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Article

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FINANCIAL ECONOMICS | RESEARCH ARTICLE

Industry concentration, stock returns and asset pricing: The UK evidence

Sulaiman Mouselli^{1*} and Aziz Jaafar²

Abstract: How does competition in firms' product markets influence stock returns? We examine this question using firms domiciled in the UK. We find that firms in less concentrated industries earn higher returns, even after controlling for the well-known determinants of the cross-section of UK stock returns. Furthermore, we suggest a novel asset pricing model that explicitly incorporates industry concentration as a distinguished risk factor capturing important features of product markets. Our results link the explanatory power of R&D activity of stock returns to product market structure. Also, we suggest an explanation for value premium on the basis of product market structure that favours barriers to entry interpretation for the higher returns obtained by less concentrated industries.

Subjects: Corporate Finance; Investment & Securities; Financial Management

Keywords: market structure; industry concentration; stock returns; asset pricing

JEL classification: G1; G12

1. Introduction

This study explores the link between the intensity of product market competition and asset pricing. In addition to the well-known risk factors (e.g., Fama & French, 1992, 1993; Lakonishok, Shleifer, & Vishny, 1994), extant literature shows that asset pricing may also be determined by market

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Sulaiman Mouselli is an Associate Professor in Finance and the Dean of the Faculty of Business Administration at Arab International University since 2015. He holds PhD in Accounting and Finance from Manchester Business School (2008). His research spans the area of asset pricing models, earnings management, corporate governance, stock market anomalies and knowledge economy. He has a number of publications in high quality journal such as *Abacus*, *British Accounting Review*, and *International Review of Financial Analysis*.

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PUBLIC INTEREST STATEMENT

This study contributes towards a better understanding of the cross-section of stock returns in the UK. It establishes a linkage between product market structure on stock returns in the framework of industry concentration. This study proposes an industry concentration factor as a potential risk factor in asset pricing model and claims that the new four-factor model explains the time-variation of returns better than the Fama-French model. It also suggests an explanation for value premium on the basis of product market structure that favours barriers to entry interpretation for the higher returns obtained by less concentrated industries. The results provide a better understanding of the determinants of the UK stock returns.

concentration (e.g., Hou & Robinson, 2006; Schumpeter, 1912). Hou and Robinson (2006) report that US firms operating in a highly concentrated market generate negative abnormal returns whereas Irvine and Pontiff (2009) indicate that such firms exhibit more volatile idiosyncratic returns. In a similar vein, using Australian data, Gallagher and Ignatieva (2010) report that firms in higher concentrated industries generate higher risk-adjusted returns *vis-à-vis* firms in lower concentrated industries. We aim to fill the gap in the literature by empirically examining this issue using an out-of-sample data from the UK. In particular, we question whether industry concentration spread has any impact on future stock returns, and whether value and growth premium are associated with time-series of stock returns.

Our main results indicate that firms in less concentrated industries earn higher returns, even after controlling for the well-known determinants of the cross-section of UK stock returns. Furthermore, we find that an asset pricing model that considers market structure explains the time-series variation in stock returns better than the Fama-French model. We also suggest an explanation for the mixed interpretations of value premium on the basis of product market structure. However, our results favour barriers to entry interpretation for the higher returns obtained by less concentrated industries.

This study incrementally contributes to the extant literature in three ways. First, it provides a risk-based explanation of high returns achieved by firms in less concentrated industries where competition is fierce which means that they work in risky conditions. However, unlike Hou and Robinson (2006), our results favour barriers to entry interpretation for the higher returns obtained by less concentrated industries than innovation risk. Second, we offer a better model than the Fama-French model in explaining the time-series variation in the UK stock returns. Finally, we argue that mixed interpretation of value premium may be due to different market structures. In particular, our results imply an explanation for these mixed results and indicate that firms with the same level of book-to-market are not the same, and differ from one another based on the market structure of the industry in which they operate. This study has important implications to both investors and policymakers as it offers better understanding of the drivers of UK stock returns. In particular, investors and financial analysts should take into consideration industry concentration while building their investment strategies. In terms of policymakers, our work shed light on the importance of understanding the roles of competition among firms as this would affect both innovation and expected returns.

The remainder of this paper is organised as follows: Section 2 provides the theoretical basis of the potential linkage between industry concentration and stock returns and how risk factor can be built on the basis of innovation risk. Section 3 describes the data and measures of industry concentration. Section 4 discusses concentration spread and stock returns whilst Section 5 presents the concentration spread and time-series of stock returns. Section 6 discusses empirical results relating to value, growth and time-series of stock returns. Finally, Section 7 concludes the study.

2. Theoretical background

Extant theoretical frameworks argue that industry concentration may affect stock returns and asset pricing. In particular, Hou and Robinson (2006) suggest two main channels: (i) innovation and (ii) barriers to entry, through which product market competition impacts future stock returns. First, it is argued that innovation is a concept of creative destruction that more likely to be prevalent in competitive industries (Schumpeter, 1912).¹ If innovation is both risky and priced, then we expect that on average competitive industries would earn higher stock returns. Second, if barriers to entry in product markets protect firms from total demand shocks while exposing others, then it would predict the degree of distress risk to vary with industry concentration. In particular, they argue that firms in more concentrated industries generate on average lower stock returns as they are shielded from undiversifiable demand shocks. Taken together, products market structure affects firms' operating decisions which in turn affect the risk of cash flows. Hence, asset pricing should be affected by firms operating decisions as well as industry concentration. That is, concentration

premium contains relevant information about asset pricing which may be proxied but not explicitly captured by existing risk factors.

Bustamante and Donangelo (2017) claim that Hou and Robinson (2006)'s barriers to entry argument ignore two important aspects of the interrelation between product market competition and asset prices. The first aspect is the dynamic nature of competition where entry is more likely to occur during expansions rather than contractions, which means that the value destruction associated with the expected entry of new firms is procyclical. The second aspect is the reverse direction through which industry's exposure to systematic risk affect competition. That is, higher industry systematic risk act as a barrier to entry to new ventures because cash flows will be discounted at higher rates. Both aspects predict positive relation between expected returns and competition and add to the already complex linkage between product market competition and stock returns.

