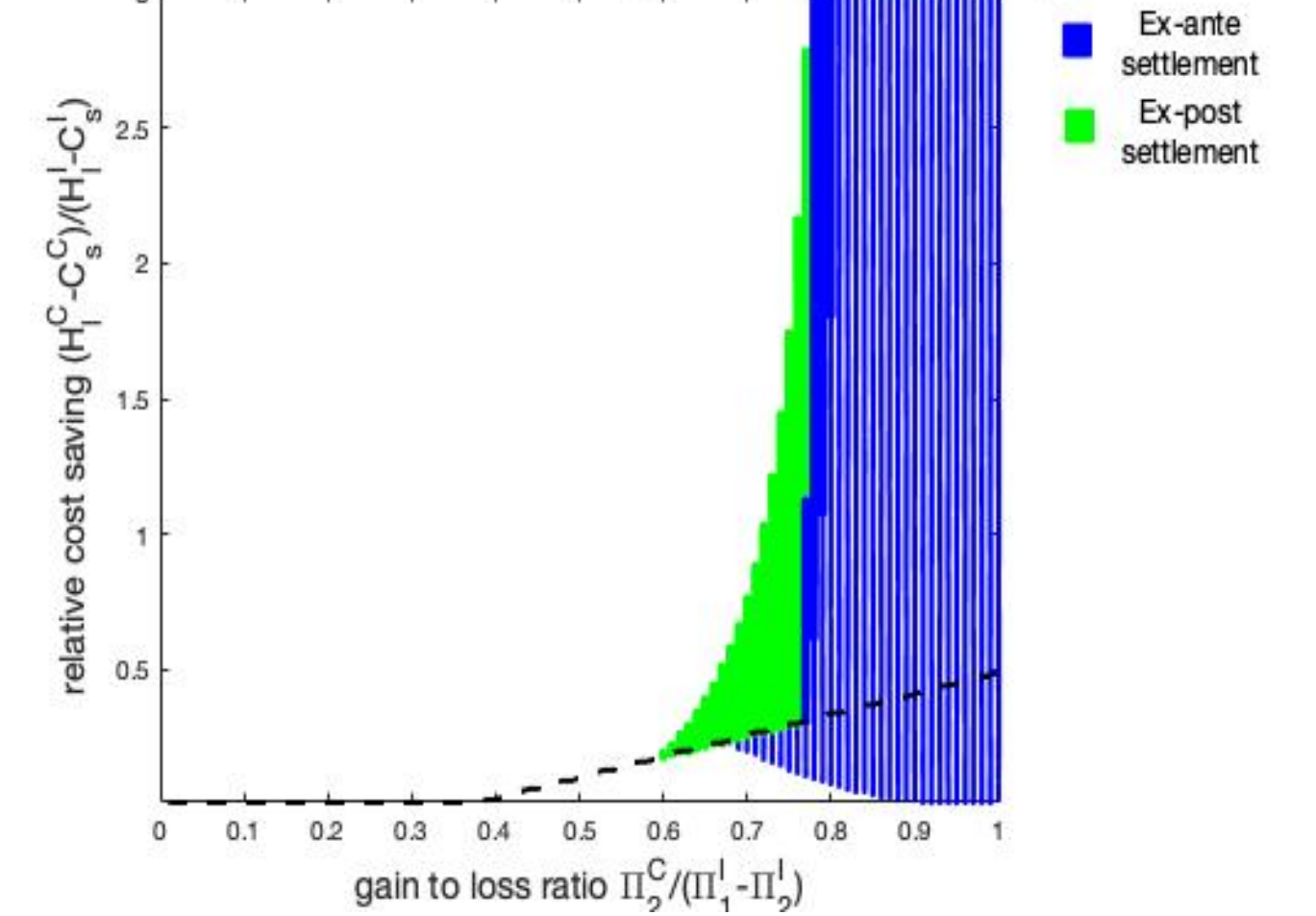
$$\Gamma = \frac{C's \text{ cost saving}}{I's \text{ cost saving}}$$

