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Michael E. Porter's "How Competitive Forces Shape Strategy," published in the 1979 *Harvard Business Review*, is considered by many as a seminal study on competitive analysis. Porter's research, which later became known as *Porter's five forces*, is influential in shaping how generations of academics and practitioners have viewed competitive or industry analysis. Porter stipulated that, in a perfectly competitive market, over a long-term horizon, only a normal profit can be earned because the strong competitive forces in the industry maintain an equilibrium. Meanwhile, if the competitive forces within an industry are weak, companies have the ability to earn attractive profits in the short run.

Because of a lack of competition, firms in a concentrated industry commonly display monopolistic competitive market characteristics and are able to achieve above-normal profits in the short run. Moreover, the equity market tends to reward the shareholders of these firms with higher returns. As Novy-Marx [2013] found, profitable firms, as defined by gross profits-to-assets, generate significantly higher returns than unprofitable firms. The study concludes that gross profits-to-assets is approximately equivalent to the Fama and French [1992] book-to-market ratio in predicting the cross section of expected returns. Novy-Marx [2013] further establishes that profitable firms generate significantly higher returns than unprofitable firms, notwithstanding higher valuations. Thus, industry concentration should have a positive relationship with industry expected shareholder return.

A review of the academic literature suggests a lack of consensus on the positive relationship of industry concentration to industry expected shareholder return. For example, U.S. and U.K. market studies found a negative relationship between industry concentration and the cross section of expected returns, whereas a study of the Australian market showed evidence of a positive relationship. Hou and Robinson [2006] analyze sample data listed in the NYSE, AMEX, and NASDAQ from 1963 to 2001 and find that firms in more concentrated industries earn lower returns even after controlling for size, book-to-market, and momentum. Citing Schumpeter [1912], who argues that innovation is a form of creative destruction that is more likely to occur in competitive or nonconcentrated industries, Hou and Robinson [2006] conclude that firms in concentrated industries engage in less innovation and as such are less risky and should command a lower expected return. Because innovation is risky, in their view, the market should price it accordingly.

The findings in the U.S. market are inconsistent with our expectation based on

Porter's competitive theory. Hashem and Su [2015] further substantiate Schumpeter's creative destruction argument as presented by Hou and Robinson [2006]. They examined the relationship between industry concentration and the cross section of expected returns in the London Stock Exchange from 1985 to 2010 and found that industry concentration is negatively related to average stock returns. The authors argued that competition creates innovation, which ultimately benefits firms, and thus a competitive industry that is not concentrated should expect higher average returns. Motivated by Hou and Robinson [2006], Gallagher, Ignatieva, and McCulloch [2015] extend the study to the Australian market in 2015. In contrast to Hou and Robinson's [2006] findings, they find that, in the Australian market, firms operating in more-concentrated industries generate higher returns than companies operating in less-concentrated industries. The finding in the Australian market is consistent with our expectation based on Porter's competitive theory. The authors attributed the different outcome of their study to local factors, such as geographical and political factors and the structure of the local markets.

The aforementioned three studies are all focused on an individual local market: United States, United Kingdom, or Australia. The lack of consensus from these local market studies along with the rise of multinational firms in recent decades motivated us to perform an industry concentration study from a global perspective. According to the S&P 500 2015 Global Sales report from S&P Dow Jones Indices (Silverblatt [2016]), among the S&P 500 companies, 44.3% of all sales were outside of the United States. Furthermore, Ashiq, Klasa, and Yeung [2009] present findings that suggest industry concentration studies based on Compustat data, as used by Hou and Robinson [2006], are poor proxies for actual industry concentration because private firms are excluded. We wish to limit our study to investable public markets. However, we believe that expanding the study to include global public companies will minimize the problems highlighted by Ashiq, Klasa, and Yeung [2009] and will be more relevant considering the global nature of the financial markets today.