Empirically, Hou and Robinson (2006) report that US firms operating in less concentrated industries earn higher returns as compared to their counterparts operating in more concentrated industries. Although they propose two risk-based interpretations, i.e., barriers to entry and innovation, they attribute the results to risk innovation. In particular, firms in less concentrated industries are riskier because they engage in more innovation, which is riskier and thus, command higher returns. Another related US study by Irvine and Pontiff (2009) report that the higher trend in idiosyncratic volatility is related to an increasingly competitive environment in which firms have less market power. Using Australian data, Gallagher and Ignatieva (2010) report significant evidence that firms in higher concentrated industries earn higher risk-adjusted returns. Furthermore, their results show that for the small companies, the stock returns increase with increasing market concentration whereas concentration tends to decrease the stock returns with increasing firm size. That is, the higher market concentration, lower the average stock returns for the larger companies and vice-versa the smaller companies.

Early attempts to link innovation risk to stock returns in the UK can be traced back to Al-Horani, Pope, and Stark (2003) and Dedman, Mouselli, Shen, and Stark (2009) who associate R&D activity to stock returns and suggest an R&D risk factor to proxy for innovation risk. Hence, industry concentration can also be interpreted as a synonymous to R&D expenditure in that it proxies for innovation risk. Therefore, the explanatory power of R&D of stock returns could be due to the market structure where such companies work. This paper contributes towards a better understanding of the impact of such linkage between industry concentration and R&D activities on stock returns.

In this paper, we offer out-of-sample analysis on this issue using UK non-financial firms that are listed on stock markets during the period between July 1991 and December 2007.² Although the UK is one of the largest market economies and similar to that of US, limited empirical analysis has been reported on the link between product market structure and asset pricing. The UK government has been actively promoting open market competition. Thus far, only one preliminary study by Hashem and Su (2015) which reports that industry concentration is negatively related to stock returns. However, the study only examines this relationship on firm and industry levels. We aim to extend this work by constructing industry concentration (IC) factor and examines the significance of its risk premium. Furthermore, we analyze the relationship between IC and Fama-French factors and macroeconomic variables. We also examine the value premium across different IC levels.

3. Data and measures of industry concentration

3.1. Sample selection

Our sample includes all UK non-financial firms contained in London Share Price Database (LSPD) between July 1991 and December 2007. To ensure that accounting information is already impounded in stock prices (available to investors), we match LSPD stock return data from July of year t to June of year $t + 1$ with accounting information from DataStream for the fiscal year

ending in year $t - 1$ similar to Fama and French (1992). We correct for delisting bias using Shumway (1997) correction. To be included in our tests, a firm must have market value and three-digit SIC classification data for June of year t . Many of our tests require the availability of DataStream data on earnings, sales, book equity, market equity, and total assets for fiscal year $t - 1$. This data requirement probably biases our sample towards larger firms, which in turn diminish the overall variation in the concentration measures.

Book equity is equity capital and reserves (DataStream item 305) minus total intangibles (DataStream item 344). The book-to-market ratio is calculated by dividing book equity by DataStream market value. Earnings is defined as earnings before interests and income taxes. Leverage is defined as the ratio of book liabilities (total assets minus book equity) to total market value of firm equity plus total assets minus book equity. For size, we use DataStream market value for June of year t .

Finally, we remove regulated industries from our sample (firms with SIC of 491, 492, 493, 494, 495, 496, and 497). Regulated industries may face lower cost of capital either because they have lower operating risks or because their capital structure and/or capital charges are legally constrained. If regulation is correlated with industry concentration, then this could potentially explain our findings without any further insights into assets prices structure.

3.2. Measuring industry concentration

We use the Herfindahl index (H) to measure industry concentration as follows:

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

Where s_{ij} is the market share of firm i in industry j and I is the total number of firms in industry j . We perform the above calculations each year for each industry, and then average the values over the past three years to ensure that any potential data errors do not have an undue impact on our Herfindahl measure. The Herfindahl measure uses the whole distribution of industry market share information to obtain a complete picture of industry concentration. Small values of Herfindahl index imply that the market is shared by many competing firms, while larger values imply the market is concentrated in the hands of a few large firms.

We calculate the Herfindahl index using three measures: Total equity, total assets, and net sales and call them H (Equity), H (Assets) and H (Sales) respectively. We compare the three measures over the 1991 to 2007 period. As Table 1 shows, they are highly correlated. We perform our tests for all three measures but only report the results for H (Equity). The results for the remaining measures are qualitatively the same.

3.3. Characteristics of concentration-sorted portfolios

In Table 2, we report characteristics averaged across concentration quintiles similar to Hou and Robinson (2006). The spread in H(Equity) is large: The most competitive quintile has an average H(Equity) of 0.110, while the most concentrated one has an average of 0.850. In addition, size, BM, production and profitability characteristics of the industry quintiles tell us much about the nature of industry concentration.

Average sales and assets increases as we move from the most competitive quintile to the most concentrated quintile and size is larger for the most concentrated quintile (opposite to US). BM is largely flat with a higher BM ratio for the more concentrated quintile compared to the remaining quintiles. Apart from quintile 4, leverage generally increases as one move from the more competitive quintile to the more concentrated one.

Similarly, profitability measures show considerable variation across quintiles. We summarize profitability with three measures. Earnings to assets (E/A) averages -2% for the lowest concentration quintile,

Table 1. Summary statistics

Summary of Industry Concentration Measures									
	Mean	Median	SD	Max	Min	25%	75%	Spearman-Pearson Correlation	
								H(Sales)	H(Equity)
H(Sales)	0.623	0.599	0.280	1.000	0.028	0.387	0.913	1.000	0.950
H(Assets)	0.628	0.619	0.279	1.000	0.018	0.391	0.914	0.950	1.000
H(Equity)	0.625	0.608	0.283	1.000	0.015	0.379	0.919	0.911	0.958

Note: The sample includes all UK non-financial firms contained in London Share Price Database (LSPD) between July 1991 and December 2007. We match LSPD stock return data from July of year t to June of year $t + 1$ with accounting information from DataStream for the fiscal year ending in year $t - 1$ similar to Fama and French (1992). We correct for delisting bias using Shumway (1997) correction. To be included in the sample, a firm must have market value and three-digit SIC classification data for June of year t . We remove regulated industries from our sample (firms with SIC of 491, 492, 493, 494, 495, 496, and 497). H (Equity), H (Assets) and H (Sales) are Herfindahl index computed based on three measures: Total equity, total assets and net sales, respectively.

jumps to 1.5% for the second lowest quintile, and is 3.3% for the highest concentration quintile. The dividend payout ratio (D/B) also increases with industry concentration. Since Fama and French (2000), among others, relate dividend policy to expected profitability, D/B ratio confirms that firms in high concentration industries are more profitable than firms in the low concentration industries.

