The Impact of Business Strategy on Cost Management

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This paper investigates the association between business strategy and firms' decisions in cost management. Using the strategy topology proposed by Miles and Snow (1978, 2003), I document that firms adopting a prospector-type strategy exhibit a higher level of cost rigidity with higher fixed and lower variable costs than firms employing a defender-type strategy. This is because prospectors are innovation-oriented and tend to make more fixed inputs in research and development activities. My findings add to the implications of business strategy in firms' resources allocation and cost management.

Keywords: business strategy, cost management, cost behavior

INTRODUCTION

Business strategy is a set of proactive actions that firms use to perceive market opportunities, set organizational objectives, direct efforts and behavior, and then improve overall performance. Following firms' business strategy, the management deploys fixed and variable resources to conduct operations and achieve the desired ends, which may influence the relative proportion of fixed and variable costs. However, the essential role of business strategy in resource allocation and cost management has been understudied. Using the business strategy typology proposed by Miles and Snow (1978, 2003), this paper investigates whether firms pursuing different strategies make diverging resource decisions and thus exhibit different cost behavior. My findings provide new insights into the impact of business strategy in the areas of corporate operations and resources management.

Miles and Snow's strategy typology is one of the most popular classifications of business strategies (Miles and Snow 1978, 2003). They summarize firms' tactics to address entrepreneurial, operational, and administrative problems, and describe four basic types of strategic behavior as *Prospector*, *Defender*, *Analyzer*, and *Reactor*. Following prior accounting research (Bentley et al. 2013; Bentley, Omer, and Twedt 2017; Abernethy, Kuang and Qin 2018), I focus on prospectors and defenders that comprise the two endpoints of the strategy continuum. Based on Miles and Snow (1978, 2003), prospector firms prioritize creativity and innovation by seeking out new market opportunities and developing new products. Their quick responses to emerging environmental trends enable them to grow rapidly and sporadically. Unlike prospectors, firms with a defender-type strategy have a narrowly focused product line with emphasis on cost efficiency of existing operations. In general, defender firms grow slowly and gradually in a stable environment.

Prospectors and defenders may have different preferences and considerations when mobilizing resources and managing fixed and variable costs. Specifically, since fixed costs stay constant when sales change, the proportion of fixed costs influences firm profitability significantly. For example, when sales

decrease, firms with a higher proportion of fixed costs and a lower proportion of variable costs will experience smaller cost savings, leading to their poorer performance than other firms. However, during sales-increasing periods, these firms have a smaller increase in costs and thus can perform better than others. Consistent with this notion, previous studies have examined external and internal risk factors as determinants of cost rigidity. For instance, Holzhacker, Krishnan, and Mahlendorf (2015) find that firms with higher financial risk and a higher likelihood of sales decline are concerned about weak performance and default risk caused by cost rigidity, so they are likely to make procurement choices to reach a less rigid cost structure. Meanwhile, Banker et al. (2014) use an analytical model to document the existence of congestion risk when demand uncertainty increases the likelihood of unusually high demand. To reduce significant congestion costs caused by demand growth, firms with greater demand uncertainty will operate with a higher capacity of fixed inputs, implying a more rigid cost structure with higher fixed and lower variable costs.

Firms follow specific business strategies to implement their plans in organizational operations, which may also influence firms' resource allocation and hence cost management. Prospectors pioneer the development of new products and exploit potential market opportunities with a diverse product line (Miles and Snow 1978, 2003). With their focus on product and market innovation, prospectors consistently undertake large investments in research and development activities, which requires a significant amount of fixed inputs that can hardly be adjusted in the short run.[1] Therefore, firms employing a prospector-type strategy tend to demonstrate a more rigid cost structure with higher fixed and lower variable costs. Conversely, defenders achieve success by focusing on a limited product line and pursuing cost efficiency in production, while a less rigid cost structure offers firms more flexibility in resources management to lower costs (Balakrishnan, Sivaramkrishnan, and Sprinkle 2008, pp.171). As a result, defender firms will prefer a less rigid cost structure with lower fixed and higher variable costs. Taken together, I expect that prospector strategies are more positively associated with cost rigidity than defender strategies.

In this paper, I employ the composite measure of business strategy proposed by Bentley et al. (2013), where a higher value of it indicates a prospector-type strategy and a lower value suggests a defender-type strategy. To capture cost rigidity, I regress annual log-changes in total operating costs on annual log-changes in sales and the slope coefficient indicates the percentage change in costs for a one percent change in sales (Kallapur and Eldenburg 2005; Banker et al. 2014). A smaller slope coefficient represents that the annual change in costs is less responsive to the contemporaneous change in sales, implying a higher level of cost rigidity with a higher proportion of fixed costs and a lower proportion of variable costs (Banker et al. 2014). To investigate the association between business strategy and cost rigidity, I interact business strategy and annual log-changes in sales and expect a negative coefficient on the interaction term, suggesting that prospector firms have a more rigid cost structure than defender firms.

