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Industry Concentration and Cash Flow at Risk

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Abstract

This paper explores the link between industry concentration, which is a feature of the product markets in which firms operate, and the risk of a firm's cash flows, offering the first empirical evidence of the risky cash-flow implications of industry market structure. Our analysis shows that on average highly concentrated industries have experienced lower volatility of cash flows while the volatility of cash flows for competitive industries is higher. Our findings are consistent with the view that innovation and distress risk, which is more pronounced in competitive industries, are prized sources of risk in the context of the cash-flow-at-risk.

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1. Introduction

Firms generate cash flows through operating decisions in product markets. These operating decisions arise from an equilibrium condition in the product market that potentially reflects strategic interactions among market participants. It is known that industrial organizations, the structure of product markets, affect managers' equilibrium operating decisions. Therefore, the structure of product markets may affect the risk of a firm's cash flows and these risky cash flows will become prized in financial markets. This paper explores the link between industry concentration, which is a feature of the product markets in which firms operate, and the risk of a firm's cash flows, offering the first empirical evidence of the risky cash flows implications of industry market structure.

The link between market structure and risky cash flows is better characterized by innovation or distress risk. According to Schumpeter (1912), innovation is a form of creative destruction that occurs in competitive industries or on the fringes of established industries and these small challengers may overturn the existing status. Morck and Yeung (2003) present complementary evidence that relates turnover in firm dominance to differences in economic growth across countries. They find that economic growth correlates positively with firm's turnover, suggesting that creative destruction is an important element of long-run growth. Knott and Posen (2003) show empirically that innovation increases with the degree of industry competition. If creative destruction describes the relation between market structure and risky innovative activities, this predicts that more concentrated industries have lower risky cash flows because firms in more concentrated industries engage in less innovation.

An alternative way to link market structure to risky cash flow is based on distress risk which is the channel through barriers to entry. Barriers to entry may affect how firms optimally respond to aggregate demand shocks. Firms in high barriers to entry industries can respond to positive demand shocks by increasing prices or raising output without fearing competitive entry. Thus, if the existence of in response to aggregate demand shocks is associated with valuable distress risk, we would expect these firms to face less distress risk. Looking over industries, we would expect firms in high barriers to entry industries are associated with lower risky cash flows since the average distress risk would be lower in these industries.

The calculation of the risky cash flows requires an estimate of the probability distribution of cash flow at some future point. One framework for building a cash flow

based on the measure of exposure and setting risk management policy based on this is described by a process called Cash-Flow-at-Risk model (C-FaR). The definition of the C-FaR measures how much shortage of cash flows will cause in the next week or month with a certain level of statistical confidence. The C-FaR can be thought as a form of VaR for measuring aggregate risk against a company's cash flow. Whereas the VaR method takes a bottom-up approach to quantifying the risks caused by individual financial assets, the C-FaR looks directly at cash flow under the assumption that all risks to a firm are manifest in shocks to expected earnings.

VaR measures how much the value of financial assets which foreign currency, equities, commodities and bonds will drop in a day or a week if they are affected by a market reversal. VaR, however, is not a suitable risk measure for most non-financial businesses. For non-financial institutions, financial assets with contractually fixed cash flows and readily available market prices only play a minor role. The non-financial firms focus on the market value of their assets and liabilities over short horizons and market or liquidation values are little relevant for a portion of the balance sheet. If VaR is applied to a non-financial firm's portfolio of financial instruments it will capture only a small part of the firm's exposure, since it ignores its underlying commercial cash flows. The C-FaR is an attempt to create an analogue to VaR that can be useful for non-financial firms to encompass firm cash flows. The C-FaR model considers every conceivable type of risk to which a firm can be exposed and produces a risk profile.

RiskMetrics is the original method of the C-FaR which identifies cash-flow volatility under market risk conditions. RiskMetrics supposed that market prices and corporate cash flows link up under all the causation condition. However, it is not possible to identify all sources of exposure to market risk, and the bottom-up approach is not the way to go. Stein, et al., (2001) apply the top-down approach which is the focus on the overall cash flows volatility instead of. RiskMetrics approach. They developed the comparables-based approach to estimating C-FaR and the model includes a statistical methodology for transforming these data into peer-benchmarked risk measurements. This approach is advantageous, since it can construct the tailored distribution of cash flow for a firm's quarter-ahead and year-ahead horizons. The approach is also based upon large samples of cash flow shocks experienced by a set of peer group firms. These samples are large enough to make relatively precise statements about the tail probabilities with some confidence, as opposed to using only the firm's own historical cash-flow data. They sort firms into pools of comparable companies using these four characteristics: market capitalization, profitability, riskiness of industry, and stock-price volatility. They identify four characteristics that have good explanatory power for pooling cash flows for comparable firms. However, this comparable method cannot

capture industry concentration idiosyncrasies that might give rise to differences in C-FaR. Different from the sorting ways, we follow the merit of comparables method with a set of level industry concentration.

