Technological Arbitrage Opportunities and Interindustry Differences in Startup Rates

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Entrepreneurship across industries

- Entrepreneurial dynamics differs greatly between industries (Eckhardt, 2002)
- Historical explanation: appropriability regimes differ (Levin et al., 1987)
- Yet by itself appropriability does not explain much: you have to have some rents to appropriate. Hence, opportunities to create rents are the key

Role of opportunities

- Entrepreneurship is pursuit of opportunities regardless of resources one controls (Stevenson & Jarillo, 1990)
- Entrepreneurial rents are typically associated with innovation and technological change
- Technological opportunities are distributed unevenly across industries (Klevorick et al., 1995) and thus may explain differences in entrepreneurial dynamics across industries

Understanding entrepreneurial opportunities

- Some sort of ‘newness’ is a must
- Schumpeterian newness: new to the world combinations a.k.a. grand innovation
- This kind of newness dominates entrepreneurship research (Shane, 2002)
- Kirznerian newness: new to the firm, not to the world a.k.a. petty innovation
- This kind of newness dominates practice (Anokhin et al., 2010): 71% of Inc 500 startups used ideas/technologies/products they had learned while at a former employer (Bhide, 2000)

Arbitrage opportunities

- Arbitrage as “free lunch”
- Recognizing shown-to-exist but not yet widespread combinations of resources that allow to buy low, recombine, and sell high with certainty (Kirzner, 1997)
- Ends and means are ‘given’ so firms can optimize (Eckhardt & Shane, 2003)
- ‘Trivial’ opportunities (Alvarez & Barney, 2004)

Prior experience and recognition of arbitrage opportunities

- Ability to recognize opportunities is conditioned by the prior experience (Shane, 2000), such that firms look for arbitrage opportunities in their narrow industries
  - CVT transmission example
- Ability to exploit opportunities is also conditioned by the industry
  - Firms in the same industry are subject to identical external forces and are likely to develop similar resource portfolios to address them

Narrow industry membership

- Narrow industry membership allows to identify new-to-the-firm combinations of resources that the firm is able to replicate
- Thus, arbitrage opportunities indeed become ‘trivial’ optimization under ‘given’ means-ends frameworks
- Absent further change in the industry, arbitrage opportunities are temporary and finite – but virtually without uncertainty

Arbitrage opportunities and entrepreneurial dynamics

- Innovation is risky (Thomas Edison example)
- Innovation is costly
- Innovation is uncertain (market may not accept it even if technology works)
- Arbitrage: none of the above. All one needs to do is initiate the process of purposeful knowledge spillover (Acs et al., 2009) (CVT; diet soda examples – Schnaars, 1994)
- **H1: There is a positive relationship between arbitrage opportunities and startup rates in the industry**

Appropriability regime unpacked

- Because arbitrageurs replicate someone else's know how, there are unique risks in the arbitrage opportunities pursuit:
  - Effectiveness of patent protection (as opposed to the ease of 'inventing around')
  - Effectiveness of product secrecy (vis-à-vis 'deciphering' the know how by imitators)
  - Effectiveness of lead time

Effectiveness of patent protection

- Innovators are required to disclose the vital information in exchange for protection
- Some industries (e.g., pharmaceuticals) are effectively shielded from imitation: ‘inventing around’ is not an option (FDA clearance)
- Any attempt at replicating is likely to be met with a lawsuit
- **H2: Effectiveness of patents as a means to ward off imitation negatively moderates the relationship between arbitrage opportunities and startup rates in the industry**

Effectiveness of secrecy

- Exploitation of technological arbitrage opportunities is contingent on the ability of the arbitrageur to decipher and replicate the more effective resource combinations (Acs et al., 2009)
- Would-be imitators risk not being able to replicate the new resource combination (examples: Coke, KFC secret seasoning)
- New entrants thus are reduced to pursuing generic (i.e., average) resource combinations
- **H3: Effectiveness of secrets as a means to ward off imitation negatively moderates the relationship between arbitrage opportunities and startup rates in the industry**

Effectiveness of lead time

- When lead time gives innovators substantial advantage, resource owners may re-price the resources to reflect the new means-ends framework before imitators are able to replicate it.
- Competitive advantage accorded to the arbitrageur by the more effective way to combine resources will not last long enough to justify imitative entry
- **H4: Effectiveness of lead time as a means to ward off imitation negatively moderates the relationship between arbitrage opportunities and startup rates in the industry**