*Here, we change Π^C and H^I , and fix other parameters

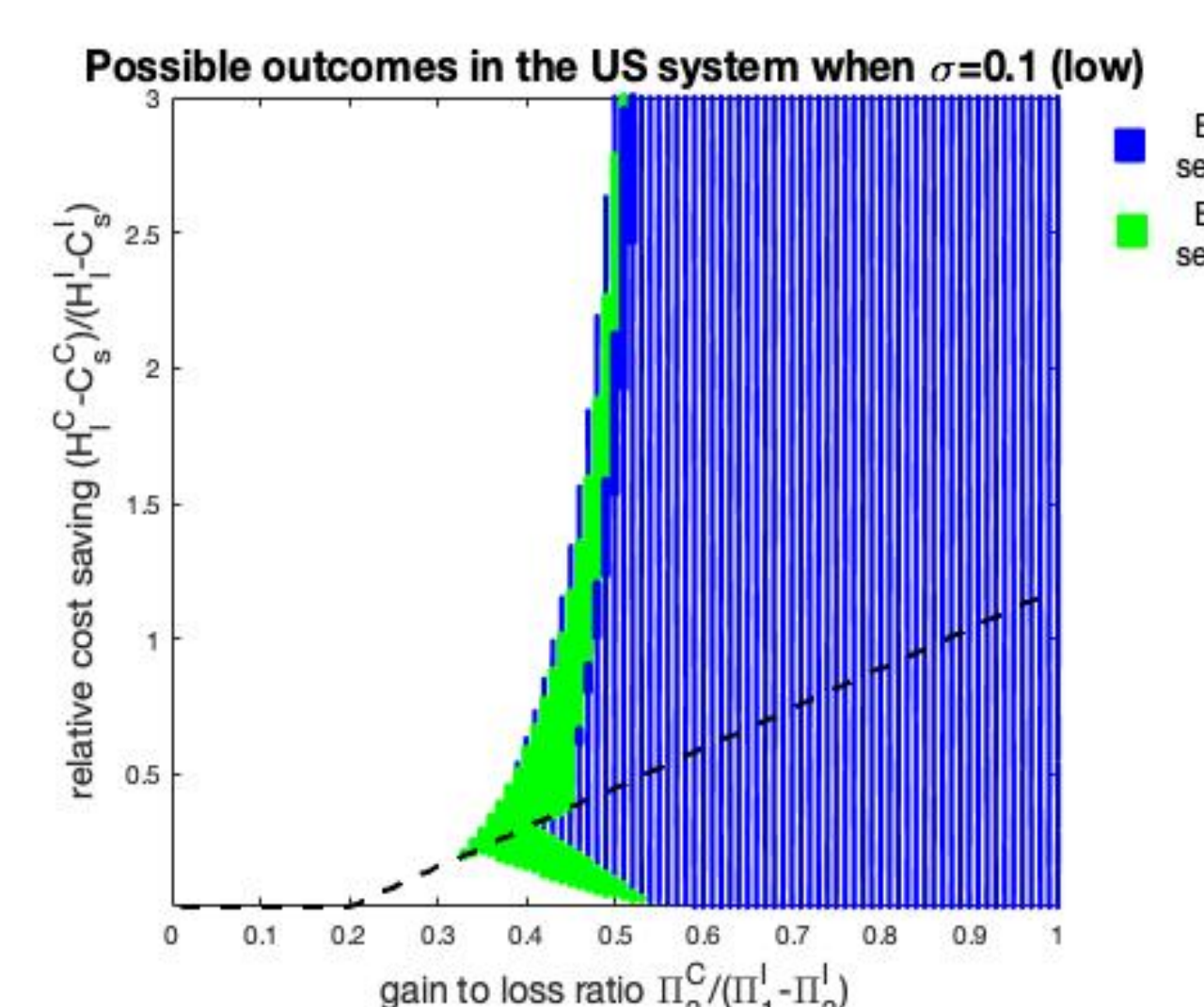
The effect of probability of patent validity