I follow prior studies to construct a sample of manufacturing firms from Compustat over the period 1980 - 2015 (Bentley et al. 2013; Banker et al. 2014). After deleting observations with missing data on required variables, my final sample consists of 69,696 firm-year observations. Consistent with my hypothesis, I find that prospector firms choose a higher level of cost rigidity with more fixed inputs than defender firms. I also explore the mechanisms for firms to change their cost structure. Decomposing total operating costs into separate cost categories, I find that prospectors allocate more fixed resources in non-production overhead (SG&A), research and development activities (R&D), and human capitals (the number of employees) to increase the level of cost rigidity.

My paper contributes to the literature in following ways. First, previous accounting literature has examined how business strategy affects financial reporting irregularities and audit effort (Bentley et al. 2013), voluntary disclosures (Bentley, Omer, and Twedt 2017), and CEO selection and resulting firm performance (Abernethy, Kuang and Qin 2018), etc. This study documents that firms with different business strategies make diverging resource allocation decisions, leading to different levels of cost rigidity. Therefore, I generalize the implications of business strategies to the areas of resource and cost management. Second, while prior studies have shown that firms consider financial risk (Holzhacker et al. 2015) and congestion risk (Banker et al. 2014) in choosing committed capacity levels and allocating fixed resources, my paper identifies business strategy as an important determinant of cost rigidity. Finally, my empirical

results provide evidence on the mechanisms for firms to adjust cost rigidity. I find that firms commit their fixed resources in overall operations, research and development activities, and human capitals to influence the level of cost rigidity.

The reminder of my paper is organized as follows. Section 2 reviews literature and develops my hypothesis. Section 3 describes empirical methodology and sample. Section 4 discusses my empirical findings. I conclude in Section 5.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Business Strategy

Business strategy is a scheme of competitive actions that firms use to attract potential customers, enhance market position, conduct business operations, and strengthen overall performance. A large stream of management literature has studied business strategy and provided various classifications of it. For example, Miles and Snow (1978, 2003) identify four unique organizational strategies as *Prospector*, *Defender*, *Analyzer*, and *Reactor*, which are positioned along a strategy continuum. Specifically, prospectors operate at one end of the strategy continuum, while defenders operate at the other end. Porter (1980) propose three generic strategies that companies use to obtain competitive advantage in an industry: differentiation, cost leadership, and focus. March (1991) consider business strategies in terms of exploration of potential opportunities and exploitation of existing certainties. Additionally, Treacy and Wiersema (1995) describe business strategies along three dimensions: product leadership, operational excellence, and customer intimacy.

The classification proposed by Miles and Snow (1978, 2003) is widely employed in the accounting literature, as it can be measured using accessible financial data and generalized to a broad cross-section of firms (Bentley, Omer, and Sharp 2013). In this study, I follow prior research in accounting to focus on the endpoints of the strategy continuum: *prospectors* and *defenders* (Bentley et al. 2013; Bentley et al. 2017; Abernethy et al. 2018). This is because these two strategies aligns with other typologies of business strategy, such as product differentiation and cost leadership in Porter (1980), exploration and exploitation in March (1991), and product leadership and operational excellence in Treacy and Wiersema (1995).

Miles and Snow (1978, 2003) suggest that *prospectors* are expected to be on the leading edge of creativity and technology. These firms are always seeking to develop innovative products in order to explore new market and exploit potential growth opportunities. Therefore, prospectors tend to undertake significant investments in research and development activities and marketing activities. In contrast, Miles and Snow (1978, 2003) document that *defenders* have a narrow product line with limited flexibility in technology. They attempt to maintain efficiency in production for the purpose of serving existing customers and protecting current market. Therefore, defenders prefer to use settled and standardized technical processes to lower costs. Due to their focused product-market domains with cost efficiency, defenders generally exhibit steady and cautious growth patterns.

The impact of business strategy on firm behavior is an important research question considered in the accounting literature. For instance, Bentley et al. (2013) develop a measure of business strategy typology proposed by Miles and Snow (1978, 2003) and find that prospectors exhibit a higher frequency of financial reporting irregularities than defenders, leading to more audit efforts from their audit firms. Bentley, Omer, and Twedt (2017) show that firms adopting a prospector-type strategy are more likely to issue voluntary disclosures than firms pursuing a defender-type strategy. With respect to firm performance, Abernethy, Kuang and Qin (2018) document that prospector firms prefer to hire CEOs with high social capital for the value-adding effect, leading to their stronger firm performance. Given that business strategy equips the management to proceed organizational operations, it may also influence managers' decisions in resources allocation and cost management.

Cost Rigidity

Cost structure indicates the relative proportion of fixed and variables costs that a firm incur and affects its profitability significantly. Specifically, fixed costs remain the same regardless of production levels,

while variable costs vary with production levels. When sales increase, a firm with a higher level of cost rigidity (a higher proportion of fixed costs and a lower proportion of variable costs) will experience a lower increase in cost, resulting in higher profits. However, when sales decrease, a firm with a lower level of cost rigidity (a lower proportion of fixed costs and a higher proportion of variable costs) will perform better than others, because a higher proportion of variable costs can be reduced timely.