In our study, we seek evidence of an industry concentration premium (highly concentrated industries earn higher returns than less-concentrated industries) from a global perspective that is consistent with Porter's competitive theory. Porter [1979] names five forces that shape industry competition: (1) competitive rivalry, (2) bargaining power of suppliers, (3) bargaining power of customers, (4) threat of new entrants, and (5) threat of substitutes. We view industry concentration as a suitable proxy to measure Porter's competitive forces. A high concentration number indicates that the industry is dominated by a few large firms and therefore is less competitive. On the other hand, a low concentration number indicates that the industry is characterized by many rivals, none of which have a significant market share.

Industry concentration is not only an indicator of competitive rivalry but of other competitive forces as well: customers, suppliers, potential entrants, and substitute products. Based on Porter's competitive theory, we believe a concentrated industry should, at the least, achieve above-normal profits in the short run, due to a lack of competition, and reward shareholders with a concentration premium. Unlike a risk-based hypothesis set forth in the aforementioned studies, a concentration premium hypothesis is consistent with Porter's competitive theory. Furthermore, in view of recent academic research on low-volatility strategies, we have trepidations about drawing conclusions based on investor risk and reward behaviors. For instance, Ang et al. [2006] present evidence of stocks with high idiosyncratic risk underperforming the overall market. Blitz and van Vliet [2007] illustrate that stocks with low historical volatility have superior risk-adjusted returns, and the low-volatility effect is similar in magnitude to value, size, and momentum. Baker, Bradley, and Wurgler [2011] show that high-beta and high-volatility stocks underperformed low-beta and low-volatility stocks. Soe [2012] argues that achieving low volatility via risk ranking or mean–variance optimization is equally effective and the low-volatility effect is not unique to the U.S. equity market.

The remainder of this article is organized as follows. The next section describes the data. The third section discusses the research and design of measuring and evaluating industry concentration. The fourth section presents empirical results, and the fifth section concludes.

DATA

The research universe is defined as publicly traded companies in the global market with a minimum market capitalization of $25 million, excluding American depositary receipts. To avoid survivorship bias, not only did we include companies that are currently trading but also companies that have dropped out of our data sample due to a bankruptcy or a merger. As a result, we can be confident that our backtest results are unlikely to suffer from upward performance bias. Fundamental data for U.S.-domiciled securities are retrieved from Compustat point-in-time monthly databases for the period from December 31, 1993, to December 31, 2013. Fundamental data for non-U.S.-domiciled securities are retrieved from FactSet Fundamentals database for the period from December 31, 1993, to December 31, 2013. The data from FactSet Fundamentals database were used with an appropriate data lag to avoid look-ahead bias. Stock price/returns data are provided by FactSet Research Systems, Inc. Industry classification is based on the current Global Industry Classification System (GICS). Throughout this article, we use the GICS subindustry classification to define industry membership. As of August 31, 2013, there were a total of 162 GICS subindustries. The starting date of December 31, 1993, was chosen due to data availability. The ending date of December 31, 2013, was chosen to achieve a minimum of 20 years of history while preserving recent history for practitioners to perform an out-sample study.

RESEARCH AND DESIGN

Defining Industry Concentration

To define industry concentration at time t_0, we used the Herfindahl Hirschman Index (HHI), which is a widely used concentration measure cited by Bikker and Haaf [1992], Hou and Robinson [2006], and the U.S. Department of Justice and the Federal Trade Commission [2010]. The HHI for industry *j* is defined as follows:

$$\text{HHI}_j = \sum_{i=1}^{I} S_{ij}^2 \tag{1}$$

where *S* is market share; *i* is firm *i*; *j* is industry *j*; *I* is the total number of firms in the selected industry; and S_{ij} is the market share of firm *i* in industry *j*. Thus, when $I = 1$, HHI takes the value of 1; when $I > 1$, HHI ranges from 0 to 1. A low HHI indicates a competitive industry, whereas a high HHI indicates a monopolistically competitive or a concentrated industry. Because industry concentration is an attribute of an industry, not a firm, we focused on industry-level data to determine whether there is a relationship between industry concentration and industry expected return. Therefore, we quintile (Quintile 1 = most concentrated; Quintile 5 = least concentrated) the HHI scores across subindustries and calculated the HHI score of each quintile:

$$\text{HHI}_Q = \frac{1}{N}\sum_{n=1}^{N} \text{HHI}_n \tag{2}$$

where *Q* is the quintiles (*Q* ranges from 1 to 5); and *N* is the total number of industries in a given quintile ($N \approx 32$).