Data

- Compustat data on 26 industries over 1999-2003
- 10,650 firm-year observations
- Labor and capital as inputs; Sales as output (Fare et al., 1998)
- Two-step procedure:
  - Intertemporal frontier calculation to determine representative slope
  - Arbitrage opportunities calculation for each industry-year *given the common industry slope*

Data (continued)

- U.S. Census Bureau – information on the number of firms by industries (by NAICS codes) from 1998 to 2005 to test different time lags
- NBER data on the appropriability regimes (Cohen, Nelson, & Walsh, 2000)

Variables (DV, IV, moderators)

- Net startup rates: ratio of the difference in the stock of active businesses in time t and (t-1) to the stock of active businesses in (t-1)
- Arbitrage opportunities: average firm distance from the production frontier in the industry (i.e., it is arbitrage opportunities available to a typical industry firm)
- Appropriability regime dimensions (patents, secrecy, lead time) are based on the percentage of innovation for which the respective mechanisms are deemed effective by the firm R&D and intellectual property specialists (survey-based estimate)

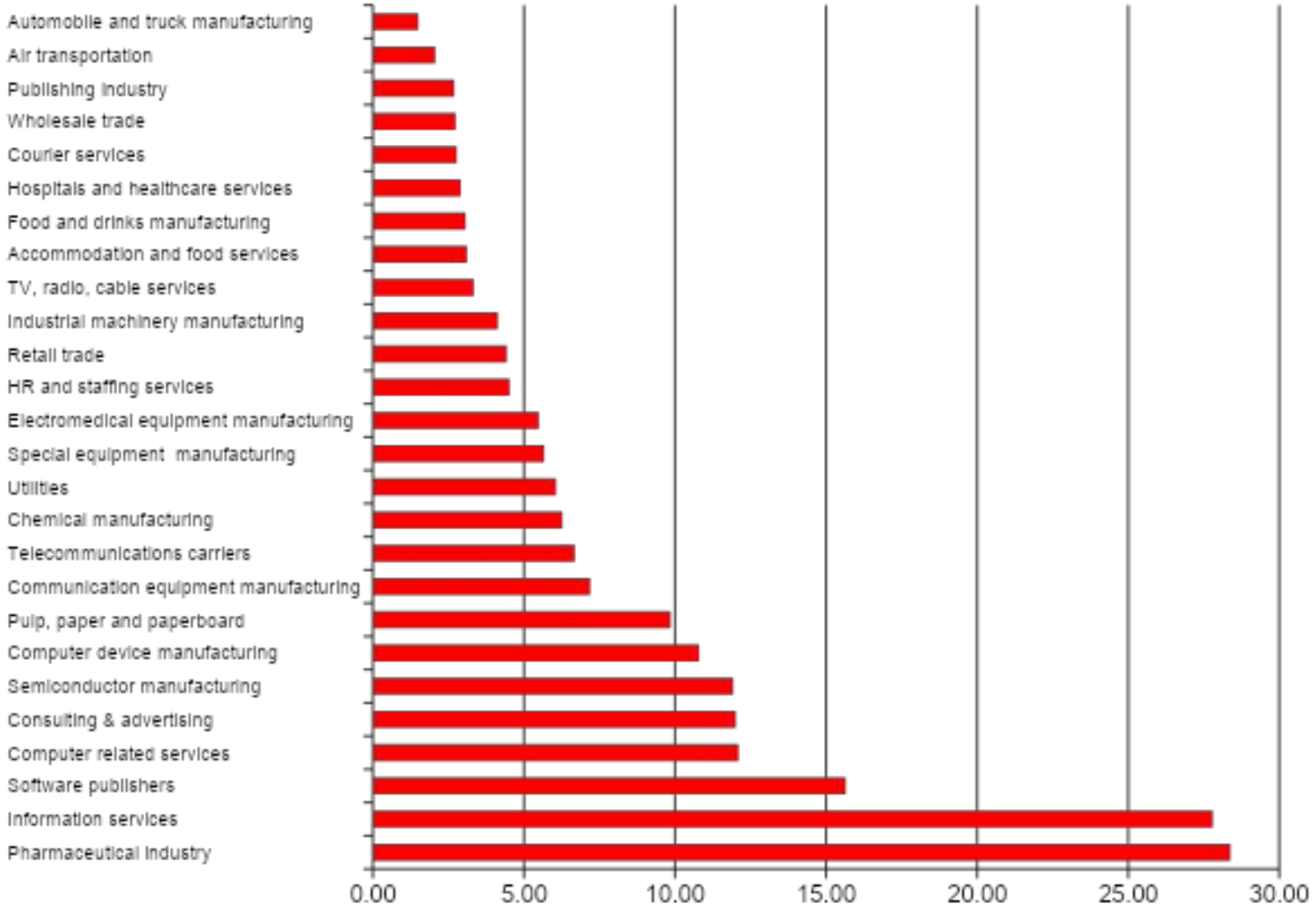
Control variables

- Innovative opportunities (average R&D intensity of the industry firms) (Malerba & Orsenigo, 1997; Dosi et al., 2006)
- Industry concentration ratio (share of the market controlled by the four largest firms)
- Year dummies