Previous literature has shown that firms in different scenarios prefer different levels of cost rigidity. For example, Holzhacker et al. (2015) focus on the risk of financial default when sales decrease. Because cost rigidity leads to weaker performance during sales-decreasing periods, firms with higher financial risk are concerned about being forced into bankruptcy and will choose a less rigid cost structure. At the same time, they find that more volatile demand is associated with higher earnings volatility and higher operating cash flows volatility, so firms with greater demand uncertainty also prefer a lower level of cost rigidity to reduce these volatilities. Conversely, Banker et al. (2014) document that firms with limited fixed capacity may incur significant congestion costs when sales increase rapidly. They show that firms with high demand uncertainty can save large congestion costs by increasing their fixed inputs. As a result, these firms are likely to choose a higher capacity of fixed inputs, leading to a more rigid cost structure with higher fixed and lower variable costs.

In addition to default risk and congestion risk, business strategy may also play an essential role in determining firms' cost rigidity. Business strategy assists the management to set organizational goals, explore beneficial opportunities, and advance business operations. During the process, it may influence managers' resource allocation to achieve specific objectives, resulting in different levels of cost rigidity. However, the impact of business strategy on cost rigidity has been understudied. In this study, I investigate the association between business strategy and cost rigidity to fill this gap.

Hypothesis Development

As in Miles and Snow (1978, 2003), firms with a prospector-type strategy promote product differentiation over cost efficiency to meet changing customer needs and exploit new market opportunities. Consequently, they often make substantial investments in research and development activities, which requires fixed resources that can hardly be adjusted in the short-term. In contrast, firms adopting a defender-type strategy specialize in particular product-market domains and establish standardized technical processes to pursue cost efficiency (Miles and Snow 1978, 2003). Therefore, defender firms may avoid to invest heavily in fixed resources, but prefer to invest in variable resources that can be adjusted timely to accommodate changing sales. Therefore, defender firms may prefer to operate with a less rigid cost structure with a lower proportion of fixed costs and a higher proportion of variable costs.

Taken together, I state my hypotheses as follows:

H1*: Prospector-type strategies are more positively associated with cost rigidity than defender-type strategies.*

SAMPLE AND EMPIRICAL METHODOLOGY

Measures of Business Strategy and Cost Rigidity

Follow Miles and Snow (1978, 2003) and Bentley et al. (2013), I construct a measure, *STRAT*, to proxy for a firm's business strategy, where a higher value indicates a prospector-type strategy and a lower value represents a defender-type strategy. As in Bentley et al. (2013), I calculate STRAT as the sum of six measures, including (1) R&D expenses divided by net sales, (2) the number of employees divided by net sales, (3) annual sales growth rate, (4) SG&A expenses divided by net sales, (5) standard deviation of employee counts, and (6) net PPE divided by total assets. Specifically, all the six variables are calculated over a rolling average over the prior five-year period and ranked into quintiles in each industry-year. I give observations in the highest quintile a score of 5, in the second highest quintile a score of 4, and so on. Then I sum the scores for all the six variables to compute the measure of strategy, which is between 6 and 30. It

equals 6 if the firm adopts a defender-type strategy, and equals 30 if the firm employs a prospector-type strategy. The detailed variable construction is presented in Appendix.

Following Banker et al. (2014), I use the following log-linear model to estimate cost rigidity:

$$\Delta lnCOST_{i,t} = \beta_0 + \beta_{i,t}\Delta lnSALES_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $\Delta lnCOST_{i,t}$ is the log-change in total operating costs for firm *i* from year *t-1* to *t*, and $\Delta lnSALES_{i,t}$ is the log-change in sales for firm *i* from year *t-1* to *t*. The slope coefficient, $\beta_{i,t}$, represents the percentage change in total operating costs for one percent change in sales, implying the degree of cost rigidity. A lower value of $\beta_{i,t}$ suggests a smaller cost response to the same amount of change in sales, indicating a more rigid cost structure with higher fixed and lower variable costs.

Sample

Following Bentley et al. (2013), I start my sample by identifying 207,804 firm-year observations from Compustat over the sample period of 1980 - 2015. Based on Banker et al. (2014), I remove observations that are not industrial firms and that are with missing data on required variables. Consistent with Banker et al. (2013), I drop observations with negative sales, negative operating costs, or operating costs that are less than 50% or greater than 200% of sales. My final sample includes 69,696 firm-year observations over the sample period. Table 1 presents sample selection procedures in panel A and sample distribution by fiscal year in panel B. Overall, my sample spreads evenly from 1980 to 2015.

Empirical Model

My model for the association between business strategy and cost rigidity is as follows:

