

# The Economics of Patent Licensing: An Empirical Analysis of the Determinants and Consequences of Patent Licensing Transactions

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## Abstract

In this paper, we investigate the economics of patent licensing using a large and unique sample of patent licensing transactions from the **ktMINE Patent License Agreement Database**. We address three key research questions for the first time in the literature:

1. What characteristics drive firms to become licensors or licensees?
2. How do licensors decide whether to retain, sell, or license patents?
3. What are the consequences of patent licensing for both parties?

Our findings indicate that licensors prefer licensing to downstream firms and firms with less similar patent portfolios. Licensors retain patents closer in technological distance to their own portfolios and sell those farther away, while licensing out patents that are in-between the two, whereas licensees prefer patents closer to their own portfolios. Patent licensing transactions significantly increase the equity market value (Tobin's Q) of both licensors and licensees, as shown by a difference-in-differences analysis around the National Technology Transfer and Advancement Act of 1995. We further find that licensors increase their R&D expenditures and generate more patents following licensing transactions, suggesting that they use some of their proceeds from licensing transactions to enhance their innovation productivity. Licensee firms, on the other hand, are more likely to cite licensors' patents, introduce more new products, and improve their innovation efficiency, suggesting that they are able to learn from using the patents they license.

## Methods

1. What characteristics drive firms to become licensors or licensees?

$$Actual\_Pair_{i,j,k,t} = \alpha + \beta_1 Pairing\ Characteristics_{i,j,k,t-1} + \beta_2 Licensor\ Innovation_{i,k,t-1} + \beta_3 Licensee\ Innovation_{j,k,t-1} + \beta_4 Licensor\ Characteristics_{i,k,t-1} + \beta_5 Licensee\ Characteristics_{j,k,t-1} + Transaction\ FE_k + \epsilon_{i,j,k,t}$$

- Pairing characteristics:
  - **Vertical\_Integrate**: a dummy variable equal to one if two firms are vertically integrated in the product market (Frésard et al., 2020)
  - **Tech\_Similarity**: cosine similarity between firm i's and firm j's patent portfolios
- 2. How do licensors decide whether to retain, sell, or license patents?

$$Licensed\_Patent_{i,j,t} = \alpha + \beta \times Tech\_Dist_{i,j,t} + \gamma X_{i,t} + \epsilon_{i,j,t}$$

- **Tech\_Dist<sub>i,j,t</sub>**: technological distance of the focal patent to a firm's patent portfolio (Akcigit et al., 2016)
- **Licensed\_Patent<sub>i,j,t</sub>**: dummy variable denotes different meaning when we examine different research questions
- 3. What are the consequences of patent licensing for both parties?

$$TobinQ_{i,t} = \alpha_i + \alpha_t + \beta Licensor_i\ (or\ Licensee_i) \times Post_t + X_{i,t} \gamma + \epsilon_{i,t}$$

- Use **National Technology Transfer and Advancement Act (NTTAA) of 1995** as a positive exogenous shock to firms' patent licensing transaction decisions
- For every licensor and licensee firm, we use a propensity-score matching method to construct the control group

## Results: Firm-Level Determinants

Licensor firms prefer to license patents to firms that are more likely to be their downstream partners; less likely to license their patents to firms that are technologically more similar to themselves.

	Actual_Pair			
	(1)	(2)	(3)	(4)
<b>Vertical_Integrate</b>	0.328* (0.168)	0.686* (0.392)		
<b>Tech_Similarity</b>			-0.354*** (0.100)	-0.491** (0.219)
<b>Licensor_Num_Pat_3</b>		2.339*** (0.455)		2.076*** (0.499)
<b>Licensee_Num_Pat_3</b>		2.448*** (0.482)		2.064*** (0.488)
<b>Licensor_CPP_3</b>		0.409*** (0.111)		0.488*** (0.113)
<b>Licensee_CPP_3</b>		0.220* (0.116)		0.257** (0.126)
<b>Licensor Firm Controls</b>	No	Yes	No	Yes
<b>Licensee Firm Controls</b>	No	Yes	No	Yes
<b>Transaction FE</b>	No	Yes	No	Yes
<b>Number of Obs.</b>	28,294	5,427	28,374	5,229
<b>Pseudo R2</b>	0.0006	0.0817	0.0028	0.0951