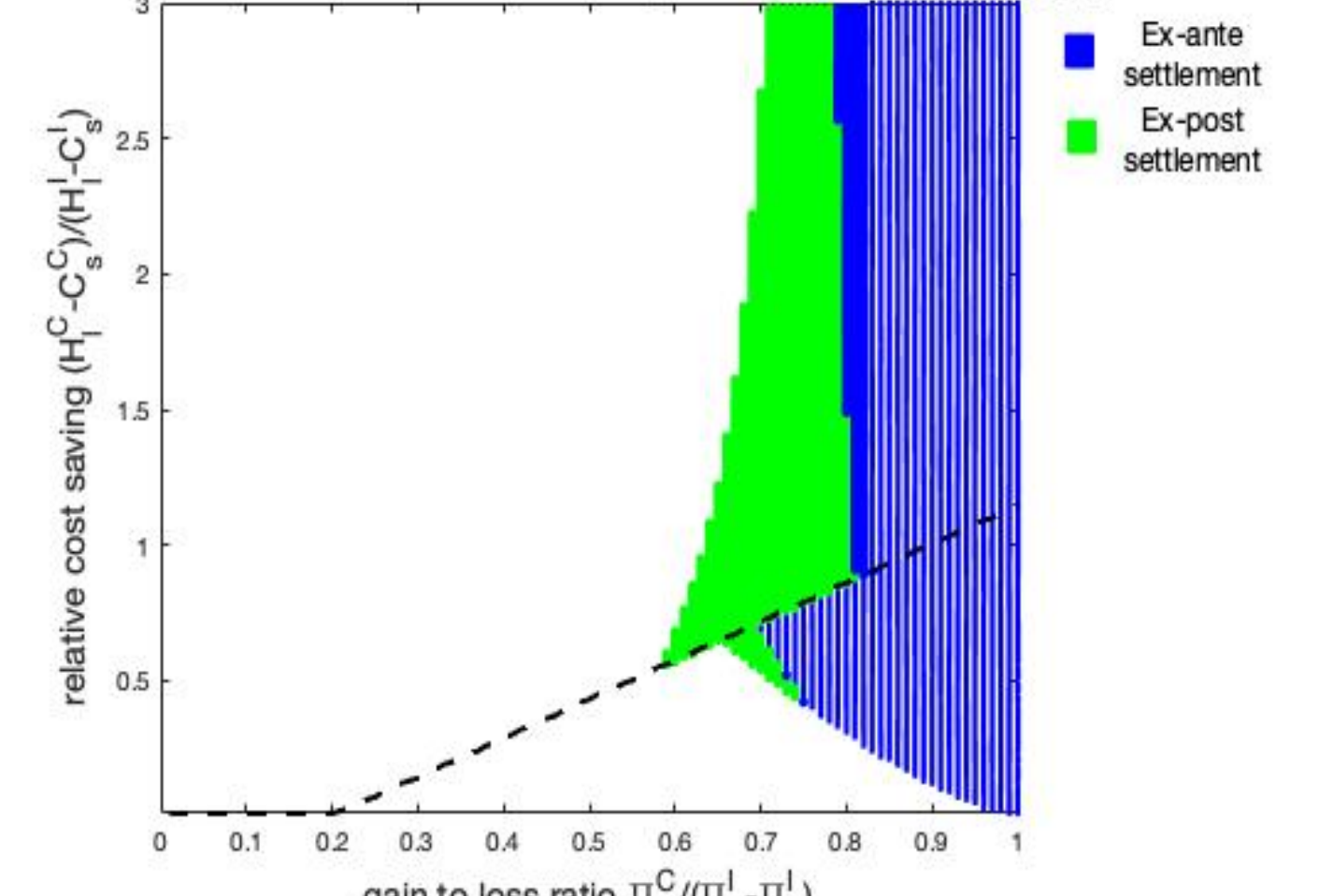
Possible outcomes in the US system when p=0.7 (high)



The effect of product market volatility



Possible outcomes in the US system when \sigma=0.5 (high)



Main findings

Through financing constraints, inter-firm characteristics affect litigation strategies greatly:

- The **gain to loss ratio** has to be high enough for firms to settle
 - For C: is able to pay settlement royalty
 - For I: has less incentive to continue litigation
- The impact of **relative cost saving**:
The more financially constrained for one party, the less likely settlement occurs
 - For C: reject settlement when I's cost is high
 - For I: not willing to offer settlement when C's cost is high
- Overall, settlement is less likely for low gain-to-loss ratios, high probability of patent validity and in more volatile product markets.

Contributions

- One of the first studies to examine the impact of firm's financial constraints on patent litigation outcomes.
- We establish the importance of product market characteristics (such as demand volatility and the relation between the plaintiff's and the defendant's products and profits) in determining the likelihood and terms of settlement.
- We model patent litigation as a strategic dynamic game in the real options framework, and consider the possibility of the challenger's exit during litigation.

References

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