Models and estimations

- Model 1: control variables
- Model 2: direct effects
- Model 3: interactions
- Estimation: Random effects, corrected for the first-order autoregression in the disturbance term (Baltagi & Wu, 1999)

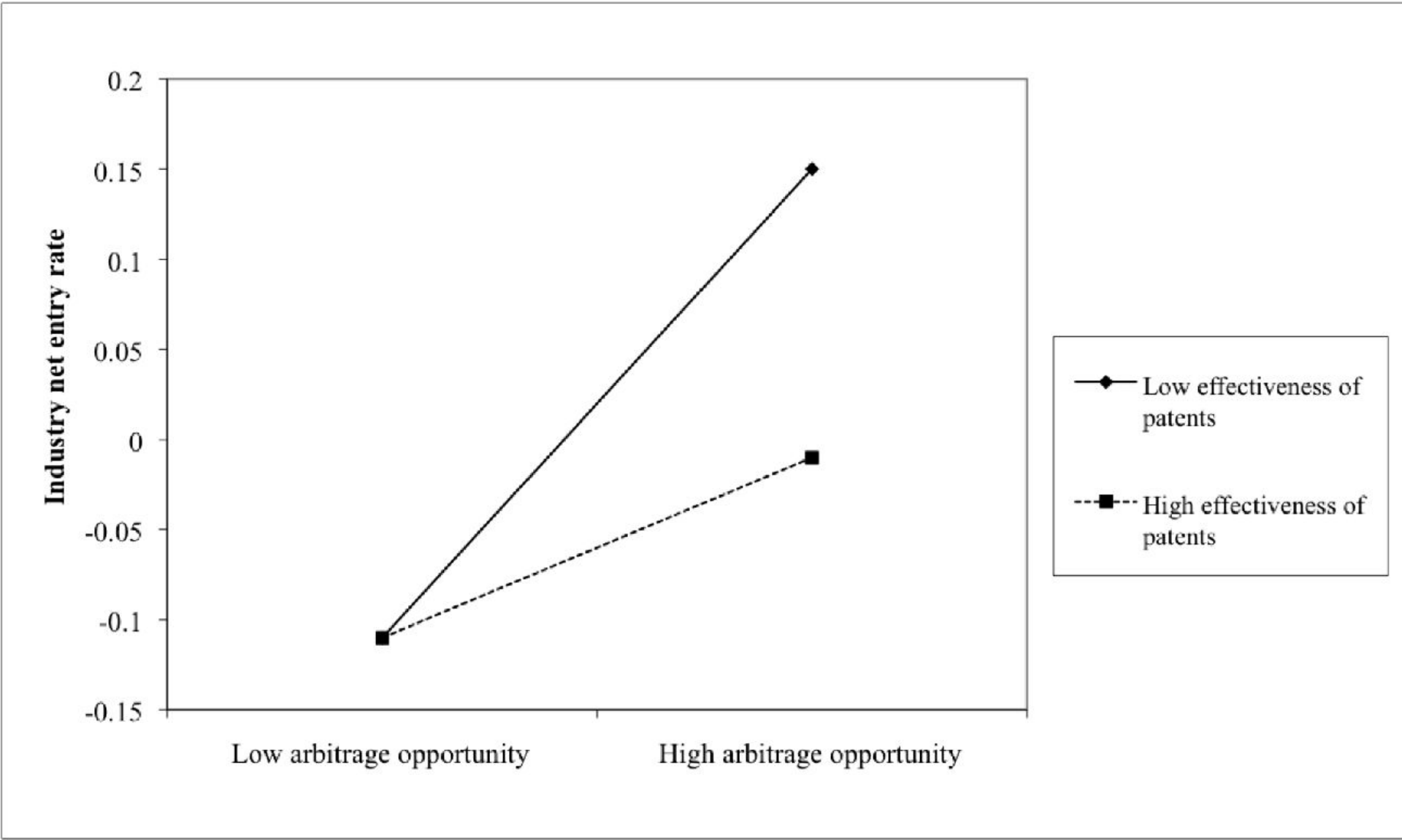
Arbitrage opportunities across industries