The variable labelled V/A is our proxy for Tobin's Q, and is computed as the market value of assets over book value of assets. It ranges from 2.558 for the lowest concentration quintile to 1.605 for the highest concentration quintile. The negative correlation between Tobin's Q and industry concentration suggests that although the high industry-concentration firms have higher profitability, this profitability is not expected to persist in the future. This is in contrast to the US evidence where Hou and Robinson (2006) document a positive correlation between Tobin's Q and industry concentration.

To get a sense on how Schumpeter's (1912) squares with our data, we also report a measure of R&D intensiveness. We find that R&D to asset ratio (R&D/A) falling monotonically from 2.9% for the lowest concentration quintile to 0.7% for the most concentrated quintile. This indicates that low industry-concentration firms engage more in R&D activities than high industry-concentration firms.

In Table 3, we report Fama and MacBeth (1973, henceforth FM) regressions of the cross-section of industry concentration measures on industry average characteristics. We estimate equations of the following form:

$$H(\text{Equity})_{jt} = \alpha_t + \sum_{n=1}^N \lambda_{nt} X_{jt} + \varepsilon_{jt}, \quad (2)$$

Where X_{jt} are industry average characteristics while n and N denote industry characteristics and total number of characteristics, respectively. Regressions are run for every year t from 1991 to 2007, and the time-series means of annual cross-sectional coefficients estimates are reported along with the time-series t -statistics. This method allows for multivariate correlation analysis, and is robust to cross-correlated error terms. Thus, the resulting coefficients can be interpreted as simple or conditional correlations between concentration and industry average characteristics, and appropriate statistical inferences can be drawn about the magnitude of these relations.

The raw labelled "simple" reports result from FM regressions of concentration on each characteristic individually. Thus, there are nine separate univariate regressions reported in a single row. Each row under the panel labelled "multiple" reports a single regression in which multiple characteristics are included as independent variables simultaneously. This provides conditional correlations of $H(\text{Equity})$ on industry characteristics.

The correlations reported here confirm the descriptive statistics from Table 2. Measures of current profitability (E/A and D/S) are positively correlated with industry concentration. Earnings to assets (E/A) and dividend payout ratio (D/B) are highly positively correlated with industry concentration unconditionally but D/B captures the impact of E/A conditionally. In addition, concentrated industries have more leverage and lower levels of R&D to asset ratio (R&D/A) which is consistent with the results from Table 2. Therefore, highly concentrated industries have high capitalised profitability but they do not engage in risk innovations and they depend more on debt than less concentrated industries.

4. Concentration and the cross-section of returns

4.1. The concentration spread

Table 4 relates industry concentration to the cross-section of average stock returns. In June of each year, firms are sorted into quintiles based on their Herfindahl index. We then report average monthly returns and t -statistics for these portfolios, as well as the difference between quintile 5 (most concentrated) and quintile 1 (least concentrated).

Table 2. Descriptive statistics of H (Equity) sorted quintile portfolios

Characteristics of H(Equity) sorted quintile portfolios												
Rank	H(Equity)	Size	BM	Assets	Sales	E/A	E/S	V/A	D/B	R&D	R&D/A	Lev.
Low	0.110	196.643	0.525	155.717	196.643	-0.020	-1.922	2.558	0.041	1.374	0.029	0.850
2	0.238	357.543	0.586	387.398	357.543	0.015	-1.968	1.991	0.039	8.794	0.024	1.002
3	0.352	601.680	0.514	569.711	601.680	0.018	-1.661	1.881	0.039	12.409	0.022	1.019
4	0.519	668.485	0.582	735.449	668.485	0.018	-0.579	1.744	0.051	4.526	0.012	0.995
High	0.850	724.307	0.715	886.616	724.307	0.033	-0.084	1.605	0.057	6.522	0.007	1.173

Note: H (Equity) is Herfindahl index computed based on total equity. For size, we use DataStream market value for June of year t. Book equity is equity capital and reserves (DataStream item 305) minus total intangibles (DataStream item 344). The book-to-market ratio is calculated by dividing book equity by DataStream market value. Earnings is defined as earnings before interests and income taxes. Leverage is defined as the ratio of book liabilities (total assets minus book equity) to total market value of firm equity plus total assets minus book equity. E/A represents equity to assets, E/S represents equity to sales, V/A is Tobin's Q computed as the market value of assets over book value of assets. D/B is the dividend payout ratio, and R&D/A is R&D to assets ratio.

Table 3. Fama-MacBeth regressions of H(Equity) on industry average characteristics

In(Size)	In(Assets)	In(Sales)	E/A	E/S	V/A	D/B	R&D/A	Leverage	ln(BM)
Panel A: Simple Regressions									
-0.017	-0.008	-0.008	0.100	0.018	-0.038	0.165	-2.574	0.017	-0.006
-7.375	-2.908	-5.332	2.172	3.745	-6.836	2.671	-19.343	7.037	-0.795
Panel B: Multiple Regressions									
-0.018			0.102				-2.258	0.011	-0.028
-5.447			2.127				-14.209	2.291	-3.232
	-0.010		0.072				-2.475	0.016	-0.023
	-2.667		1.476				-15.472	3.936	-2.519
		-0.010	0.084				-2.398	0.016	-0.023
		-4.323	1.758				-16.008	3.479	-2.584
-0.017				0.008			-2.165	0.010	-0.028
-5.321				2.201			-11.847	2.042	-3.261
-0.012					-0.016		-2.096	0.004	
-4.257					-2.698		-14.925	1.379	
-0.019			0.078			0.153	-2.270	0.011	-0.026
-5.456			1.427			2.642	-14.835	2.502	-2.796

Note: This table presents Fama-MacBeth regressions of the H(Equity) index with other industry average characteristics Fama-MacBeth estimated monthly between July 1991 and December 2007. H(Equity) is Herfindahl index computed based on total equity. For size, we use DataStream market value for June of year t. Book equity is equity capital and reserves (DataStream item 305) minus total intangibles (DataStream item 344). Earnings is defined as earnings before interests and income taxes. Leverage is defined as the ratio of book liabilities (total assets minus book equity) to the total market value of firm equity plus total assets minus book equity. E/A represents equity to assets, E/S represents equity to sales, V/A is Tobin's Q computed as the market value of assets over book value of assets. D/B is the dividend payout ratio, and R&D/A is R&D to assets ratio. Every year, a cross-sectional regression is estimated. The time-series mean of the annual regression coefficients and the time-series t-statistics (appearing below) are reported. In Panel A, each coefficient is obtained from a simple (univariate) regression of H(Equity) on each characteristic alone. Panel B reports the results of multiple (multivariate) regressions of H(Equity) on a series of industry characteristics. The time-series mean of the annual regression coefficients and the time-series t-statistics (appearing below) are reported.