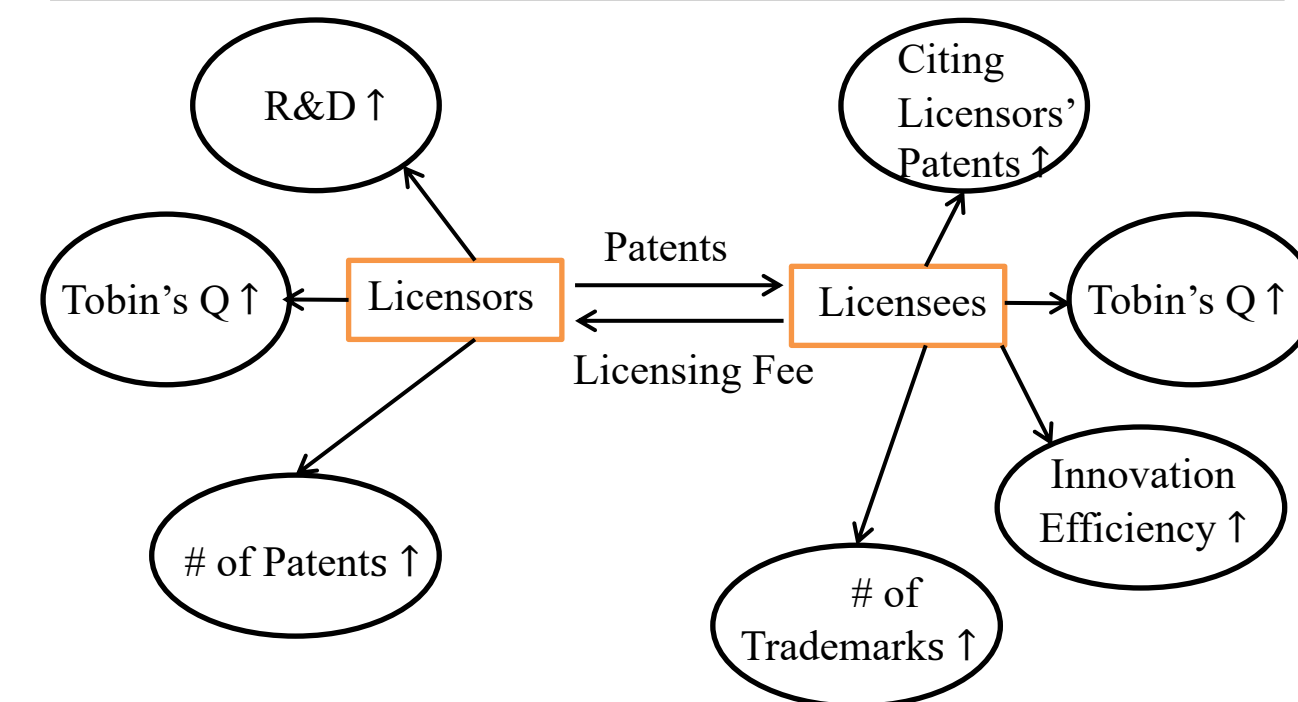
## Results: Patent-Level Determinants

1. Patents that are technologically further away from the licensor firm's main knowledge space are more likely to be monetized (i.e., either sold or licensed out) by the licensor.
2. Patents with a greater technological distance from the licensor's patent portfolio is less likely to be licensed out relative to being sold in a patent transaction
3. Licensees prefer patents closer to their own portfolios.

	Licensed_Pat (Licensed Pat = 1, Sold Pat = 0)			
	(1)	(2)	(3)	(4)
<b>Dist_to_Licensor</b>	-1.050* (0.605)	-1.313** (0.627)	-1.311** (0.670)	-1.413** (0.689)
<b>Backward_Cite</b>		0.364*** (0.126)		0.372*** (0.125)
<b>Forward_Cite</b>		0.135 (0.089)		0.163** (0.075)
<b>Num_Claim</b>		0.082 (0.126)		0.053 (0.138)
<b>Litigate</b>		0.956** (0.442)		0.838** (0.421)
<b>Firm FE</b>	Yes	Yes	Yes	Yes
<b>Filing Year FE</b>	Yes	Yes	No	No
<b>Tech Class x Filing Year FE</b>	No	No	Yes	Yes
<b>Number of Obs.</b>	72,046	71,031	33,025	32,400
<b>Pseudo R2</b>	0.5629	0.6384	0.6714	0.6897

## Results: Consequences

	Tobin's Q	
	Licensor	Licensee
<b>Licensor × Post</b>	1.123** (0.478)	
<b>Licensee × Post</b>		0.943** (0.392)
<b>Firm Controls</b>	Yes	Yes
<b>Firm FE</b>	Yes	Yes
<b>Year FE</b>	Yes	Yes
<b>Number of Obs.</b>	5,268	6,188
<b>Adj. R2</b>	0.3418	0.3613



## Conclusion

1. Firms with higher innovation productivity and R&D expenditures are more likely to be licensors; firms facing a decline in their innovation productivity are more likely to be licensees. Licensors are more likely to license patents to firms with whom they have a downstream relationship; less likely to license patents to firms with technologically similar patent portfolios.
2. Licensors are likely to retain patents closer in technological distance to their current patent portfolio, selling patents that are farther away and licensing out those in-between; licensee firms choose patents closer in technological distance to their own patent portfolio.
3. Licensing transactions are efficient: increase the equity market value (Tobin's Q) of both licensor and licensee firms. Licensor firms increase R&D expenditures and generate more new patents; licensee firms are learning from corresponding licensors' technologies, introduce a larger number of new products, and increase innovation efficiency.

## References

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2. Frésard, L., G. Hoberg, and G. M. Phillips (2020). Innovation activities and integration through vertical acquisitions. *The Review of Financial Studies* 33(7), 2937–2976.

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