For the measurement of market share, we followed Hou and Robinson [2006] and used net sales. We defined this variable as *HHI*(*Sales*) and calculated $HHI(Sales)_Q$ at time t_0 using Equation (2). To evaluate industry concentration based on *HHI*(*Sales*) across time, we calculated the average $HHI(Sales)_Q$ as follows:

$$Average\ HHI(Sales)_Q = \frac{1}{T}\sum_{t=1}^{T} HHI(Sales)_{Q,t} \tag{3}$$

where *T* is the total number of monthly periods (240); and $HHI(Sales)_{Q,t}$ is $HHI(Sales)_Q$ at time *t*.

$HHI(Sales)_Q$ and average $HHI(Sales)_Q$ as of December 31, 2013, and for the in-sample period of December 31, 1993, to December 31, 2013, are shown in Exhibit 1. The average $HHI(Sales)_Q$ of 0.32 for Quintile 1 in Exhibit 1 is consistent with the U.S. Department of Justice's definition of a concentrated industry. The U.S. Department of Justice and the Federal Trade Commission [2010] calculated HHI scores on a scale of 1 to 10,000 (our study uses a scale of 0 to 1) and defined a concentrated industry as having an HHI score greater than 2,500. Following Hou and Robinson [2006], we also defined market share using assets and equity. We named these variables *HHI*(*Assets*) and *HHI*(*Equity*). Although sales data are available for the entire in-sample period, we allowed for the varying definition to ensure that the conclusions that we ultimately obtain are not contingent on the definition of market share. The Spearman's rank correlation for *HHI*(*Sales*), *HHI*(*Assets*), and *HHI*(*Equity*) presented in Exhibit 2 indicates the three variables are highly correlated.

A comparison of average $HHI(Sales)_Q$, $HHI(Assets)_Q$, and $HHI(Equity)_Q$ is shown in Exhibit 3 and further validates that the definition of market share, whether based

EXHIBIT 1
Industry Concentration Quintiles

Panel A: As of 12/31/2013

Quintile	$HHI(Sales)_Q$	No. of Firms[†]
1	0.22	54
2	0.11	131
3	0.07	119
4	0.05	142
5	0.03	291

Panel B: From 12/31/1993 to 12/31/2013 (monthly average)

Quintile	Average $HHI(Sales)_Q$	Average # of Firms
1	0.32	35
2	0.14	78
3	0.09	84
4	0.06	116
5	0.03	248

Notes: Quintile 1 = most concentrated, Quintile 5 = least concentrated, by GICS subindustries.

Sources: Compustat, FactSet Research Systems Inc.

[†]*Cross-sectional average of GICS subindustries within a selected quintile.*

EXHIBIT 2
Market Share Variable Correlation Matrix[†]

	1	2	3
1 HHI(Sales)	1.00	—	—
2 HHI(Assets)	0.89	1.00	—
3 HHI(Equity)	0.85	0.90	1.00

Sources: Compustat, FactSet Research Systems Inc.

[†]*Spearman's rank correlation.*

on sales, assets, or equity, had no significant impact on the outcome of this study. For the remainder of this study, we use sales as the variable to define market share.

Defining Profitability

Next, to determine whether monopolistically competitive markets are able to achieve above-normal profits in the short run, we selected the following four measurements to evaluate profitability for each of the *HHI*(*Sales*) quintiles. First, following Novy-Marx [2013], we defined gross profitability as the difference between the total sales and the total cost of goods sold in an industry divided by the total assets of the industry. Second, return on equity was calculated as the total net income of the industry divided by the total book equity of the industry. Third, return on assets is stated as the total net income of an industry divided by the total assets of the industry. Finally, net margin is defined as the total net income of an industry divided by the total net sales of the industry.