Table 4. Industry concentration and the cross-section of average stock returns

	Firm-Level Returns					Industry-Level Returns						
	Quintiles					Quintiles						
	1	2	3	4	5	5-1	1	2	3	4	5	5-1
H(Equity)												
Raw	1.38	1.13	1.19	0.96	1.07	-0.31	1.25	1.07	0.90	1.16	1.18	-0.07
t-stat	3.32	3.48	3.87	3.06	3.53	-1.44	3.59	3.44	2.88	3.54	3.42	-0.30
Adjusted	0.59	0.32	0.31	0.11	0.22	-0.37	0.44	0.21	0.02	0.33	0.35	-0.09
t-stat	3.24	2.61	2.47	0.92	1.74	-2.01	3.53	1.73	0.16	1.91	1.53	-0.39
H(Sales)												
Raw	1.35	1.25	0.97	1.08	1.09	-0.26	1.26	1.02	0.99	1.20	1.13	-0.14
t-stat	3.29	3.77	3.10	3.48	3.51	-1.23	3.59	3.40	3.03	3.73	3.18	-0.53
Adjusted	0.58	0.46	0.12	0.18	0.23	-0.35	-0.24	-0.41	-0.69	-0.24	-0.57	-0.33
t-stat	3.18	3.18	0.95	1.45	1.81	-1.89	-0.92	-1.77	-1.95	-0.77	-1.47	-1.05
H(Assets)												
Raw	1.35	1.20	0.95	1.19	1.06	-0.28	1.21	1.21	1.01	1.04	1.16	-0.05
t-stat	3.30	3.56	2.97	3.94	3.43	-1.32	3.42	3.97	3.23	3.25	3.30	-0.20
Adjusted	0.56	0.42	0.08	0.32	0.20	-0.37	0.40	0.36	0.14	0.16	0.35	-0.05
t-stat	3.15	3.06	0.53	2.59	1.52	-1.94	3.15	2.85	0.99	1.05	1.50	-0.21

Note: In June of each year, firms are sorted into quintiles based on their Herfindahl index. We then report average monthly returns and t-statistics for these portfolios, as well as the difference between quintile 5 (most concentrated) and quintile 1 (least concentrated). Adjusted returns are the intercepts from the time-series regressions of portfolios' excess returns on the market excess return, size factor (SMB) and book-to-market factor (HML) constructed following Dimson et al. (2003). The same method is used for industry-level returns. T-statistics are reported below average returns.

Since Table 2 shows that industry concentration is associated with a number of known determinants of average returns, we also report risk-adjusted returns on each portfolio using Fama and French (1993, henceforth FF) model in Table 4. Adjusted returns are the intercepts from the time-series regressions of portfolios' excess returns on the market excess return, size factor (SMB) and book-to-market factor (HML) constructed following Dimson, Nagel, and Quigley (2003). The expected value of abnormal returns is zero if size, book-to-market, and beta completely describe the cross-section of expected returns.

The first row in the panel labelled H(Equity) in Table 4 presents raw average returns computed by equally weighing firms within each concentration portfolio. Looking across Herfindahl quintiles, firms in the least concentrated (more competitive) industries earn a significant average return of 1.38% per month. This declines to a significant average return of 1.07% per month for firms in the most concentrated quintile. The Spread between the two is -0.31% per month but is statistically insignificant. Interestingly, adjusting for risk using FF model increases this spread to -0.37% per month which carries a statistically significant t-statistics of -2.01. This suggests that the return premium associated with industry concentration is independent from those of size, book-to-market and Beta and that controlling for industry concentration is important for understanding the cross-section of stock returns. The results from H(Sales) and H(Assets) panels confirm the previous results from H(Equity) measure.

4.2. Fama-MacBeth cross-sectional regressions

In this section we test the relation between industry concentration and average stock returns, we apply Fama-MacBeth (FM) regressions of monthly stock returns on industry concentration and other characteristics. We report regressions of firm-level returns regressed on firm characteristics and H(Equity) measure. The time-series average of each cross-sectional regression loading is reported together with its time-series t-statistics. These regressions validate previous results of the relationship between industry concentration and average returns without imposing quintile breakpoints and they permit us to control for additional alternative explanations.

The first column in Table 5 shows that more concentrated firms earn lower average returns which gets along with our previous results from quintile portfolios. The cross-sectional regression coefficient on H(Equity) index is negative (-0.33%) and carries a t-statistics of -1.37. The next two rows show that firm average returns are negatively and significantly related to size with

Table 5. Fama-MacBeth cross-sectional regressions of firm-level returns

Intercept	H(Equity)	ln(Size)	ln(BM)	Leverage
0.0128	-0.0033			
3.44	-1.37			
0.0313		-0.0018		
4.54		-3.13		
0.0142			0.0029	
4.95			3.23	
0.0102				0.0014
3.09				2.44
0.0296		-0.0015	0.0020	
3.92		-2.23	1.92	
0.0292		-0.0015	0.0019	0.0003
3.74		-2.17	1.95	0.58
0.0302	-0.0041	-0.0014	0.0020	0.0004
3.83	-1.95	-2.09	2.02	0.77

Note: Table 5 report regressions of firm-level returns regressed on firm characteristics and H(Equity) measure. Fama-MacBeth

a coefficient of -0.018% while positively and significantly related to book-to-market with a coefficient of 0.29% . This result is consistent with the previous UK literature (see Dedman et al. (2009) for example), which confirm the role of size and book-to-market in explaining the cross-section of stock returns. The fourth row demonstrates a role for leverage in explaining the cross-section of stock returns with a positive slope of 0.14% which is significant at 1% level.

The last row retests the industry concentration effect, controlling for all of the above characteristics. Taking these variables into account increase the size and the significance of industry concentration as FM regressions of individual stock returns on the Herfindahl index with size, book-to-market, and leverage produce an average slope coefficient of -0.41% which is marginally significant at 5%. Although this result is not strong by itself, it indicates that industry concentration has incremental cross-section explanatory power of stock returns in the presence of widely accepted characteristics of size and book-to-market.

cross-sectional regressions estimated monthly between July 1991 and December 2007. The time-series average of each cross-sectional regression loading is reported together with its time-series t-statistics appearing below.