$$\begin{aligned}\Delta lnCOST_{i,t} = {} & \beta_0 + \beta_1\Delta lnSALES_{i,t} + \boldsymbol{\beta_2 STRAT_{i,t} * \Delta lnSALES_{i,t}} + \beta_3 GDPG_t * \Delta lnSALES_{i,t} \\ & + \beta_4 UNCERT_i * \Delta lnSALES_{i,t} + \beta_5 MA_{i,t} * \Delta lnSALES_{i,t} + \beta_6 AI_{i,t} * \Delta lnSALES_{i,t} \\ & + \beta_7 EI_{i,t} * \Delta lnSALES_{i,t} + \beta_8 SIZE_{i,t} * \Delta lnSALES_{i,t} + \beta_9 AGE_{i,t} * \Delta lnSALES_{i,t} \\ & + \beta_{10} GROWTH_{i,t} * \Delta lnSALES_{i,t} + \beta_{11} ROA_{i,t} * \Delta lnSALES_{i,t} \\ & + \beta_{12} MB * \Delta lnSALES_{i,t} + \beta_{13} HHI_{i,t} * \Delta lnSALES_{i,t} + \beta_{14} STRAT_{i,t} \\ & + \beta_{15} UNCERT_{i,t} + \beta_{16} MA_{i,t} + \beta_{17} AI_{i,t} + \beta_{18} EI_{i,t} + \beta_{19} SIZE_{i,t} + \beta_{20} AGE_{i,t} \\ & + \beta_{21} GROWTH_{i,t} + \beta_{22} ROA_{i,t} + \beta_{23} MB_{i,t} + \beta_{24} HHI_{i,t} + \varepsilon_{i,t}\end{aligned} \quad (2)$$

Specifically, $\Delta lnCOST_{i,t}$ is the log-change in total operating costs for firm *i* from year *t-1* to *t*; $\Delta lnSALES_{i,t}$ is the log-change in sales for firm *i* from year *t-1* to *t*; and $STRAT_{i,t}$ is the composite measure of business strategy as defined in Section 3.1. The interaction term, $STRAT_{i,t} * \Delta lnSALES_{i,t}$, is the variable of my interest. Based on

H1, I predict β_2 to be negative and significant, suggesting that prospector firms choose a more rigid cost structure with a higher proportion of fixed costs and a lower proportion of variable costs than defender firms.[2]

Following previous literature (Anderson et al. 2003; Banker et al. 2014), I control for determinants of cost rigidity, such as GDP growth ($GDPG_t$), demand uncertainty ($UNCERT_{i,t}$), managerial ability ($MA_{i,t}$), asset intensity ($AI_{i,t}$), employee intensity ($EI_{i,t}$), firm size ($SIZE_{i,t}$), firm age ($AGE_{i,t}$), sales growth ($GROWTH_{i,t}$), return on assets ($ROA_{i,t}$), market-to-book ($MB_{i,t}$), and industry concentration ($HHI_{i,t}$). I provided full details of variable definitions in Appendix. All continuous variables are winsorized at the 1st and 99th percentiles to exclude outliers. I also control for year and industry fixed effects based on two-digit SIC codes. Standard errors are clustered at the firm level.

TABLE 1
SAMPLE SELECTION AND SAMPLE DISTRIBUTION

This table reports sample selection procedures in Panel A and sample distribution by fiscal year in Panel B. The sample spans from 1980 to 2015.

Panel A: Sample Selection	
Compustat data for years between 1980 and 2015	207,804
Drop observations that are not industrial firms	-107,044
Drop observations with missing data on required variables from Compustat	-28,440
Drop observations with negative sales or negative operating costs or operating costs are less than 50% or greater than 200% of sales	-2,624
Final Sample	69,696

Panel B: Sample Distribution by Fiscal Year

Fiscal Year	Number of Observations
1980	1,832
1981	1,925
1982	1,908
1983	1,915
1984	1,866
1985	1,906
1986	1,911
1987	1,893
1988	1,893
1989	1,911
1990	1,894
1991	1,887
1992	1,911
1993	1,929
1994	1,978
1995	2,232
1996	2,322
1997	2,368
1998	2,422
1999	2,341
2000	2,170
2001	2,114
2002	2,117
2003	2,087
2004	2,010
2005	1,922
2006	1,901

2007	1,881
2008	1,819
2009	1,811
2010	1,768
2011	1,718
2012	1,638
2013	1,595
2014	1,561
2015	1,340
Total	69,696

Descriptive Statistics

Table 2 provides the descriptive statistics for my full sample. The mean (median) Δ*lnSALES* is 0.0724 (0.0653) and the mean (median) Δ*lnCOST* is 0.0674 (0.0641), which are close to those reported in Banker et al. (2014). The mean (median) value of *STRAT* is 17.5967 (18.0000), similar to that reported in Bentley et al. (2013). The mean (median) value of *MA* is 0.0054 (-0.0094), consistent with Demerjian et al. (2012). The mean (median) value of the log of total assets (*SIZE)* is 5.1326 (4.9979), and the mean (median) value of the log of firm age (*AGE*) is 2.7732 (2.7726). Overall, the descriptive statistics of key variables in my sample are comparable to those in prior studies (Bentley et al. 2013; Banker et al. 2014; Demerjian et al. 2012).

TABLE 2
SUMMARY STATISTICS

This table reports summary statistics of the full sample. The full sample contains 69,696 observations from 1980 to 2015. All continuous variables are winsorized at the 1% and 99% levels. Variable definitions are presented in Appendix.