This measure will be readily interpretable because risk is defined in terms of cash flows and presented in terms of the firm's business plan. This measure of financial price risk is complete because it accounts fully for interactions among the firm's risk. By disclosing the results of Cash-Flow-at-Risk analysis ahead of time, a company can help put earnings shocks into a credible, objective perspective and such information is a great of interest to investors, who are naturally concerned about volatility in reported quarterly earnings. Moreover, we think that an industrial firm can use C-FaR analysis to model its operating performance.

Hou and Robinson (2006) studied the time-series properties of the concentration premium to explore its relation to risk-based explanations. Their findings are that firms in more concentrated industries earn lower returns and suggest that industry concentration proxies for a risk factor sensitivity. Thus, we should draw out the shocks of cash flows of firms in the different industry concentration and examine the relation between industry concentration and risky cash flows based on theories of C-FaR by non-financial firms for all listed corporations in Taiwan. This study is to link risky cash flows and industry product market characteristics through the channel we apply and manifest further the view of a statement of industry concentration proxies for a risk factor (Hou and Robinson, 2006).

Our first contribution o this study is to examine whether less concentrated industries have the higher risk of cash flows of the firms in market. The second contribution is that non-financial firms perceive any value in paying more attention to risk management techniques and framework to create industry competition.

2. Methodology used

2.1 Measuring industry concentration

We measure industry concentration by using the Herfindahl index, which is defined as

$$Herfindahl_j = \sum_{i=1}^{I} A_{ij}^2, \quad (1)$$

where A_{ij} is the market share of firm *i* in industry *j*. The Herfindahl index measure uses the entire distribution of industry market share information to obtain a complete picture of industry concentration and large values imply that market shares is concentrated of a few

large firms, while small values of the Herfindahl index imply that the market shared by many competing firms. Beginning with the full pool of forecast errors of cash flows, we sort firms based on the quintile of the Herfindahl index, and firms of the same quintile industry concentration should be in the same pool. Quintile 1 corresponds to the 20% of industries with the lowest concentration (imply the smaller values of the Herfindahl index), while quintile 5 corresponds to the 20% of industries with the highest concentration (imply the larger values of the Herfindahl index). Eventually, all forecast errors were allotted to 5 sub-samples. The forecast errors could be regarded as originating from the same level of concentration, and all the groups matched on these five levels of concentration.

2.2 Measurement of Cash Flow at Risk

The operating cash flow (OCF) refers to the cash flow that results from the firm's day-to-day activities of producing and selling. Operating cash flow is an important number because it tells us, on a very basic level, whether or not a firm's cash inflows from its business operations are sufficient to cover its everyday cash outflows. For this reason, a negative operating cash flow is often a sign of trouble. The basic definition of operating cash flow equals to the EBIT plus the depreciation, and minus the taxes. There is little variation in depreciation a quarter ahead, which is not surprising in Taiwan. In addition, preferential laws of tax regulation have provided firms with enjoyable tax refunds. In essence, firms do not increase the amount of tax. Therefore, our basic measure of operating cash flow is earnings before interest and taxes (EBIT).

To allow the comparability across firms with the same position to compare the firms with different sizes of capital, we divided each EBIT by start-of period each total assets. To avoid situations where the ratio EBIT/Assets becomes extremely high, we throw out the firms whose total assets are in the lowest five percent of the distribution each quarter. We also remove firms that are merged or have other dramatic changes which are the causes of the total assets a firm increased or decreased more than 50% in a quarter. This may induce a great deal of volatility in measured EBIT/Assets.