We conclude from Table 5 that firms in more concentrated industries earn lower returns than their counterparts in less concentrated industries. This result is in agreement with the results from Table 2 where the low quintile concentration portfolio earns higher returns than the high quintile portfolio. This result is also robust to the inclusion of control variables such as size, book-to-market and leverage. Hence, we can argue that industry concentration effect is not being driven by other firm characteristics or affected by capital structure selection.

5. Concentration and time-series variation in returns

5.1. Time-series variation of industry concentration premium

In this section, we aim to answer the question whether the concentration premium remains significant after taking existing risk factors into account. In Table 6, we report results from the following time-series regressions of monthly concentration premia on risk factors and economic indicators:

$$\lambda_t^H = \alpha + \sum_{i=1}^I \beta_i F_{it} + \sum_{j=1}^J \gamma_j X_{jt} + \varepsilon_t, \quad (3)$$

where F_{it} are returns to factor mimicking portfolio in month t and X_{jt} are month- t values of business cycle indicators. The dependent variable, λ_t^H , is the time-series of H(Equity) risk premia generated from the FM regressions reported in the last row in Table 5, in which the cross-section of individual stock returns is regressed on industry concentration, controlling for other characteristics.

In the first row in Table 6, the monthly concentration premium is regressed against the market excess returns. The next row adds the factor mimicking portfolio associated with size effect (SMB) and book-to-market effect (HML). The third row regresses the monthly concentration premium against the T-bill rate.

As Table 6 indicates, the H(Equity) premium declines to -30 basis point when regressed on the market excess returns. Controlling for the FF factors actually reduces the premium to -33 basis point per month with a t-statistics of -1.67 , whereas the adjusted R^2 goes slightly up to 14%. This suggests that concentration premium cannot be explained by SMB and HML which confirms the results in Table 5 that industry concentration contains independent information about the cross-section of average returns.

Table 6. Time-series variation of the concentration premium

Alpha	RMRF	SMB	HML	T-Bill	INF	Term	g_t	g_{t+4}	Adj-R ²
-0.0030	-0.2448								0.10
-1.51	-4.69								
-0.0033	-0.2742	-0.1885	0.0345						0.14
-1.67	-5.24	-3.15	0.47						
-0.0040				-0.0262					-0.01
-0.48				-0.01					
0.0049					-0.3875				0.01
0.71					-1.38				
-0.0051						0.0232			0.01
-2.22						1.08			
-0.0041							-0.0412		-0.01
-1.93							-0.15		
-0.0035								-0.1031	0.01
-1.59								-1.13	
-0.0010	-0.2750	-0.1917	0.0290	-0.5230					0.13
-0.12	-5.23	-3.15	0.39	-0.31					
0.0078	-0.2720	-0.2135	0.0160		-0.4804				0.15
1.19	-5.22	-3.49	0.22		-1.78				
-0.0049	-0.2814	-0.2113	0.0196			0.0383			0.15
-2.28	-5.40	-3.48	0.27			1.89			
-0.0034	-0.2763	-0.1896	0.0344				0.0695	0.0078	0.13
-1.64	-5.17	-3.08	0.47				0.28	0.09	
-0.0003	-0.2753	-0.2203	0.0207	1.4214	-0.4602	0.0280			0.15
-0.03	-5.25	-3.57	0.28	0.71	-1.35	1.28			
-0.0014	-0.2637	-0.2092	0.0153	2.4474	-0.5949	0.0366	-0.0324	-0.1212	0.14
-0.16	-4.91	-3.34	0.20	1.12	-1.64	1.58	-0.13	-1.17	

Note: This table presents results from time-series regressions of the H(Equity) premium on various asset pricing factors and business cycle indicators. The H(Equity) premium is obtained from monthly

In the third and fourth row in Table 6, we regress the concentration premium on T-bill rate. The concentration premium loads negatively and insignificantly on both T-bill rate and inflation. However, the intercept term turns to be insignificant in both equations. The disappearance of H(Equity) premium once we control for those variables indicates that concentration premium may be correlated with the business cycle. When we introduce inflation to Fama and French factors in the same model, the H(Equity) premium becomes insignificant. This suggests that improving economic conditions result in the disappearance of concentration premium which gets along with a risk-based interpretation that concentration premium may be a proxy for distress risk. However, the increase of adjusted R² that happens with the inclusion of inflation variable is only slight from 14% to 15%.

5.2. Can the concentration premium explain portfolio returns and existing factors?

Since Table 6 shows mixed results on whether the concentration premium is subsumed by existing asset pricing factors, we perform two different types of tests to disentangle the information content of different risk factors. First, we examine if the addition of IC to Fama-French three-factor model is a useful addition that better explain portfolio returns in the UK. Second, we examine how much of existing asset pricing factors can be explained by the concentration premium.

To achieve the first goal, we construct IC Factor by sorting firms into two portfolios on the basis of their H(Equity) score at the end of June each year. Then, we compute the monthly value-

weighted returns of the zero-investment portfolio that is long on firms that belong to high competitive industries and short on firms that belong to low competitive industries. Next, we run time-series regressions of risk factors on 16 sizes and book-to-market sorted portfolio with and without the IC factor. If IC factor is a risk factor, it should explain the portfolio returns. The modified Fama-French four-factor model specification is

$$R_{pt} - R_{ft} = \alpha + \beta_m(R_{mt} - R_{ft}) + \beta_{SMB}SMB_t + \beta_{HML}HML_t + \beta_{IC}IC_t + \varepsilon_{pt} \quad (4)$$

To test the null hypothesis that the IC factor does not explain the time-series variation in portfolio returns, we test the joint significance of the estimates β_{IC} in Equation (4). The results from time-series regressions in panel A of Table 7 suggest that Fama and French factors are significant in explaining portfolio returns. The F-test of the joint significance the estimates β_{IC} in Panel B of Table 7 is 4.49 and significant at 1% level of significance. Hence, we reject the null hypothesis that the β_{IC} in Equation (4) are zero and suggests that IC factor is significant in explaining UK portfolio returns. Furthermore, the values of adjusted R^2 obtained from the four-factor model are generally higher than those of the Fama French three-factor model. This indicates that the inclusion of a risk factor that proxy the product market structure improves the pricing power of Fama French three-factor model. Also, the most notable conclusion from Panel B of Table 7 is that IC factor is independent and incremental to SMB and HML factors which is consistent with the results obtained from Table 5 in FM regressions. IC factor loads significantly on 10 out of the 16 intersected portfolios in the presence of HML factor. This indicates that IC factor captures different information from that captured by the value factor.