Variable	N	Mean	25%	Median	75%	Std. Dev.
Δ*lnSALES*	69,696	0.0724	-0.0409	0.0653	0.1767	0.2819
Δ*lnCOST*	69,696	0.0674	-0.0329	0.0641	0.1663	0.2424
STRAT	69,696	17.5967	15.0000	18.0000	20.0000	3.4992
UNCERT	69,696	0.2186	0.0802	0.1450	0.2592	0.2543
MA	69,696	0.0054	-0.0503	-0.0094	0.0371	0.0994
AI	69,696	1.0665	0.6503	0.8702	1.2193	0.8603
EI	69,696	8.0209	3.7634	6.2611	10.3134	6.5568
SIZE	69,696	5.1326	3.4448	4.9979	6.7150	2.3248
AGE	69,696	2.7732	2.1972	2.7726	3.3322	0.6910
GROWTH	69,696	0.1264	-0.0401	0.0675	0.1933	0.4818
ROA	69,696	0.0012	-0.0189	0.0405	0.0844	0.1848
MB	69,696	2.3387	0.9297	1.6006	2.7515	3.8295
HHI	69,696	0.1800	0.0916	0.1381	0.2286	0.1353

TABLE 3
PEARSON AND SPEARMAN CORRELATIONS BETWEEN VARIABLES

This table reports Pearson (lower left) and Spearman (upper right) correlations among key variables in the full sample. The sample period spans from 1980 to 2015. Variable definitions are presented in Appendix. Bold figures indicate significant levels of less than 5%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Δ*lnSALES*		**0.90**	**0.12**	**0.05**	**0.20**	**-0.01**	**-0.03**	**0.02**	**-0.13**	**1.00**	**0.34**	**0.29**	**-0.04**
Δ*lnCOST*	**0.88**		**0.10**	**0.01**	**0.18**	0.00	**-0.01**	**0.04**	**-0.13**	**0.90**	**0.29**	**0.27**	**-0.03**
STRAT	**0.12**	**0.09**		**0.11**	**0.02**	**0.21**	**0.24**	**0.17**	-0.07	**0.12**	**-0.03**	**0.16**	**-0.06**
UNCERT	**0.13**	**0.05**	**0.20**		**-0.03**	**0.13**	**-0.04**	**-0.27**	**-0.26**	**0.05**	**-0.27**	**-0.05**	**-0.11**
MA	**0.18**	**0.14**	**0.05**	-0.00		**-0.16**	**-0.03**	**-0.15**	**-0.04**	**0.20**	**0.26**	**0.23**	**-0.07**
AI	**-0.01**	**-0.02**	**0.13**	**0.20**	**-0.06**		**-0.12**	**0.28**	**-0.04**	**-0.01**	**-0.13**	**0.11**	**-0.18**
EI	-0.03	**-0.02**	**0.21**	**0.02**	**-0.09**	0.04		**-0.37**	**-0.08**	**-0.03**	**-0.08**	**-0.18**	**0.14**
SIZE	**0.01**	**0.05**	**0.16**	**-0.24**	**0.05**	**0.13**	**-0.33**		**0.38**	**0.02**	**0.22**	**0.15**	-0.03
AGE	**-0.12**	**-0.12**	**-0.07**	**-0.23**	-0.01	**-0.07**	**-0.10**	**0.38**		**-0.13**	**0.13**	**-0.02**	**0.06**
GROWTH	**0.87**	**0.71**	**0.11**	**0.22**	**0.13**	**0.06**	-0.00	**-0.04**	**-0.13**		**0.34**	**0.19**	**-0.04**
ROA	**0.16**	**0.16**	**-0.08**	**-0.28**	**0.11**	**-0.06**	**-0.05**	**0.29**	**0.15**	**0.03**		**0.34**	**0.04**
MB	**0.14**	**0.13**	**0.11**	**0.06**	**0.15**	**0.03**	**-0.07**	**0.02**	**-0.04**	**0.12**	**0.04**		**-0.09**
HHI	**-0.03**	**-0.03**	**-0.03**	**-0.06**	**-0.10**	**-0.10**	**0.09**	**-0.01**	**0.05**	**-0.03**	**0.04**	**-0.05**	

Table 3 reports Pearson and Spearman correlations among main variables used in my full sample. The correlations between *STRAT* and other independent variables are all below 0.25, less than the threshold of possible multicollinearity (Gujarati 2003). Pearson and Spearman correlations are similar in magnitudes, implying that there are no obvious outliers.

EMPIRICAL RESULTS

The Rigidity of Total Operating Costs

In this section, I investigate the association between business strategy and the rigidity of total operating costs. Table 4, column (1) reports the regression results of estimating model (2). Specifically, I follow Banker et al. (2014) to control for GDP growth (*GDPG*) and demand uncertainty (*UNCERT*). Column (1) shows that the coefficient on *STRAT**Δ*lnSALES* is negative and significant (coefficient = -0.012, t-statistic = -8.97). Given that a higher value of *STRAT* suggests a prospector-type strategy, this result shows that prospector firms choose a more rigid cost structure with a higher proportion of fixed costs and a lower proportion of variable costs. With regards to the control variable, the coefficient on *UNCERT**Δ*lnSALES* is negative and significant (coefficient = -0.153, t-statistic = -9.87), consistent with Banker et al. (2014) that demand uncertainty is positively associated with cost rigidity.