The derivation of C-FaR requires a forecasted probability distribution of cash flow over some horizon in the future. In order to measure how much cash flow deviates from expectations, Stein, et al., (2001) used a very simple autoregressive model with four lags of EBIT/Assets in quarter t-1, -2, t-3 and t-4. They also considered adding a dummy variable, which perhaps could explain the seasonal factor in the data. We also applied the autoregressive specification with four lags(AR(4)) to forecast the cash flows in any quarter, and our model is fit to use the worth data over the past five year. They measure the

deviations from the real cash flows to the expectations and make the statements of the difference between the real and forecasting cash-flow, is called shock to cash flows forecast errors. The forecast errors may be a shock or surprise from the unique factor of the individual firm, which is like the manager is resigned, the change of the sales and the marketing policies, the health of the managers, and successful innovation. The forecast error can be regarded as a kind of risk. When we want to measure the C-FaR with 95% (99%) confidence level over the next following quarter for each sub-sample, we need to calculate the fifth (first) percentiles of the left-tailed empirical distribution for each sub-sample. Our final purpose is not to make a precise prediction of the expected cash flows. Even more important, we want to produce the entire probability distribution of shocks to cash flows and further the left tail of this distribution. The method offers a number of practical advantages: First, within any given peer group, the model naturally produces estimates that are correct on average; Second, the model is non-parametric, and thereby avoids imposing the highly unrealistic assumption that shocks to cash flow are normally distributed.

3. Empirical Results

Initially, we collected quarterly data from the balance sheets and the income statement from the Taiwan Economic Journal (TEJ). Our data involved all listed corporations in all 18 non-financial industries from the Taiwan Stock Exchange Corporation (TSEC). Table I shows the selection of a final sample that depicts 241 available observations conducted in the Taiwan market from January 2000 to December 2007. The comprehensive coverage among many groups is provided by the Taiwan Stock corporations' data that permits investigation of industry concentration in the relative importance of industry in this study.

Under the concept of comparable-based approach to estimating C-FaR, the model includes industry concentration methodology for transforming these forecast errors into peer-benchmarked risk measurements. First we sort forecast errors of firms into five quintiles based on the Herfindahl index of industry concentration. Then, we calculated the C-FaR of five-percent and one–percent of left-tailed of the empirical distribution for each quintile. Thus, the higher the volatility of cash flows, the higher the C-FaR will be.

Table II and III reports the C-FaR characteristics averaged among concentration quintiles. The most competitive quintile has an average C-FaR of 7.82 (9.21), while the most concentrated quintile has an average C-FaR of 2.13 (3.46) based on 95% (99%) confidence level. As the result, the higher the C-FaR is, the higher cash flow volatility of the quintile 1 with the competitive industries is. Our analysis shows that on average, highly concentrated industries have experienced lower the volatility of cash flows, while the

volatility of cash flows for competitive industries higher. Our findings are consistent with the view that innovation and distress risk, which is more pronounced in competitive industries, are prized sources of risk in the context of cash-flow-at-risk.

4. Conclusion

Looking over these industries, we would expect firms in high barriers to entry industries to earn lower average returns (associated with lower risk) since the average distress risk would be lower in these industries. To test this prediction, our empirical approach is to measure barriers to entry directly and relate them with cash-flow-at-risk. Our results indicate that firms in the quintile of the most competitive industries have cash-flow-at-risk that are nearly three times higher than those of the firms in the quintile of the most concentrated industries. This difference occurs 95% and 99% confidence level. Our findings support the view of a statement of industry concentration proxies for a risk factor (Hou and Robinson, 2006) and are consistent with the firms in more concentrated industries that will earn lower return (Hou and Robinson, 2006) and face lower risk.

Table I Number of firms by primary two-digit SIC industry

Industry	
Cement	7
Food	14
Plastics	12
Textiles	35
Electric, Machinery	9
Appliance, Cable	10
Chemical	14
Glass, Ceramics	6
Paper, Pulp	6
Steel, Iron	15
Rubber	7
Automobile	36
Elect. & Computer	36
Construction	5
Transportation	11
Tourism	5
Department Stores	7
Others	6
Total	**241**

Table II Quarter-Ahead C-FaR for 95% confidence level

Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
7.82	5.67	3.74	2.98	2.13

For a firm with $100 in assets, each cell shows how large a negative shock to one-quarter ahead EBIT occurs with 5% probability.

Table III Quarter-Ahead C-FaR for 99% confidence level

Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
9.21	7.01	5.17	4.32	3.46

For a firm with $100 in assets, each cell shows how large a negative shock to one-quarter ahead EBIT occurs with 1% probability.

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