Firm repertoires and performance: The influence of competitive pressure

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to gain and maintain a competitive advantage over rivals.

Existing work highlights two broad means by which firms seek

- Selecting an appropriate "position" on the competitive landscape based on a set of unique activities a fundamental precept (Porter, 1996; Ghemawat, 1991)
- Complementarities among activities may explain firm performance differences (Lenox, Rockhart, and Lewin, 2006; Ghemawat and Levinthal, 2008)
- Positions evolve and reinforced along a stable trajectory through a refinement of path-dependent capabilities (e.g., Gavetti, 2005)

<u>As a consequence:</u>

The "positional" perspective

INTRODUCTION

 Firms exploit complementarities which results in *consistent* patterns of activity (Lamberg et al., 2009)

- At the same time, evidence suggests "hyper-competition" more common, with only transient advantage available (McGrath, 2013; Sirmon et al., 2010; D'Aveni, 1994)
- A "gale" of competitive activity can erode returns quickly through imitation (Young et al., 1996; Derfus et al., 2008)
- Threats to sustainability can be a water mattress (pushing one down can exacerbate another) (Polidoro and Toh, 2011)

As a consequence:

 Complex, hard to predict action patterns may forestall imitation and substitution (Ferrier, 2001; Connelly et al., 2017)



INTRODUCTION But less is known about how competitive pressure affects the the comparative performance of these two approaches.

If a manager asked you which approach they should employ, which would you recommend?



INTRODUCTION This ambiguity leads us to the following question:



How does competitive pressure affect the extent to which enhanced performance is derived from *competitive repertoires* that emphasize the <u>achievement of fit</u> versus <u>fending off competitors</u>?

e.g., via defraying, defusing, and delaying competitive response

e.g., through a set of activities that exploit unique, protected capabilities





Definition: "[A]ctions used by an organization during a given year to attract, serve, and keep customers, composed of concrete market decisions such as price changes, product line or service alterations, and changes in the scope of operations" and "is made up of the entire range of the firm's competitive moves". (Miller and Chen, 1996: 420)

Specific aspects we consider:

Complexity: Variety of actions performed over a certain period (Ferrier, 2001)

Consistency: Year-to-year stability of the repertoire trajectory (Lamberg et al., 2009)

Competitive pressure: Count of actions performed by others (Young et al., 1996)

EMPIRICAL SETTING We test our expectations in the context of the commercial 3D printer market across life-cycle stages and strategic groups.

What do competitive actions look like in this context?





Capacity increases: <u>Stratasys</u>, Inc. (Nasdaq:SSYS) today announced it has entered a <u>binding purchase agreement for a building</u> located adjacent to its corporate headquarters in Eden Prairie, Minnesota. The facility provides approximately 86,000 square feet of office and manufacturing space that will accommodate the company's intermediate expansion requirements.

MedTechWorld MEDTEC Europe **Promotional activity:** Up to 900 component suppliers of medical technology manufacturers <u>will be exhibiting</u> <u>their innovations and services</u> at MEDTEC Europe in Stuttgart. The central theme is innovative materials as well as product development and production processes. Amongst other things, [...] <u>Concept Laser</u> is showcasing a generative metal laser fusion solution at this industry gathering with its LaserCUSING® process.



New product introductions: <u>3D Systems</u> Introduces Fabricate(TM) 3D Printing Directly Onto Textiles for Cube 3D Printer-- A new 3DIY application that reinvents textile design, pattern-making andfashion with 3D printing: watch video -- <u>FabricateTM app makes stylish innovation and</u> <u>personalization accessible</u> to fashion designers, boutiques, shops and the fashionable everywhere.

Source: Factiva data extracted for empirical analysis.

and scope, learning economies Can also optimize routines and structures

 Negative aspects include mal-adaptation and organizational rigidity

Positive aspects include economies of scale

Competitive pressure - main effect

Consistency - direct effects

Performance losses via imitation / substitution

Competitive pressure interaction

- Increased competition increases risk of mal-adaptation and lack of fit
- Accelerates rate of routine obsolescence

H1: As competitive intensity increases, the level of repertoire consistency at which performance reaches a maximum will decrease, and the performance achieved at this optimum will be lower.

