Signal v. Appropriation: Why Do Investors Fund Patenting Firms?

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Venture funding

- It’s hard out there for a startup
  - Hard to get funding
  - High failure rate

- It gets easier…to get funding – if you have a patent
  - Funding rates go up
  - But does survival (spoiler from another paper – not necessarily)
  - Does profits (spoiler from another paper – not necessarily)

But Patents Matter

- Why?

- Is it because they signal some unobservable characteristics?
  - Or
- Is it because they provide some value in and of themselves?

How do we tell?

- A long unanswered question – but an important one
- Firms say they get patents first for appropriative value, and *then* for their ability to attract investments
- Investors say they don’t value the appropriative patents
    - But they heavily weight their investment decisions toward patenting firms
- Few have tried to measure the appropriative value
    - Most use an instrumental variable, which is hard to find

Our Data

- Kauffman Firm Survey
  - Eight year panel of startup firms
    - Funded/non-funded
    - Patenting/non-patenting
  - 3140 at survey start
  - 1630 survive all eight years
  - Oversamples on high tech, but representative (and weighted)

Patenting by the KFS Firms

Table 1: Patent Descriptives

Year	Firms	Patent Holders	Holders/Firms	Patents	Patents/Holders
2004	3140	120	3.82%	584	4.87
2005	2837	124	4.37%	608	4.9
2006	2554	122	4.78%	487	3.99
2007	2330	106	4.55%	556	5.25
2008	2092	86	4.11%	622	7.23
2009	1928	82	4.25%	386	4.71
2010	1775	72	4.06%	355	4.93
2011	1630	72	4.42%	335	4.65

Funding and Profits of the Firms

Table 2: Finance Descriptives

Year	Firms	Debt	% Debt	Equity	% Equity	$\Pi > 0$	% $\Pi > 0$
2004	3140	193	6.15%	144	4.59%	1149	36.6%
2005	2837	264	9.31%	187	6.59%	1555	54.8%
2006	2554	290	11.4%	189	7.40%	1564	61.2%
2007	2330	307	13.2%	180	7.73%	1379	59.2%
2008	2092	303	14.5%	165	7.89%	1206	57.6%
2009	1928	307	15.9%	152	7.88%	1152	59.8%
2010	1775	310	17.5%	146	8.23%	1095	61.7%
2011	1630	292	17.9%	140	8.59%	1092	67.0%

Patents and Funding

Table 3: Patenting Firms vs Non-Patenting Firms Financing

Year	%Pat & Debt	% No Pat & Debt	%Pat & Equity	% No Pat& Equity
2004	13.3%	5.86%	19.2%	4.01%
2005	16.9%	8.96%	24.2%	5.79%
2006	25.4%	10.6%	32.8%	6.13%
2007	29.2%	12.4%	32.1%	6.56%
2008	30.2%	13.8%	30.2%	6.93%
2009	43.9%	14.7%	35.4%	6.66%
2010	47.2%	16.2%	30.6%	7.28%
2011	36.1%	17.1%	30.6%	7.57%

Why Invest? Our Methodology

- We are interested in the effect of patenting, other things equal
- Many of those other things are observable signals:
  - Owner experience, credit risk, industry, and other demographic information
- But some of the remaining effect is unobservable
  - Critics contend that this is the “signal” value of patents
  - Patents are not providing value due to their appropriative value
    - but instead due to the remaining unobservables

Our Methodology

- We net out the unobservable effects by comparing two models
- Model I:
  - Pooled panel regression (compares year to year changes)
  - Includes time dummy variables
  - Measures effect of patenting on investment *ceteris paribus*
- Model II:
  - Fixed effects panel regression, including time dummy variables
  - Now holds year and firm constant
    - which means that any unobservable signals are netted out because those will remain the same year after year
  - What remains in the patent coefficient is the appropriative value of the patent
- The ratio between Model I and Model II is the signal to appropriative value

Initial Results

- Model I: Patent = 13%*** more likely chance of equity funding
- Model II: Patent = .8% more likely chance of equity funding
- Interpretation: Zero appropriative effect

Heterogeneity Analysis

- There’s a lot of variation in the numbers – maybe something else is driving these results

- Industry?
  - Everyone’s first guess
  - Turns out, no – same results
- Firm Structure?
  - Yes!

Firm Structure

Table 5: Average Venture Capital Financing by Year and Legal Status

Year	Sole	LLC	S-Corp	C-Corp	GP	LP
2004	0	12972	915	78306	0	0
2005	0	17912	1221	117600	253	3333
2006	0	2022	16129	113862	303	0
2007	0	434	0	29856	370	0
2008	0	0	0	46431	0	0
2009	0	4819	0	53846	0	0
2010	0	3778	0	6682	0	0
2011	0	0	0	12895	862	0

Table 4: Legal Status vs Patent Ownership in 2011

Legal Status	No Patent	Patent
Sole Proprietorship	476	8
Limited Liability Company	550	20
S-Corporation	390	24
C-Corporation	90	19
General Partnership	28	1
Limited Partnership	20	0
Something Else	4	0

The Power of General Partnership

- Testing by type of entity shows that almost the entire zero result is driven by general partnerships
  - about 68% less likely to obtain funding than a sole proprietorship in Model II
  - *But only if they have a patent*
- Why? We have no idea, but only one firm had a patent, so that may be driving the results
- The differences are much smaller for C-Corps
  - These are 5% more likely than sole proprietorships in Model II
  - and 32% more likely in Model I
  - This makes the signal to appropriation value a more reasonable 6:1
- For LLCs:
  - Model I: 11.7%, Model II: -.8%
  - Perhaps only C-Corps get appropriative value

Even so…

Table 9: Patent Estimates on Subset Data by Legal Status

	I	II
C-Corp	.243***	.003
	(.0687)	(.0129)
LLC	.116*	.003
	(.0481)	(.0217)
	(1.2e-01)	(1.8e-01)
R^2	.17	.03
Observations	17,906	17,906
F-test	110.06***	18.99***
Note:	*p<0.1; **p<0.05; ***p<0.01	

How might our model be wrong?

- Maybe appropriation brings more equity quantity?
  - No – we tested that, with the same results
- If there are signals that come and go with years
  - e.g. patenting is somehow tied to a new CEO in a given year
  - The time fixed effect solve some of this
- If the firms that have dropped out of the survey are somehow different
  - We measure up to exit
  - There’s no reason to believe that exit would have affected the investment decision years earlier
- If oversampling of high-tech changes the results
  - We tested with and without weighting, and the results did not change