To achieve the second goal, we report time-series regressions of existing asset pricing factors on the conditional H(Equity) premium in Table 8. First, we regress returns from a number of factor-mimicking portfolios on the conditional H(Equity) premium. This is presented in Panel A of Table 8. The first column labelled “mean”, reports the unconditional mean of the mimicking factor returns over the 1991 to 2007 period. The remaining three columns report the conditional mean, the loading on conditional H(Equity) premium, and the regression R^2 .

The first row in Panel A of Table 8 examines the excess market return. The unconditional mean of the excess market return is 44 basis point per month in our sample but this drops to 27 basis point after we account for comovement with H(Equity) premium. The regression R^2 , however, reveals that 10% of the variation in the market premium is explained by the concentration premium. The second row shows that SMB loads negatively and significantly on the conditional H(Equity) premium, leaving a constant term that is statistically zero. The R^2 indicates that we explain only 2% of the variation in the size premium with the conditional H(Equity) premium. This is only a modest success, however, as the unconditional size premium is statistically insignificant 14 basis point in our sample.

Interestingly, controlling for the concentration premium actually strengthens the book-to-market factor. HML loads positively on the conditional H(Equity) premium, and the concentration premium explains only 1% of the variation in HML. But the mean of HML increases three basis points per month from 49 basis points unconditionally to 52 basis points conditionally. This conditional mean value of HML is statistically significant with t-statistics of 2.67.

In Panel B of Table 8, we replace the asset pricing factors with factor premia obtained from cross-sectional FM regressions. We focus on size and book-to-market. The results largely confirm those from Panel A, namely, the size premium remains almost the same while the book-to-market premium increases from 29 basis points per month unconditionally to 35 basis point per month conditionally. This result points to an interesting interaction between concentration and the book-to-market premium, which we take up in more details in the next section.

Table 7. Loadings from time-series regressions for 16 size-BM portfolios

	Low	2	3	High	Low	2	3	High	F
	α				t_α				F
Panel A: Loadings on the Fama-French Factors from Time-Series Regressions									
	β_M								
Small	0.69	0.17	0.63	0.82	1.71	0.59	2.86	4.96	2.99
2	-0.03	0.04	0.02	0.24	-0.14	0.22	0.17	1.30	<0.01
3	-0.25	0.04	0.01	0.47	-1.33	0.33	0.04	2.99	
Big	-0.14	0.05	0.10	0.28	-0.93	0.39	0.64	1.06	
	β_{SMB}								
Small	0.91	0.76	0.81	0.57	8.64	9.96	13.98	13.13	>100
2	1.14	0.92	0.82	0.85	18.82	19.80	21.52	17.73	<0.01
3	1.18	1.03	0.89	0.97	24.07	29.63	23.53	23.72	
Big	0.88	0.91	0.94	1.18	22.79	24.96	23.12	16.74	
	β_{HML}								
Small	1.27	1.10	0.92	0.80	10.52	12.58	13.89	16.19	>100
2	1.25	1.02	0.86	0.89	18.06	19.24	19.75	16.16	<0.01
3	1.05	0.93	0.90	0.86	18.72	23.44	20.73	18.34	
Big	-0.05	-0.07	-0.06	0.25	-1.08	-1.77	-1.24	3.09	
	Adj-R ²								
Small	-0.29	0.00	0.13	0.31	-2.00	-0.04	1.63	5.12	35.95
2	-0.21	0.02	0.41	0.57	-2.49	0.28	7.67	8.48	<0.01
3	-0.24	0.26	0.55	0.74	-3.50	5.47	10.46	12.86	
Big	-0.49	0.26	0.54	0.67	-8.97	5.01	9.51	6.79	
			Low	2	3	High			
Small			46.75	52.92	62.11	64.66			

(Continued)

Table 7. (Continued)

	Low	2	3	High	Low	2	3	High	F
	α				t_α				
2			75.74	76.79	78.30	71.45			
3			81.25	85.79	80.97	80.44			
Big			77.32	77.56	76.25	60.51			
Panel B: Loadings on the Four Factor Model (FF + IC) from Time-Series Regressions									
Small	0.52	0.15	0.54	0.83	1.28	0.49	2.42	4.91	3.12
2	-0.22	-0.03	0.01	0.37	-1.01	-0.15	0.05	2.03	<0.01
3	-0.39	0.00	0.07	0.53	-2.14	0.02	0.50	3.32	
Big	-0.14	0.11	0.08	0.17	-0.96	0.81	0.49	0.65	
	β_M				t_β				F
Small	0.83	0.75	0.76	0.57	7.51	9.24	12.62	12.46	>100
2	1.04	0.89	0.81	0.92	17.24	18.22	20.13	18.66	<0.01
3	1.11	1.01	0.93	1.00	22.39	27.62	23.40	23.26	
Big	0.88	0.94	0.93	1.12	21.44	24.66	21.59	15.27	
	β_{SMB}				t_β				F
Small	1.17	1.08	0.86	0.81	9.17	11.60	12.36	15.22	>100
2	1.13	0.98	0.85	0.97	16.22	17.49	18.29	17.08	<0.01
3	0.97	0.91	0.94	0.90	16.84	21.51	20.60	18.03	
Big	-0.05	-0.04	-0.07	0.18	-1.09	-0.85	-1.44	2.15	
	β_{HML}				t_β				F
Small	-0.19	0.01	0.19	0.30	-1.23	0.10	2.29	4.82	31.66
2	-0.09	0.06	0.42	0.49	-1.09	0.86	7.50	7.25	<0.01
3	-0.15	0.29	0.51	0.70	-2.22	5.76	9.38	11.80	
Big	-0.48	0.22	0.55	0.73	-8.49	4.15	9.32	7.23	

(Continued)

Table 7. (Continued)

	α			t_α			F		
	Low	2	3	High	Low	2		3	High
	β_c							F	
Small	0.59	0.09	0.33	-0.02	2.37	0.49	2.40	-0.21	4.49
2	0.66	0.22	0.06	-0.43	4.86	2.04	0.61	-3.93	<0.01
3	0.48	0.14	-0.23	-0.19	4.32	1.72	-2.55	-2.00	
Big	0.02	-0.20	0.08	0.38	0.23	-2.37	0.81	2.27	
	Adj-R ²								
			Low	2	3	High			
Small			47.99	52.74	63.01	64.48			
2			78.27	77.16	78.23	73.42			
3			82.82	85.93	81.50	80.73			
Big			77.21	78.08	76.20	61.34			

Note: This table reports the loadings from time-series regressions on 16 intersected portfolios sorted by size and BM. The corresponding t-statistics are also reported, and they are corrected for heteroscedasticity and serial correlation, using the Newey-West estimator with five lags. The sample period is from July 1991 to December 2007. The last column reports F-statistics, and their corresponding p-values, from a Seemingly Unrelated Regression (SUR), testing the joint significance of the loadings. The intercepts are in percentages.