Table 4, column (2) presents the regression results of estimating model (2) with all control variables included. The coefficient on *STRAT**Δ*lnSALES* is still negative and significant (coefficient = -0.011, t-statistic = -9.19), suggesting that prospector firms prefer a higher capacity of fixed inputs because they undertake higher investments in research and development activities than defender firms. As a result, prospectors demonstrate a more rigid cost structure with higher fixed and lower variable costs. I continue to find a negative coefficient on *UNCERT**Δ*lnSALES* (coefficient = -0.025, t-statistic = -1.87), implying a positive association between demand uncertainty and cost rigidity (Banker et al. 2014). Furthermore, a

negative and significant coefficient on *MA**Δ*lnSALES* (coefficient = -0.320, t-statistic = -5.74) suggest that more able managers tend to operate with a higher level of fixed inputs, which may be caused by their concern about increased congestion risk associated with growing sales. Finally, I find that firms with larger size, stronger performance, and in concentrated industry exhibit a lower level of cost rigidity.

Overall, the results in Table 4 are consistent with my main hypothesis that prospector-type strategies are more positively associated with cost rigidity than defender-type strategies. This is because prospector firms are innovation-oriented and are likely to make more fixed inputs in research and development than defender firms.

Mechanisms of Changing Cost Rigidity

My findings discussed earlier suggest that prospector firms choose a higher capacity of fixed inputs than defender firms. In this section, I investigate the mechanisms for firms to change cost structure: investments in marketing, production, human capital, and research and development. Following Banker et al. (2014), I decompose total operating costs into SG&A expenses and COGS. At the same time, I include the number of employees and R&D expenses. I replace total operating costs with these separate cost categories and re-estimate model (2).

Table 5 presents the results of estimating the relation between business strategy and the rigidity of different cost categories. Column (1) shows the results using Δ*lnSGA* as the dependent variable: the coefficient on *STRAT**Δ*lnSALES* is significantly negative (coefficient = -0.004, t-statistic = -2.23), suggesting that prospector firms choose higher committed capacity in their overall operations, such as marketing and administration, to increase cost rigidity. In column (2), I use Δ*lnCOGS* as the dependent variable and find an insignificant coefficient on *STRAT**Δ*lnSALES* (coefficient = -0.002, t-statistic = -1.31). This result implies that the change of cost rigidity is not achieved through fixed inputs adjustment in the production department. In column (3), I focus on the number of employees and use Δ*lnEMP* as the dependent variable. The coefficient on *STRAT**Δ*lnSALES* is negative and significant (coefficient = -0.004, t-statistic = -2.22), indicating that prospector firms may prefer permanent employees that are more skilled and costly to be replaced rather than temporary employees. As a result, they have a higher level of fixed inputs in human resources than defenders, leading to a more rigid cost structure. Column (4) provides the results for the rigidity of R&D expenditures. Using Δ*lnRD* as the dependent variable, the coefficient on *STRAT**Δ*lnSALES* is negative and significant (coefficient = -0.006, t-statistic = -1.74). This is consistent with my argument that prospectors have greater emphasize on innovation and technology than defenders, so they make higher committed capacity in research and development activities, resulting in a higher level of cost rigidity.

Collectively, Table 5 provides supporting evidence that firms with a prospector-type strategy choose a more rigid cost structure than others. The increase in cost rigidity is achieved through making more fixed inputs in marketing, administration, human capitals, and research and development activities.[3]

CONCLUSION

In this paper, I study the association between business strategy and the rigidity of cost structure. Using the business strategy typology proposed by Miles and Snow (1978, 2003) and the measure developed by Bentley et al. (2013), I find that prospector strategies are more positively associated with cost rigidity than defender strategies. This is because, compared with defenders, prospectors make greater efforts in developing new products continuously and hence undertake higher fixed investments in research and development activities. Furthermore, I find that firms change their cost rigidity through managing fixed resources in marketing, administration, human capitals, and research and development activities.

This study adds to the exiting literature on business strategy by showing that business strategy has a significant impact on firms' comprehensive plan and organizational operations, which subsequently influences firms' resources deployment and cost management. Additionally, my study makes a contribution to the literature on cost rigidity by identifying business strategy as a determinant of cost rigidity and showing the mechanisms of adjusting cost rigidity.

TABLE 4
REGRESSION EXAMINING THE RELATION BETWEEN BUSINESS STRATEGY AND COST RIGIDITY

This table reports the results of estimating the association between business strategy and cost rigidity. Industry and year fixed effects are included in each model. T-statistics are based on robust standard errors clustered at the firm level. All continuous variables are winsorized at the 1% and 99% levels. Variable definitions are presented in Appendix. *, **, *** denote significance based on two-tailed t-tests at or below the 10%, 5%, and 1% levels, respectively.

