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INDUSTRY CONCENTRATION AND THE CROSS-SECTION OF STOCK RETURNS: EVIDENCE FROM THE UK

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Abstract. In this paper, we examine the relationship between market structure and expected stock returns in the London Stock Exchange during 1985 and 2010. Using Fama-MacBeth regressions, we find that industry concentration is negatively related to average stock returns, even after controlling for beta, size, book-to-market equity, momentum, and leverage. In addition, there is a strong evidence of a growth effect. Firms or industry portfolios with smaller book-to-market ratios have significantly higher returns. In contrast, beta is never statistically significant. The above results are robust to firm- and industry-level regressions, and the formation of firms into 100 size-beta portfolios. Our findings indicate that competitive industries earn, on average, higher risk-adjusted returns than concentrated industries. An explanation is that investors in more competitive industries require larger premiums for greater distress risks associated with these industries. Our paper is one of the first to link market competition with the average stock returns in the UK, and contributes to the asset pricing literature by extending the evidence from the US to another important financial market.

Keywords: industry concentration, stock returns, market structure, distress risk, asset pricing, London stock exchange.

JEL Classification: G11, G12, L11.

Introduction

Prior research has uncovered a number of patterns in the cross-section of average stock returns, including the value premium, size effect, book-to-market equity effect and momentum effect. For example, Fama and French (1992) show that size and book-to-market equity ratio capture the cross-section of returns much better than market beta. Fama and French (1993) further show that size, book-to-market equity and beta can explain the time-series performance of stock portfolios. Carhart (1997) finds that the momentum factor is important in explaining the cross-section of equity mutual fund returns. Lewellen (1999) finds that firm characteristics and macroeconomic variables predict significant time variation in expected returns on portfolios sorted by size and book-to-market equity ratio. Hou and Robinson (2006) argue that industry concentration

affects the cross-section variation of stock returns. Because competitive industries are associated with more innovation and distress risks, investors in industries with strong competitive pressures will demand a positive return premium commensurate with the risk involved.

Given that the UK shares many similar characteristics with the US in terms of industry structure and market trading, it will be of interest to examine whether industry competitiveness affects the cross-section of UK stock returns in a manner consistent with that observed in the US. Specifically, the purpose of this paper is to address the following four research questions: First, is there a significant industry concentration premium in the UK stock market? In other words, do firms operating in more concentrated industries generate higher risk-adjusted returns? Second, are there significant differences in stock returns due to beta, size, book-to-market equity, momentum, and leverage? Third, does industry concentration premium remain significant after accounting for other risk factors? Fourth, is the relationship between industry structure and stock returns robust to firm-and industry-level regressions, and the formation of firms into various size-beta portfolios?

Using data for 1300 firms publicly listed in the London Stock Exchange (LSE) during 1985 and 2010, this paper finds that industry concentration is negatively related to expected stock returns in all Fama-MacBeth regressions, which is consistent with Hou and Robinson (2006) but against Gallagher and Ignatieve (2010). In addition, the negative relationship between industry concentration and expected stock returns remains significant, even after controlling for risk factors such as beta, size, book-to-market equity, momentum, and leverage. Furthermore, average stock returns are negatively related to book-to-market equity ratios and beta is never important in explaining the cross-section of stock returns in the UK. The above results are robust to firm- and industry-level regressions, and the formation of firms into 100 size-beta portfolios. Overall, the findings of this paper indicate that competitive industries earn, on average, higher returns compared to concentrated industries, in a manner that is consistent with higher distress risk faced by competitive industries.

The incremental contributions of our paper are three-fold. First, given that the literature remains inconclusive about the role of market structure in asset pricing, it is necessary to test the link between industry concentration and stock returns using a variety of samples. This paper provides one of the first country-specific studies extending the evidence from the US to cover an extensive and more recent period in the UK. Second, extant studies on the behaviour of asset prices in the UK have not considered industry structure as a potential source of risk. This paper is one of the first to link market competition with the average stock returns in the UK. Third, prior research on the cross-section of UK stock returns predominantly uses portfolio returns formed on firm characteristics. This paper examines whether market structure helps to explain the observed differences in average stock returns using both firm- and industry-level regressions.

The rest of the paper is organised as follows. Section 1 briefly reviews the literature on empirical asset pricing. Section 2 describes the data and presents descriptive statistics

on measures of industry concentration. Section 3 reports industry average characteristics across industry concentration quintile portfolios and the correlation between industry concentration and industry characteristics. Section 4 applies Fama-MacBeth regressions to examine the relationship between industry concentration and the cross-section of stock returns using firm- and industry-level regressions and 100 size-beta portfolios. The last section summarizes the findings and discusses some unresolved issues for future research.

1. Literature review

Prior research into the determinants of the cross-sectional variation in average stock returnshas uncovered a large number of anomaliesthat are inconsistent with rational asset pricing theories. For example, Fama and French (1992) demonstrate that firm size and book-to-market can explain the cross-section of stock returns, while beta has no explanatory power. Jegadeesh (1990), Jegadeesh and Titman (1993) find that stocks with higher returns during the previous few months tend to have higher future returns (short-term momentum). Fama and French (1993) find that a three factor-model including size, value, and beta can capture the time-series variation in stock returns. Carhart (1997) augments the three-factor model to include a momentum factor and finds that the four-factor model can better explain the cross-section of stock returns.