Sources: Lamberg et al., 2009; Nelson & Winter, 1982; Langlois, 1997, Gersick, 1991, Tripsas & Gavetti, 2000; Chen, 1996, Nadkarni & Narayanan, 2007

Repertoire consistency

THEORY The curvilinear effect of repertoire consistency on performance





THEORY The repertoire complexity – performance link

Complexity - direct effects

- Temporal and resource complementarities
- Action causal cycles can be coordinated
- Diminishing returns to actions deferred

<u>Competitive pressure – direct effects</u>

Performance losses via imitation / substitution

Competitive pressure interaction

- Copying actions and competencies harder
- Guessing subsequent actions more difficult



H2: As competitive intensity increases, the positive relationship between repertoire complexity and performance will become stronger in magnitude.

Sources: Bridoux et al., 2013, Ghemawat & Levinthal, 2008; Rivkin, 2001; Ferrier, 2001; Keyhani et al., 2015; Lenox, Rockhart & Lewin, 2006



MEASURES Key study measures and data sources



Firms selling at least one unit were at risk for inclusion from the point of first sale.

Variable	Operationalization	Mean	SD
Repertoire complexity	Entropy index of repertoire components based on a portfolio of five action types (price, product, marketing, capacity, and service related)	.66	.13
Repertoire consistency	Magnitude and direction of change in action space (5-dimensional) based on Lamberg et al. (2009)	.57	.22
Performance	Return on assets in the following year (t+1)	-1%	10%
Total activity	Count of all actions taken by a firm in a one year period	52 acts	114 acts
Competitive pressure	Count of all actions taken by set of firms in the same strategic group less the actions of the focal firm	119 acts	215 acts

Performance Data			
Sources	EDGAR; S&P Capital IQ; Wohler's Reports; PrivCo		
Observations	221 ROA observations for 18 firms that sell 3D printers (matched n = 110)		
Coding	As is, concatenated from sources		

Action Data			
Sources	Factiva		
Observations	360 firm-year observations of 24 companies compiled from 11,993 actions coded from 20,179 articles (matched n = 110)		
Coding	Computer-aided text analysis		

Control variables included total competitive activity, industry concentration, firm size and age, total firm activity, change in competitor count, among others. We also included an underlying time trend as a control for missing time-varying covariates, but this was non-significant and introduced collinearity to the model.

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KEY FINDINGS Complexity seems to mitigate the negative effects of competition on performance to some degree.

PARATUS 1917

(Random effects model, interactions plotted at -1 / +1 SD, Hausman $\chi^2(15) = 3.06$).



Source: Table 2, Model 1b, 1d. The main effect of complexity is significant when no interaction is present; interaction (centered at competitive activity = 0) is significant at p < .10 in the random effects model and p < .05 in the fixed effects model. All VIFs below recommended value of 10. n = 110.

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WEY FINDINGS We find consistency is broadly beneficial if competition is low, but an tradeoff emerges as competition increases.



(Random effects model, interactions plotted at -1 / +1 SD, Hausman $\chi^2(15) = 6.66$).



Source: Table 2, Model 1c, 1e. Consistency main effect significant at p < .10 when no interaction present; squared interaction term is significant at p < .05 in the random effects model at p < .05 in the fixed effects mode indicating a significant change in curvature. All VIFs below recommended value of 10. n = 110.

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DISCUSSION AND FUTURE RESEARCH OPPORTUNITIES Here are some musings that we would like to proffer to get the conversation going.



Limitations and forthcoming refinements

- Relatively small sample post-merge; with more data, power can increase
- Repertoire metrics course-grained;
 currently increasing resolution
- Currently a correlational study; searching for means of causal identification beyond fixed effects (e.g., reverse causality concerns)
- Correspondence between actions and underlying strategy; how to show reliability and convergent validity?

New questions uncovered

- Interactions between complexity and consistency – tradeoffs and capability differences? (e.g., Connelly et al., 2017)
- Would findings replicate across industries?
- Consistency of conclusions with other means of assessing firm action patterns, such as typologies or investment patterns (e.g., Wowak et al., 2016)
- Incorporating timing of attacks more explicitly (e.g., Ferrier, 2001)
- How does the Red Queen factor in? (e.g., Derfus et al., 2008; Giachetti et al., 2018)

Our findings regarding consistency are robust to the use of a lagged DV; complexity findings are not as robust.