Results

	Model 1	Model 2	Model 3
Year dummies	Included	Included	Included
Concentration ratio	.01**	.03*	.02*
Innovative opportunities	.04***	-.02	.01
Arbitrage opportunities		.09***	.09***
Patents		-.02*	-.04***
Secrecy		-.01	-.04***
Lead time		-.01	-.03°
Arbitrage opportunities*Patents			-.04***
Arbitrage opportunities*Secrecy			-.07**
Arbitrage opportunities*Lead time			-.05°
Intercept	-.03	-.04*	-.02
R-squared	.16	.40	.48
Change in R-squared		.24	.08

Arbitrage opportunities, effectiveness of patents, and startup rates



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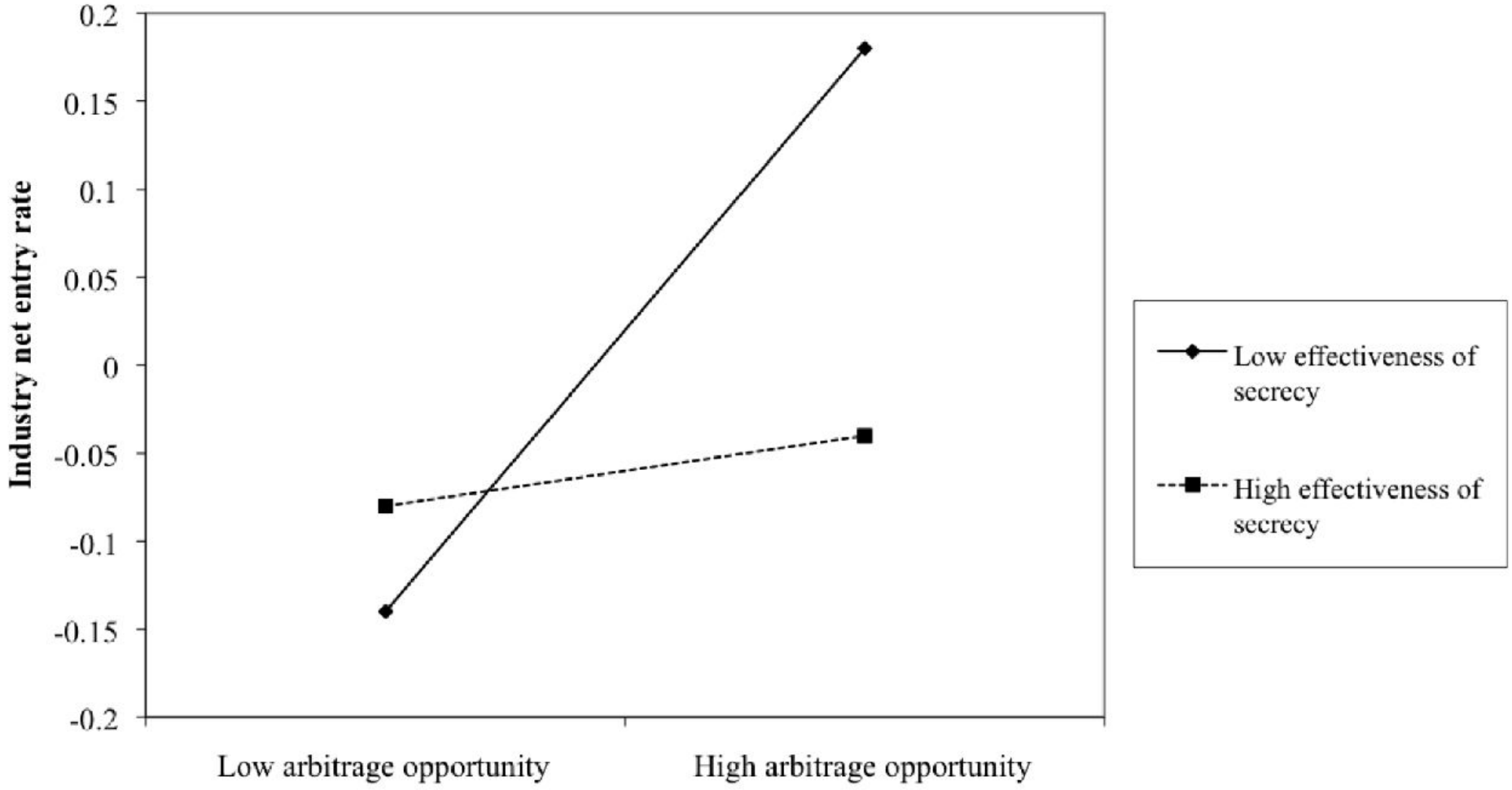
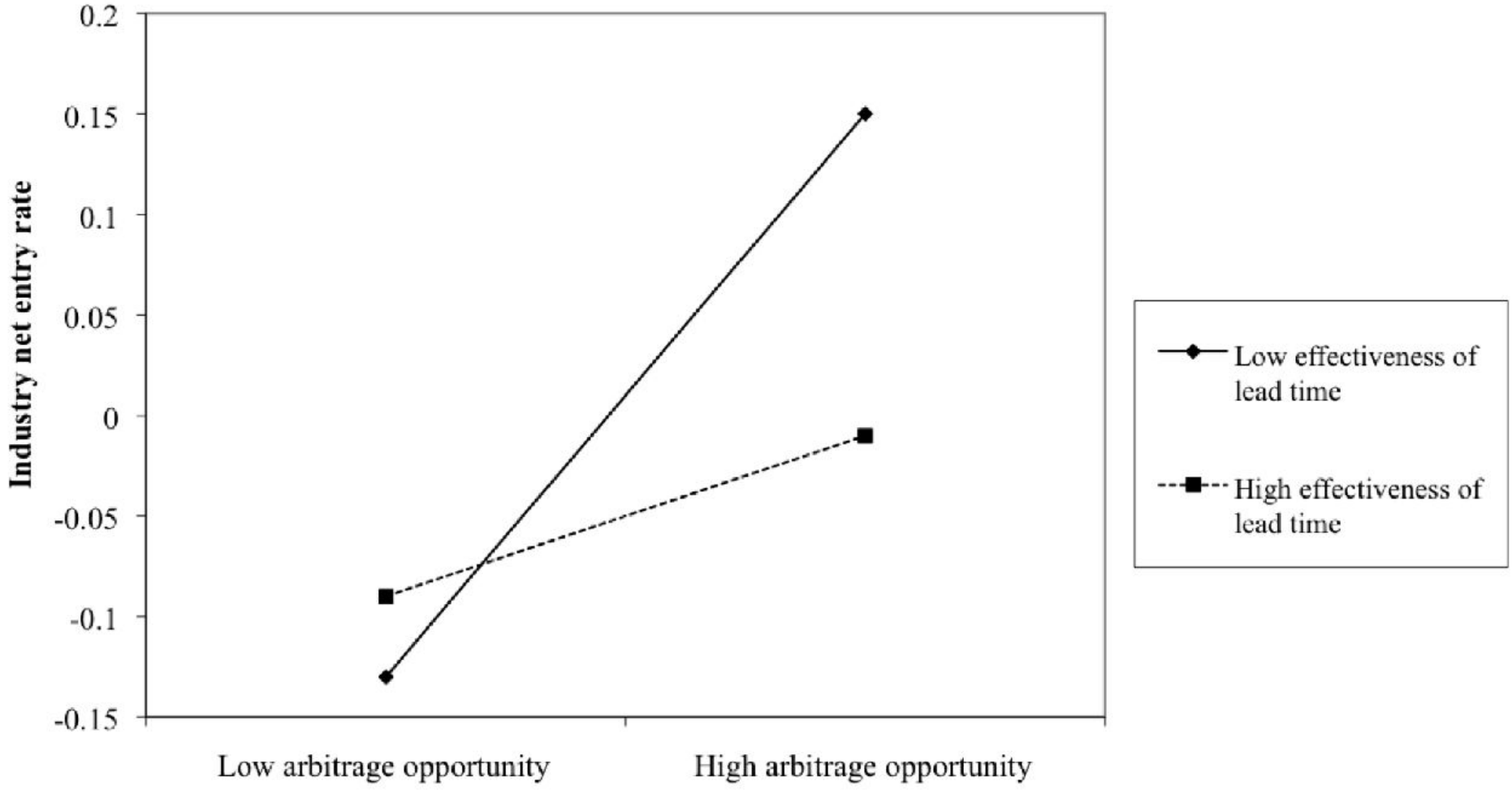


Arbitrage opportunities, effectiveness of lead time, and startup rates



Validation

- Similar results were obtained when using alternative sources of information on entrepreneurship:
  - Share of self-employed (Audretsch et al., 2009)
  - Number of non-employers (U.S. Census Bureau)

Discussion

- Arbitrage opportunities vary a great deal across industries
- Arbitrage opportunities explain startup rates across industries above and beyond innovative opportunities
- Arbitrage opportunities explain over 30% of variance in industry startup rates
- Once arbitrage opportunities enter the picture, innovative opportunities lose their significance

Questions?

Thank you!