Table 8. Can the concentration premium explain existing factors?

LHS	Mean	Alpha	H(Equity) Premium	R ²
Panel A: Explaining Factor Returns				
RMRF	0.0044	0.0027	-0.4121	0.10
	1.60	1.02	-4.69	
SMB	-0.0014	-0.0022	-0.1771	0.02
	-0.59	-0.89	-2.19	
HML	0.0049	0.0052	0.0916	0.01
	2.49	2.67	1.39	
Panel B: Explaining Cross-Sectional Factor Premia				
Size premium	-0.0018	-0.0020	-0.0300	0.01
	-3.13	-3.32	-1.51	
BM premium	0.0029	0.0035	0.1515	0.12
	3.23	4.15	5.31	

Note: This table reports results from time-series regressions of mimicking portfolio returns and cross-sectional premia of asset-pricing factors on the conditional H(Equity) premium. In Panel A, the dependent variables are factor mimicking returns computed similar to Dimson et al. (2003). RMRF is the market excess return. SMB and HML are sizes and BM factor mimicking returns. In Panel B, the dependent variables are cross-sectional premia obtained from monthly Fama-MacBeth regressions of stock returns on ln(Size), ln(BM). The column labelled “Mean” is the average value of the factor mimicking return or premium. Alpha is the regression intercept from regressing factor return/premium on H(Equity) Premium. The column labelled “H(Equity) Premium” reports the loading of the factor/premium on H(Equity) premium. The final column reports the R² of the regression. Estimates are reported with t-statistics appearing below.

6. Value, growth, and industry concentration

Based on the fact that the book-to-market premium increases in magnitude when we control for industry concentration, we turn next to FM regressions that explore the interaction of book-to-market and concentration. These are presented in Table 9. Returns are at the firm level (as in Table 5) and the final column is an interaction term between industry concentration and firm-level book-to-market. The coefficient on the interaction term is negative (-0.0007) suggesting that the premium associated with being high book-to-market firm declines as industry concentration increases. This result contradicts the US evidence obtained by Hou and Robinson (2006) who find that book-to-market premium increases with the increase in industry concentration.

To get a sense of the economic magnitude involved here, next we examine returns to book-to-market portfolios for different levels of industry concentration in a five-by-five sort. At the end of June of each year, we sort firms into concentration quintiles according to their concentration (H(Equity)) value. Further, we independently sort firms into book-to-market quintiles according to their book-to-market ratio. The intersection of these portfolios gives 25 concentration-book-to-market portfolios. Then, we calculate their average returns from July to June of the following year. Panel A of Table 10 reports the

Table 9. Fama-MacBeth cross-sectional regression for the interaction between industry concentration and book-to-market effect

Fama-MacBeth cross-sectional regressions					
Intercept	H(Equity)	ln(Size)	ln(BM)	Leverage	H(Equity) x ln(BM)
0.0290	-0.0053	-0.0013	0.0028	0.0004	-0.0007
3.72	-2.07	-1.98	2.18	0.86	-0.42

Note: The table presents results from monthly Fama-MacBeth cross-sectional regressions of individual stock returns on ln(Size), ln(BM), Leverage, H(Equity), and an interaction term between H(Equity) and ln(BM). Time-series averages of the monthly regression coefficients, in percentage, are reported with time-series t-statistics below.

Table 10. Interaction between industry concentration and book-to-market effect

H(Equity) Quintiles	BM Quintiles					5-1 Spread
	1 (Low)	2	3	4	5 (High)	
Panel A: Value-Weighted Average Returns of H(Equity) and BM sorted Portfolios						
1(Low)	0.69	0.88	0.92	1.48	1.95	1.26
	1.12	1.59	1.83	2.94	4.14	1.91
2	0.36	0.84	0.85	1.49	1.42	1.07
	0.87	2.19	2.26	3.94	3.04	2.21
3	1.09	0.70	0.56	1.14	1.61	0.52
	2.61	1.76	1.49	2.68	3.61	1.09
4	0.66	0.43	1.43	1.47	1.15	0.50
	1.41	0.82	3.20	3.16	2.66	0.96
5 (High)	0.30	0.82	1.44	1.05	1.04	0.74
	0.72	1.54	3.67	2.47	2.05	1.48
All	0.62	0.73	1.04	1.33	1.44	0.82
	1.75	2.01	3.16	3.90	3.92	2.55
Panel B: Equally-Weighted Average Returns of H(Equity) and BM sorted Portfolios						
1(Low)	0.87	1.51	1.10	1.75	2.13	1.26
	1.53	2.97	2.45	4.64	5.28	2.54
2	0.88	0.73	0.91	1.24	1.84	0.96
	1.94	1.77	2.74	3.33	5.63	2.39
3	1.23	0.91	0.95	1.28	1.57	0.34
	2.88	2.50	2.76	3.80	5.18	0.96
4	0.54	0.58	1.32	0.99	1.39	0.85
	1.26	1.62	3.58	3.23	4.22	2.53
5 (High)	0.70	0.94	0.80	1.14	1.47	0.77
	1.64	2.16	2.38	3.59	3.97	1.96
All	0.84	0.94	1.02	1.28	1.68	0.84
	2.07	2.57	3.09	4.26	5.85	3.11
Panel C: R&D/A of H(Equity) and BM sorted Portfolios						
1(Low)	0.04	0.04	0.03	0.02	0.01	-0.02
2	0.04	0.04	0.02	0.01	0.01	-0.03
3	0.03	0.03	0.02	0.02	0.01	-0.02
4	0.01	0.02	0.01	0.01	0.01	-0.01
5(High)	0.01	0.01	0.01	0.00	0.00	-0.01
1-5 Spread	0.03	0.03	0.02	0.02	0.01	

Note: Panels A and B report value-weighted (Panel A) and equal-weighted (Panel B) average returns of BM quintile portfolios, their t-statistics, and the difference in returns between Quintile 5 and Quintile 1 within each concentration quintile. Firms are sorted into 5 × 5 double-sorted portfolios on H(Equity) and BM. The row entitled “All” reports average returns of BM quintiles formed across concentration quintiles. Panel C reports the R&D to assets ratio (R&D/A) for the 5 × 5 double-sorted portfolios based on H(Equity) and BM.

average value-weighted monthly returns of the five book-to-market portfolios as well as the difference in returns between quintile 5 and quintile 1 for each H(Equity) group. Panel B reports equally weighted returns. Each row demonstrates the prevalence of the book-to-market effect within each concentration group.