	Dependent Variable = Δ*lnCOST*			
	(1)		(2)	
	Coefficients	t-statistic	Coefficients	t-statistic
Δ*lnSALES*	1.020***	(45.22)	0.905***	(14.99)
STRAT*ΔlnSALES	**-0.012*** **	**(-8.97)**	**-0.011*** **	**(-9.19)**
*GDPG*ΔlnSALES*	1.075***	(4.12)	1.220***	(5.23)
*UNCERT*ΔlnSALES*	-0.153***	(-9.87)	-0.025*	(-1.87)
*MA*ΔlnSALES*			-0.320***	(-5.74)
*AI*ΔlnSALES*			-0.047***	(-8.56)
*EI*ΔlnSALES*			0.004***	(6.24)
*SIZE*ΔlnSALES*			0.037***	(15.56)
*AGE*ΔlnSALES*			-0.013**	(-2.03)
*GROWTH*ΔlnSALES*			-0.011	(-0.53)
*ROA*ΔlnSALES*			0.166***	(7.43)
*MB*ΔlnSALES*			-0.004***	(-3.68)
*HHI*ΔlnSALES*			0.162***	(4.92)
STRAT	0.001***	(3.02)	-0.001***	(-7.19)
UNCERT	-0.027***	(-7.50)	-0.037***	(-10.12)
MA			-0.013	(-1.50)
AI			0.004**	(2.36)
EI			0.001***	(4.12)
SIZE			0.005***	(15.22)
AGE			-0.010***	(-13.64)
GROWTH			-0.018	(-0.33)
ROA			-0.057***	(-10.73)
MB			0.001***	(5.50)
HHI			-0.001	(-0.21)
Intercept	0.000	(0.01)	-0.006	(-0.21)
Industry Fixed Effect	Yes		Yes	
Year Fixed Effect	Yes		Yes	
N	69,696		69,696	
Adjusted R^2	0.7982		0.8250	

TABLE 5
REGRESSION EXAMINING THE RELATION BETWEEN BUSINESS STRATEGY AND COST RIGIDITY FOR SG&A, COGS, EMPLOYEES, AND R&D

This table reports the results of estimating the association between business strategy and cost rigidity of SG&A, COGS, employ counts and R&D expenditures in column (1) – (4), respectively. Industry and year fixed effects are included in each model. T-statistics are based on robust standard errors clustered at the firm level. All continuous variables are winsorized at the 1% and 99% levels. Variable definitions are presented in Appendix. *, **, *** denote significance based on two-tailed t-tests at or below the 10%, 5%, and 1% levels, respectively.

	(1) Dependent Variable = *ΔlnSGA*		(2) Dependent Variable = *ΔlnCOGS*	
	Coefficients	t-statistic	Coefficients	t-statistic
ΔlnSALES	0.456***	(5.81)	1.137***	(12.13)
STRAT*ΔlnSALES	**-0.004****	**(-2.23)**	**-0.002**	**(-1.31)**
*GDPG*ΔlnSALES*	1.637***	(6.81)	0.424	(1.48)
*UNCERT*ΔlnSALES*	-0.084***	(-5.42)	-0.018	(-0.94)
*MA*ΔlnSALES*	0.015	(0.25)	-0.317***	(-3.60)
*AI*ΔlnSALES*	-0.043***	(-6.95)	-0.030***	(-3.77)
*EI*ΔlnSALES*	0.005***	(5.85)	0.001	(1.31)
*SIZE*ΔlnSALES*	0.039***	(12.95)	0.011***	(2.99)
*AGE*ΔlnSALES*	-0.011	(-1.43)	-0.018**	(-2.07)
*GROWTH*ΔlnSALES*	-0.016	(-0.63)	0.012	(0.37)
*ROA*ΔlnSALES*	0.136***	(4.82)	0.115***	(3.95)
*MB*ΔlnSALES*	-0.002**	(-2.16)	-0.000	(-0.19)
*HHI*ΔlnSALES*	0.210***	(5.42)	0.016	(0.31)
STRAT	-0.003***	(-12.48)	-0.001***	(-2.73)
UNCERT	-0.030***	(-5.30)	-0.031***	(-6.59)
MA	0.067***	(6.52)	-0.079***	(-6.06)
AI	0.014***	(6.39)	-0.000	(-0.02)
EI	0.001***	(4.03)	0.001**	(2.16)
SIZE	0.009***	(16.08)	0.004***	(9.03)
AGE	-0.020***	(-16.35)	-0.005***	(-5.21)
GROWTH	0.018	(0.26)	-0.087	(-0.98)
ROA	-0.029***	(-3.79)	-0.082***	(-11.74)
MB	0.002***	(5.67)	0.001	(0.10)
HHI	-0.010	(-1.18)	-0.002	(-0.32)
Intercept	0.122***	(4.04)	-0.023	(-0.51)
Industry Fixed Effect	Yes		Yes	
Year Fixed Effect	Yes		Yes	
N	67,747		69,578	
Adjusted R^2	0.4798		0.7709	

TABLE 5 (CONTINUED)
REGRESSION EXAMINING THE RELATION BETWEEN BUSINESS STRATEGY AND COST RIGIDITY FOR SG&A, COGS, EMPLOYEES, AND R&D