EXHIBIT 3
Comparison of Variables Representing Market Share

From 12/31/1993 to 12/31/2013 (monthly average)			
Quintile	Average $HHI(Sales)_Q$	Average $HHI(Assets)_Q$	Average $HHI(Equity)_Q$
1	0.32	0.21	0.22
2	0.14	0.11	0.12
3	0.09	0.08	0.07
4	0.06	0.05	0.05
5	0.03	0.03	0.03

Notes: Quintile 1 = most concentrated, Quintile 5 = least concentrated, by cross-sectional average of GICS subindustries within a selected quintile.

Sources: Compustat, FactSet Research Systems Inc.

Industry Concentration and Expected Industry Returns

To test the relationship between *HHI*(*Sales*) and the industry expected return, we used Equation (4), where the one-month time horizon return premium for industry j is $(ER_{jt} - Rf_t) - \beta_{jt}(Rm_t - Rf_t)$.

$$(ER_{jt} - Rf_t) - \beta_{jt}(Rm_t - Rf_t) = \alpha + \beta_1 HHI(Sales)_{jt-1} + \varepsilon_{jt} \tag{4}$$

where ER_{jt} is the expected return of industry j at time t; $HHI(Sales)_{jt-1}$ is the *HHI*(*Sales*) of industry j at time $t - 1$; Rm_t is the market return at time t; Rf_t is the risk-free rate at time t; ε_{jt} is an error term; and β_{jt} is the beta of industry j at time t. The beta of industry j at time t (β_{jt}) is calculated by taking the market capitalization–weighted average of the beta (β_{st}) of companies in industry j at time t. β_{st} is calculated using the 36-month trailing returns of the companies versus the market return. A minimum of 30 monthly returns is required to calculate β_{st}. We calculated the expected return of industry j at time t (ER_{jt}) in three different ways: equally weighted, market value weighted, and sales weighted. We ran Equation (4) using the three

EXHIBIT 4

HHI(Sales) and Expected Industry Return

Dependent Variable	Equally Weighted	Market Value Weighted	Sales Weighted
Intercept	–0.09***	–0.05	0.15***
	(–2.77)	(–1.38)	(3.77)
HHI(Sales)	0.74***	1.10***	0.78***
	(3.69)	(4.75)	(3.26)
N	34,311	34,311	34,311

Notes: This exhibit shows the results for the cross-sectional time-series pooled regression of subsequent one-month industry returns (equally weighted, market value weighted, and sales weighted) on HHI(Sales).

Sources: Compustat, FactSet Research Systems Inc.

****Significant at the 1% level.*

definitions of ER_{jt}. Exhibit 4 reports the regression results using Equation (4), which imply a statistically significant relationship between *HHI*(*Sales*) and the subsequent one-month industry return regardless of how the expected industry returns are calculated.

To evaluate the robustness of the relationship between industry concentration and expected returns, we calculated the subsequent average return of the *HHI*(*Sales*) quintile at each month end. Thus, there were 240 periods for our in-sample data. Within each quintile, the industry returns were calculated by aggregating constituents using the following three methods: equally weighted, market value weighted, and sales weighted. One-month, six-month, twelve-month, and twenty-four-month time horizons were chosen as the holding time horizon to accommodate various investor holding period preferences. This method of quintiling and evaluating subsequent holding periods is a widely used backtesting process among practitioners. We applied the same methodology for factor selection in another study (Aw, Dornick, and Jiang [2014]). We recognize that any holding period assumption longer than one month leads to overlapping periods Furthermore, following Hjalmarsson [2008], we adjusted the *t*-statistics by dividing it by the square root of the time horizon to correct for the effects of the overlap in the data.

Controlling for Size, Book-to-Market, and Momentum

We use the procedure used by Kent et al. [1997] and Hou and Robinson [2006] to adjust individual stock returns for size, book-to-market, and momentum. First, we must create a characteristic-based benchmark. To do so, at each month end, we sort all firms into size quintiles. Then, within each size quintile, we sort by book-to-market quintiles. Within each of these 25 buckets, we further sort into quintiles based on the firms' past six-month return. Stock returns are averaged within each of these 125 buckets to form a benchmark return that is subtracted from each individual stock's return.