As the table indicates, the spread in returns associated with the book-to-market ratio is largest among the least concentrated industries. For example, high book-to-market stocks outperform low

book-to-market stocks by 1.26% per month in the lowest Herfindahl quintile, and this number declines to 0.74% per month for the highest Herfindahl quintile. These double-sorted portfolio results reinforce the findings from the cross-sectional regressions in Table 9, which show that book-to-market declines as industry concentration increases.

These double-sort portfolios yield insights into the relations among market structure, value and growth. Some risk-based explanations suggest that book-to-market ratio may proxy for a risk related to distress (see, for example, Fama and French (1995), Chen and Zhang (1998), or Griffin and Lemmon (2002)) while others associate it with relative profitability (see, for example, Zhang (2005) and Cooper (2006)) and yields mixed results. Our results suggest an explanation for these mixed results and indicate that firms with the same level of book-to-market are not the same and differ from one another on the basis of the market structure of the industry in which they operate.

On the one hand, a low book-to-market firm in a concentrated industry is inappropriately described as a “growth firm”. As we noticed from Table 2, a firm operates in a concentrated industry has on average a large asset base, high unit profitability (E/A) and low R&D/A (Table 2), and subsequently has high capitalized profitability. Its book-to-market is low not because its growth prospects are high, but because its current and expected future profitability is high. High profitability, low-risk firms are thus being labelled growth firms, pulling down the average returns of low book-to-market stocks to 0.30% per month (Panel A of Table 10).

On the other hand, a low book-to-market firm in a competitive industry is surely better characterized as a growth firm. These firms engage more in R&D activities on average (Panel C of Table 10) and are less profitable as can be noticed in Table 2. Therefore, a low book-to-market ratio really reflects expected growth and not a high capitalized profitability. Growth is risky, and this is compensated by higher expected returns of 0.69% per month. (Panel A of Table 10).

These findings help us distinguish between the creative destruction and barriers-to-entry hypotheses. Panel A and B in Table 10 show that spreads in returns across concentration quintiles are larger in the portion of high the book-to-market spectrum than among low book-to-market firms where growth is more dominant. That is, higher spread in returns is observed among high book-to-market firms compared to low book-to-market firms. These findings favour the barriers-to-entry hypothesis opposite to the US where creative destruction is more salient (Hou & Robinson, 2006).

Fama–MacBeth cross-sectional regressions of stock returns on industry $H(\text{Equity})$, controlling for other characteristics (see the last row of Table 5). RMRF is the market excess return. SMB and HML are sizes and BM factor-mimicking returns (see Dimson et al. (2003) for description). T-Bill is the 3-month Treasury bill rate. INF is the monthly percentage change in the consumer Price Index. Term is the difference between the yield on the long-term and short-term government interest rates. The long-term interest rate is approximated by the yield on the government long-term bond while the short-term interest rate is measured by the 3-month Treasury bill rate. Both interest rates are converted to their monthly equivalents to be comparable with stock returns. g_t and g_{t+4} are the current and next four quarters’ growth rates in Industrial production. Alpha is the intercept from time-series regression. t -statistics are reported below parameter estimates.

7. Conclusion

One of the fundamental questions in empirical asset pricing is what are the determinants of the cross-section of stock returns? The literature on return predictability offers many empirically motivated financial characteristics. However, our research suggests a link between market structure and stock returns on the basis of industry concentration. This link was coincidentally captured by other accounting factors such as R&D (Dedman et al., 2009).

We argue that market structure affects firm riskiness by affecting the equilibrium operating decisions it makes. We mainly link industry concentration to stock returns through innovation and distress risk. Firms that work in a competitive industry (where innovation risk and distress risk is high) should command higher expected returns.

Consistent with the US evidence (Hou & Robinson, 2006) and Australian evidence (Gallagher, Ignatieva, & McCulloch, 2015), we find that firms working in competitive industries earn higher stock returns, even after controlling for the well-known factors that affect the cross-section of average returns, such as size, leverage, and book-to-market. Moreover, we suggest a four-factor model that explicitly incorporates industry concentration as a distinguished risk factor that captures important features of product markets.

Much of the recent empirical asset pricing literature uses industry sector as conditioning information and explores whether certain asset pricing phenomenon are attributable to industry effects. This paper attempts to explain the impact of industry characteristics on the equilibrium trade-off between risk and return without conditioning on certain industries. This study focuses on risk-based explanations for the concentration premium in which two types of risk; innovation and distress, affect stock returns. However, we discard the possibility that other types of risk as well as some behavioural biases may push investors to undervalue firms in less-concentrated industries, producing high returns ex-post.

Our work offers important implications to relevant stakeholders including academics, regulators and market participants as it provides a better understanding of the UK stock returns. With respect to market participants and especially for investors and financial analysts, industry concentration should be accounted for in their portfolio analysis. High book-to-market firms produce higher returns if they are in competitive industries than if they are in concentrated industries. Similarly, regulatory bodies should understand the role of competition among firms as they would affect expected returns. Moreover, firms in concentrated industries engage less in R&D activities, which should encourage regulatory bodies to open up those industries to more competition to enhance innovation. Finally, the limitation of this study is it does not consider the period during and the post-financial crisis; hence, future research can extend the empirical analysis by comparing between these periods.

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Notes

1. Creative destruction can be defined as an idea that innovation occurs in small firms related to established industries, and over time, these firms challenge the established firms by introducing new technology (Hou & Robinson, 2006).

2. The empirical analysis excludes the impact of financial crisis; hence, it stops at the end of 2007. Hoberg and Phillips (2010) argue that firms in highly competitive industries are more prone to cash-flow uncertainty compared to firms in less competitive industries. Hence, firms in highly competitive industries, because of the financial crisis, are expected to develop strategies and barriers that could move the industry to become less competitive. Such transition could change the results over the subsequent time period and deserves thorough investigation by its own.

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