However, Daniel and Titman (1997) raise further controversy on multifactor asset pricing models by arguing that firm characteristics, rather than factor loadings, determine the cross-sectional variation of expected returns. They find no significant return premium associated with any of the Fama-French three factors during the period between 1973 and 1993 in the US. Hawanini and Keim (2000) document that many anomalies such as the size effect, the value effect and the dividend yield effect appear to be only significant during the month of January, and casts doubt on the risk-based multifactor models. Davis *et al.* (2000) show that covariances (sensitivities of returns to factors) have more explanatory power than characteristics during 1929 and 1997. Chou *et al.* (2004) find that the predictive ability of size and book-to-market equity diminishes for the periods 1982 to 2001 and 1990 to 2001, respectively. Hou and Robinson (2006) test the link between average stock returns and market structure, and finds that firms in concentrated industries earn significantly lower return than those in competitive industries. However, Gallagher and Ignatieve (2010) and Gallagher *et al.* (2014) document that Australian firms in concentrated industries earn, on average, higher risk-adjusted returns compared to those in competitive industries.

In recent years, there has been a growing literature on empirical asset pricing in the UK stock markets. For instance, Miles and Timmermann (1996) find that book-to-market equity ratio is positively related to the cross-section of stock returns, and both size and book-to-market equity risk premiums can predict up to 20% of the time-series variation in the monthly stock returns. Strong and Xu (1997) find that book-to-market equity ratio and leverage can explain the cross-section of stock returns during 1973 and 1992, while beta and firm size have no explanatory power. Liu *et al.* (1999) report the pres-

ence of momentum profits during 1977 and 1998, which cannot be explained by firm size, book-to-market equity ratio and cash earnings-to-price ratio. Gregory *et al.* (2001) document significant value premiums during 1975 and 1998, and that the Fama-French three-factor model cannot explain excess returns on value strategies using portfolios formed on past sales growth and book-to-market value. Dimson *et al.* (2003) find that the UK firms with high dividend yields outperform those with low dividend yields. Hon and Tonks (2003) provide evidence that momentum strategies are only profitable from 1977 onwards, while the momentum effect disappears prior to 1977. Hung *et al.* (2004) show that both the CAPM and Fama-French three-factor model hold in the UK stock market, and that book-to-market effect dominates the size effect. Michou *et al.* (2007) survey various sorting methods to construct size and book-to-market mimicking portfolios, and casts doubt on the predictive ability of the Fama-French three-factor model to estimate abnormal stock returns in the UK. Chen and Hill (2013) find that default risk is a significant determinant of stock returns and this relationship is "hump backed", as predicted by Garlappi and Yan (2011). Foran *et al.* (2015) find that systematic liquidity risk is positively priced in the cross-section of UK stocks, specifically for the quoted spread liquidity measure.

Although the aforementioned research has provided important evidence on the ability of multifactor models in explaining stock returns in the UK, a number of issues remain to be further explored. For example, the ultimate success of multifactor models depends on the ability of the model to capture risk completely, but prior research on the UK stock market has not considered industry structure as a source of risk, which may induce errors in variables (EIV) problem in empirical analyses. Moreover, existing studies on the UK stock market often discover inconsistent evidence on the relative importance of size, book-to-market, momentum, leverage and beta in explaining the cross-section of expected returns. It will be worthwhile to examine whether various sets of risk factors remain statistically and economically significant after industry competition is accounted for. Furthermore, different methods of estimating factor risk premiums can lead to quite different characteristics in asset pricing relationship. Therefore, it is important to test the multifactor models using a variety of risk measures and regression techniques.

2. Data and the measurement of industry concentration

2.1. Data

The sample used in this study is an unbalanced panel consisting of 1300 companies publicly listed in the LSE during 1985 and 2010. Data stream classifies each company into an industry based on the firm's primary business activity published by the FTSE Actuaries. There are a total of six levels of industrial classifications. Throughout this paper, we use the most detailed level 6 classification consisting of 88 industries. Appendix provides a description of industry classification.

Consistent with prior studies, we exclude de-listed companies, financial companies (banks, investment trusts, insurance companies, and properties companies), companies that have more than one classification of ordinary shares, and companies with negative

book-to-market-ratio. To ensure that stock prices for listed companies reflect prior accounting information, we extract data on market value of equity, book-to-market ratio, leverage, total assets, and net sales at the end of the fiscal year $t - 1$. We then match stock returns data from July of year t to June of year $t + 1$ with accounting information for fiscal year ending in $t - 1$. In addition, to allow estimation of market beta and post-ranking beta, we require a company to have monthly return data during the previous 3–5 years.

For every sample company in each year, we collect information on the following firm-specific characteristics and accounting variables: (1) *SIZE* is the end-of-year market value of equities; (2) *B/M* is the book value divided by the market value of common equity; (3) *LEV* is the ratio of total debt and equity; (4) *ASSETS* is the book value of total assets; (5) *SALES* is net sales revenue; (6) *R&D* is research and development expense; (7) *R&D/A* is the ratio of *R&D* and total assets.