EXHIBIT 5

Industry Profitability and Industry Concentration

HHI(Sales) Quintile	Gross Profitability	Return on Equity	Return on Assets	Net Margin
1	27.95%	8.77%	3.67%	5.59%
2	25.87%	8.20%	3.02%	4.99%
3	22.50%	8.71%	3.10%	5.62%
4	22.14%	8.74%	3.19%	5.16%
5	20.58%	8.00%	2.69%	4.64%
Δ (1–5)	7.37%***	0.77%	0.98%***	0.95%**
	(7.69)	(0.92)	(7.63)	(2.41)

Notes: GICS subindustry gross profit is (sum of all net sales within subindustry – sum of all COGS within subindustry)/(sum of all net sales within subindustry). Then take an average gross profit within each quintile. GICS subindustry ROE is calculated as (sum of all net income within subindustry)/(sum of all book equity within subindustry). Then take an average ROE within each quintile. GICS subindustry ROA is (sum of all net income within subindustry)/(sum of all assets within subindustry). Then take an average ROA within each quintile. GICS subindustry net margin is calculated as (sum of all net income within subindustry)/(sum of all net sales within subindustry). Then take an average net margin within each quintile.

Sources: Compustat, FactSet Research Systems Inc.

***Significant at the 5% level. ***Significant at the 1% level.*

EMPIRICAL RESULTS

In this section, we present the results of our findings on the relationship of industry concentration to industry profitability and subsequent industry returns. Consistent with Hou and Robinson [2006] and others, we found that concentrated industries, in general, have less competition among the existing competitors, have higher barriers to entry, and have greater bargaining power against industry suppliers and industry buyers. Therefore, on average, they have higher profitability. Exhibit 5 presents the differences between the monthly mean values of Quintile 1 (most concentrated) and Quintile 5 (most competitive) for the four profitability

EXHIBIT 6

Industry Concentration and Average Returns

HHI(Sales) Quintile	Equal Weighted Average Return	MKV Weighted Average Return	Sales Weighted Average Return
Panel A: Industry Concentration and Industry Average Monthly Return			
1	0.97	1.01	1.07
2	0.68	0.84	1.01
3	0.75	0.85	0.97
4	0.75	0.82	1.00
5	0.66	0.63	0.86
Δ (1–5)	0.32***	0.38***	0.21
	(2.66)	(2.99)	(1.56)
Panel B: Industry Concentration and Industry Average Return of Buy/Hold for 6 Months			
1	6.69	6.54	6.99
2	5.11	5.21	6.25
3	5.46	5.55	6.18
4	5.43	5.26	6.39
5	4.78	4.26	5.47
Δ (1–5)	1.90**	2.28**	1.53*
	(2.15)	(2.58)	(1.69)
Panel C: Industry Concentration and Industry Average Return of Buy/Hold for 12 Months			
1	14.22	13.63	14.71
2	11.28	10.72	12.76
3	11.83	11.50	12.71
4	11.54	10.60	13.09
5	10.08	8.65	11.00
Δ (1–5)	4.14**	4.97**	3.71*
	(2.02)	(2.43)	(1.78)
Panel D: Industry Concentration and Industry Average Return of Buy/Hold for 24 Months			
1	28.38	27.18	28.77
2	24.05	22.41	25.75
3	24.20	23.21	25.26
4	23.07	20.74	25.54
5	20.49	17.16	21.63
Δ (1–5)	7.89	10.02*	7.14
	(1.43)	(1.82)	(1.26)

Notes: Robustness check using equally weighted, market cap weighted, and sales weighted over various time horizons (1, 6, 12, and 24 Months).

Sources: Compustat, FactSet Research Systems Inc.

**Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.*

EXHIBIT 7

Controlled Industry Average Monthly Return, Various Horizons

HHI(Sales) Quintile	Equal Weighted Average Return	MKV Weighted Average Return	Sales Weighted Average Return
Panel A: Controlled Industry Average Monthly Return†			
1	0.31	0.25	0.27
2	0.09	0.12	0.25
3	0.11	0.11	0.18
4	0.09	0.06	0.20
5	–0.03	–0.15	0.04
Δ (1–5)	0.34***	0.40***	0.23**
	(3.76)	(3.67)	(2.11)
Panel B: Controlled Industry Average Monthly Return of Buy/Hold for 6 Months			
1	1.87	1.62	1.78
2	0.71	0.62	1.42
3	0.81	0.75	1.11
4	0.59	0.36	1.23
5	–0.31	–0.73	0.17
Δ (1–5)	2.18***	2.36***	1.60**
	(3.09)	(2.97)	(2.14)
Panel C: Controlled Industry Average Monthly Return of Buy/Hold for 12 Months			
1	4.00	3.46	3.98
2	1.70	1.10	2.63
3	2.01	1.78	2.36
4	1.23	0.62	2.47
5	–0.81	–1.51	0.10
Δ (1–5)	4.81***	4.97***	3.88**
	(2.94)	(2.78)	(2.33)
Panel D: Controlled Industry Average Monthly Return of Buy/Hold for 24 Months			
1	7.96	7.26	7.80
2	4.62	3.42	5.53
3	4.21	3.83	4.40
4	2.09	0.89	4.17
5	–1.60	–3.18	–0.36
Δ (1–5)	9.56**	10.44**	8.16*
	(2.25)	(2.29)	(1.87)

Notes: Characteristics-benchmark is calculated by first sorting by market cap, then quintile (5); second by B/P within market cap, then quintile (25); and third by momentum within B/P within market cap, then quintile (125). Finally, subtract each security return from the average characteristics-benchmark return. Robustness check: equally weighted, market cap weighted, and sales weighed over various time horizons (1, 6, 12, and 24 months).

Sources: Compustat, FactSet Research Systems Inc.

*†Controlled for Size, Book to Market, & Momentum. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.*

EXHIBIT 8

Performance of Market Leaders in Concentrated Industries

	BVA	*t*-Stat	PHR	DPHR	IC	SR
1-Month Holding Period	9.32***	4.13	58.9	57.1	0.01	0.14
3-Month Holding Period	7.52***	2.86	62.2	62.6	0.01	0.21
6-Month Holding Period	6.53**	2.19	62.7	72.6	0.01	0.24
12-Month Holding Period	4.89*	1.74	59.8	72.0	0.01	0.32
18-Month Holding Period	3.82	1.55	61.4	76.5	0.01	0.39
24-Month Holding Period	2.89	1.29	62.7	76.5	0.01	0.41

Notes: Market leaders are defined as those firms in HHI(Sales) quintile 1 whose sales constitute a minimum of 10% or more of the industry total sales. The backtest period is the sample period for study, December 31, 1993–December 31, 2013. BVA, TAV, and PHR are in annualized percentage terms.

Sources: Compustat, FactSet Research Systems Inc.

**Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.*

measures. The $HHI(Sales)_{Q1}$ to $HHI(Sales)_{Q5}$ spread for gross profit, return on assets, and net margin were all statistically significant, whereas the return on equity was not. The results are in line with those of Novy-Marx [2013].

The relationship of industry concentration to industry expected return is illustrated in Exhibit 6, which shows the *HHI*(*Sales*) quintile average return and the return difference between the most concentrated (Q1) and the least concentrated (Q5) quintiles for holding periods of 1 month, 6 months, 12 months, and 24 months. The *t*-statistics are calculated with the time-series average return difference between Q1 and Q5 for the historical period from December 31, 1993, to December 31, 2013. The data show that the average return of the most concentrated industries is significantly greater than that of the least concentrated industries. The findings are similar for different industry return average measurements and are consistent with various holding periods.

Exhibit 7 shows the *HHI*(*Sales*) quintile returns controlling for size, book-to-market, and momentum, along with Q1 to Q5 spread and *t*-statistics for various holding periods. Even after adjusting for size, book-to-market, and momentum, the spreads in average returns across concentration quintiles are still significant. As a matter of fact, the average return spreads and their *t*-statistics improved after controlling for size, book-to-market, and momentum. This suggests that the return spreads of the high-concentration quintile and the low-concentration quintile are independent of size, book-to-market, and momentum.