	(3) Dependent Variable = ΔlnEMP		(4) Dependent Variable = ΔlnRD	
	Coefficients	t-statistic	Coefficients	t-statistic
ΔlnSALES	0.713***	(7.75)	0.576***	(3.28)
STRAT*ΔlnSALES	**-0.004****	**(-2.22)**	**-0.006***	**(-1.74)**
*GDPG*ΔlnSALES*	1.635***	(6.24)	1.762***	(3.30)
*UNCERT*ΔlnSALES*	-0.096***	(-5.05)	-0.110***	(-3.41)
*MA*ΔlnSALES*	-0.119*	(-1.93)	0.151	(1.61)
*AI*ΔlnSALES*	-0.013**	(-2.47)	-0.049***	(-6.18)
*EI*ΔlnSALES*	0.004***	(4.77)	0.005***	(3.09)
*SIZE*ΔlnSALES*	0.020***	(6.58)	0.072***	(12.46)
*AGE*ΔlnSALES*	-0.024**	(-2.57)	-0.045***	(-2.65)
*GROWTH*ΔlnSALES*	0.036	(1.28)	0.073	(1.27)
*ROA*ΔlnSALES*	0.013	(0.55)	-0.040	(-0.93)
*MB*ΔlnSALES*	0.000	(0.38)	-0.001	(-0.37)
*HHI*ΔlnSALES*	0.092**	(1.98)	0.277***	(3.07)
STRAT	-0.010***	(-24.90)	-0.008***	(-10.38)
UNCERT	0.025***	(4.05)	-0.017	(-1.38)
MA	0.142***	(10.88)	0.170***	(7.92)
AI	0.016***	(5.22)	0.019***	(5.43)
EI	0.010***	(19.00)	0.003***	(5.47)
SIZE	0.012***	(18.55)	0.013***	(10.77)
AGE	-0.025***	(-15.25)	-0.026***	(-8.62)
GROWTH	-0.183**	(-2.30)	-0.265*	(-1.69)
ROA	0.099***	(11.66)	0.026	(1.60)
MB	0.003***	(8.36)	0.003***	(4.01)
HHI	-0.051***	(-4.06)	0.016	(0.67)
Intercept	-0.018	(-0.50)	0.083	(0.00)
Industry Fixed Effect	Yes		Yes	
Year Fixed Effect	Yes		Yes	
N	69,233		45,893	
Adjusted R^2	0.3899		0.1180	

ENDNOTES

1. For example, because of their consistent focus on innovation, prospectors may hire experienced employees and purchase equipment to conduct experiments, which are costly to be adjusted timely. Specifically, this paper investigate the impact of business strategy on the relative proportion of fixed and variable costs, not the level of R&D expenditures.
2. Following prior studies on cost structure (Banker et al. 2014; Irvine et al. 2016), I use dependent and independent variables in the same year. I obtain similar results if all the control variables are lagged.

[3] In this section, R&D expenses, SG&A expenses, and the number of employees are used in the construction of both business strategy and cost structure. However, I use the level of R&D, SG&A, and employee counts to calculate the composite measure of business strategy, while I estimate the response of cost change to sales change to proxy for cost structure. Therefore, these two measures are fundamentally different and my results are not likely to be driven by a mechanical relation.

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APPENDIX

Variable	Definition
$\Delta lnSALES$	Log-changes in sales revenue of firm *i* from year *t-1* to year *t*.
$\Delta lnCOST$	Log-changes in operating costs of firm *i* from year *t-1* to year *t*.
STRAT	The sum of six measures: *RD5*, *EMP5*, *SALE5*, *SGA5*, σ (*EMP5*), and *CAP5*. *RD5* is R&D expenditures deflated by net sales averaged over rolling prior five years. *EMP5* is employee counts deflated by net sales averaged over rolling prior five years. *SALE5* is the annual sales growth rate averaged over rolling prior five years. *SGA5* is SG&A expenses deflated by net sales averaged over rolling prior five years. σ (*EMP5*) is the standard deviation of the number of employees over rolling prior five years. *CAP5* is net PPE deflated by total assets averaged over rolling prior five year. Each variable is ranked into quintiles per industry-year. A score of 5 is given to firm-years in the highest quintile, 4 is given to those in the second highest quintile, and so on. The scores are summed over the six measures for firm *i* in year *t* with a maximum score of 30 (prospector) and a minimum score of 6 (defender).
UNCERT	The standard deviation of $\Delta lnSALE$ for firm *i* from year *t-4* to *t-1*.
MA	The managerial ability score created by Demerjian et al. (2012) for firm *i* in year *t*.
GDPG	GDP growth in year *t*.
AI	Total assets scaled by net sales revenue for firm *i* in year *t*.
EI	The number of employees scaled by net sales revenue for firm *i* in year *t*.
SIZE	Natural log of total assets for firm *i* in year *t*.
AGE	Natural log of firm age, measured from the first year firm *i* appears in the Compustat.
GROWTH	Annual sales growth rate for firm *i* in year *t*.
ROA	Income before extraordinary items divided by beginning-of-year book value of assets for firm *i* in year *t*.
MB	The market value of equity over the book value of equity for firm *i* in year *t*.
HHI	Herfindahl index of competition of firm *i*'s two-digit SIC industry in year *t*.
$\Delta lnSGA$	Log-changes in SG&A expense for firm *i* from year *t-1* to year *t*.
$\Delta lnCOGS$	Log-changes in cost of goods sold for firm *i* from year *t-1* to year *t*.
$\Delta lnEMP$	Log-changes in the numbers of employees for firm *i* from year *t-1* to year *t*.
$\Delta lnRD$	Log-changes in R&D expenditures for firm *i* from year *t-1* to year *t*.