Although Exhibit 7 provides evidence that industry concentration has a positive relationship with industry expected return, practitioners may find difficulty in implementing an investment strategy that takes advantage of our findings. Because there are no subindustry-level exchange-traded funds available, exposure to a concentrated subindustry can be achieved either by holding all constituents in the subindustry or by choosing a subset of the constituents. To assist practitioners with implementation, we further extended our study by analyzing the market leaders in each subindustry. We defined market leaders as those firms in *HHI*(*Sales*) Quintile 1 whose sales constitute a minimum of 10% or more of the subindustry's total sales. We followed the same methodology presented by Aw, Dornick, and Jiang [2014] to validate the performance of the market leaders. The Appendix explains Aw, Dornick, and Jiang's [2014] calculation methodology for measurement statistics used in Exhibit 8.

CONCLUSION

In this study, we examine the relationship between industry concentration and industry equity returns in the global equity market between 1993 and 2013. The motive for using global data is that an increasing number of firms are operating and competing in a global market as a result of globalization. In contrast to Hou and Robinson [2006] for the U.S. stock market and Hashem and Su [2015] for the U.K. market, we find that highly concentrated industries deliver higher returns than highly competitive (less-concentrated) industries. In addition, we also find that high-concentration industries can earn higher profits. Our finding on the relationships among industry concentration, industry profitability, and equity returns may be interpreted using Porter's five forces framework. Industry competition for profits goes beyond established industry rivals to include four other competitive forces: customers, suppliers, potential entrants, and substitute products. The five forces work together to determine the competitive intensity and therefore the overall industry profitability. All else equal, we can argue that highly concentrated industries are less competitive and therefore more profitable than less-concentrated industries. However, overall industry attractiveness does not imply that every firm in the industry will have the same profitability. Our findings seem consistent with Porter's five forces framework.

APPENDIX

MEASUREMENT STATISTICS TO EVALUATE A FACTOR SELECTION

1. *Buy value added* (*BVA*) is defined as the spread of Quintile 1's average return to the model investable universe's average return. A positive *BVA* indicates that the model is providing value, and a negative *BVA* indicates that the model is detracting value. *BVA* also allows for new relevant information to be captured by the model at each model update within any measurement period.

$$BVA = \frac{\sum_{1}^{n} R_{n(Q1)}}{n} - \frac{\sum_{1}^{u} R_{u(Universe)}}{u}$$

   where R is returns; n is the total number of stocks in Quintile 1; and u is the total number of stocks in the model universe.
2. t-*statistic* (t-*stat*) is a measure of the confidence interval for a given hypothesis test. The *t*-stat is used to determine whether excess return being provided by the model is significantly different from zero. For a 95% confidence level, the *t*-stat value should not be between −1.96 and +1.96, allowing the rejection of the null hypothesis that excess return is zero.
3. *Persistent hit rate* (*PHR*) is defined as the total number of periods in which the selected quintile outperforms the universe as a percentage of the total number of periods. For example, if the equally weighted returns of Quintile 1 outperform the equally weighted returns of the universe in 20 out of 30 monthly periods, the *PHR* is 20 divided by 30 (66.67%).

$$PHR = \frac{B}{P}$$

   where B is the total number of stock ranking periods in which $BVA > 0$; and P is the total number of stock ranking periods.
4. *Downside persistent hit rate* (*DPHR*) is defined as the PHR calculated for only those time periods in which the universe's performance is negative.

$$DPHR = \frac{b}{p}$$

   where b is the total number of stock ranking periods in which $BVA > 0$, given $p > 0$; and p is the total number of stock ranking periods in which model universe returns are <0.
5. *Information coefficient* (*IC*) is a measure of how a factor's or model's ranking score is correlated to subsequent returns. It is the correlation coefficient between the factor rank and the return rank for all companies in the universe for a specific period.
6. *Sharpe ratio* (*SR*) is defined as the equally weighted returns of Quintile 1 minus the risk-free rate divided by the standard deviation of the Quintile 1 stocks.

ENDNOTE

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