To calculate the post-ranking beta (*PBETA*), we obtain monthly firm- or industry-level returns or returns from 100 size-beta portfolios constructed based on the methodology of Fama and French (1992) during year t and $t + 1$. We then regress the monthly stock/industry/portfolio returns on market returns over the 12-month period. Finally, we assign the post-ranking beta to each stock/industry/portfolio on an yearly basis so that it has the same beta within the 12-month period.

2.2. Measures of industry concentration

Consistent with Hou and Robinson (2006), Gallagher and Ignatieve (2010), we use the Herfindahl-Hirschman index to measure industry concentration as follows:

$$H_j = \sum_{i=1}^{M} S_{ij}^2, \tag{1}$$

where S_{ij} represents the market share of firm i in industry j for a given year, and M is the number of firms in industry j. For robustness, we compute S_{ij} based on net sales, book value of total assets, and book value of equity, respectively. Thus we have three types of Herfindahl index denoted as *H_SALES*,*H_ASSETS* and *H_EQUITY*. If an industry is concentrated/competitive, the market shares are distributed to a small/large number of firms and the value of the Herfindahl index will be large/small. We calculate H_j every year for each industry, and then average the values over the previous three years to reduce potential errors in measuring industry concentration.

2.3. Descriptive statistics

Table 1 presents summary statistics of three measures of industry concentration for 88 industries between 1985 and 2010. As shown in the table, the average firm in our sample belongs to an industry with mean (median) *H_SALES* of0.3984 (0.3345), *H_ASSETS* of 0.3852 (0.3144) and *H_EQUITY* of 0.3710 (0.2987), which are all lower than the 0.544 (0.490), 0.549 (0.499) and 0.546 (0.502) reported in Hou and Robinson (2006). The results indicate that our sample of the UK firms during 1985 and 2010 face more competition than the sample of US firms during 1962 and 2001.

Although *H_SALES* is on average higher than the other two measures of industry concentration, it has the lowest standard deviation. In addition, the spread in industry concentration is large. The most competitive deciles (lowest 10%) has an average *H_SALES* of 0.1145, while the most concentrated deciles (top 90%) has an average of 0.8438. Furthermore, the Spearman-Pearson correlation matrix indicates that all three measures of industry concentration are highly correlated with each other. The correlation coefficient between *H_ASSETS* and *H_EQUITY* is the largest while the correlation coefficient between *H_SALES* and *H_EQUITY* is the smallest.

3. Industry concentration and industry characteristics

3.1. Industry average characteristics and concentration quintiles

Table 2 reports average firm- and industry-level returns as well as average industry characteristics for each quintile portfolio constructed based on the values of their *H_SALES*. We calculate industry returns at industry level and other characteristics at the firm level, and then average them within each quintile portfolio.

An inspection of the table reveals several interesting findings. First, the mean firm- and industry-level returns decrease from Q1 to Q5, suggesting that firms in low concentration quintiles earn, on average, higher returns than those in high concentration quintiles. The spread in the average firm-level returns between the lowest and highest concentration quintiles is approximately 0.22% per month, or 2.64% per annum. The spread based on the average industry-level returns for the lowest and highest *H_SALES* quintiles is approximately 0.21% per month, or 2.52% per annum. The results are consistent with our conjecture that competitive industries earn, on average, higher returns than concentrated industries. Second, the average firm size, total assets and net sales for concentrated industries are significantly higher than those for competitive industries. Third, the average R&D expenditure increases from £3.64 million for the least concentrated quintile to reach a dramatic £92.5 million for quintile 4, and then decreases to £46.78 million for the most concentrated quintile. Scaling by total assets leads to the same pattern. The results suggest that firms in more competitive industries spend less on innovations.

Finally, firms in the most competitive industries have larger book-to-market equity ratios than those in the most concentrated industries, but there is little differences in leverage ratios across various industry concentrations quintiles. There is no evidence that firms in competitive industries are more risky than those in concentrate industries, because the average post-ranking beta rises from 0.7934 for quintile 1 to 0.8444 for quintile 2, falls to 0.7704 for quintile 4, and then rises to 0.8539 for quintile 5.

Table 1. Summary statistics and correlation matrix for measures of industry concentration

	Summary of industry concentration measures									Spearman-Pearson correlation		
	Mean	Median	SD	Max	Min	10%	25%	75%	90%	*H_SALES*	*H_ASSETS*	*H_EQUITY*
H_SALES	.3984	.3345	.2607	1	0	.1145	.1955	.5302	.8438	1	0.9195	0.8837
H_ASSETS	.3852	.3144	.2642	1	.0459	.0989	.1788	.5259	.8468	0.9197	1	0.9604
H_EQUITY	.3710	.2987	.2653	1	.0436	.0918	.1710	.5040	.8372	0.8837	0.9604	1

Notes: Herfindahl Index is the sum of the squared market shares for all firms in a given industry in a calendar year, and is calculated based on net sales (*H_SALES*), total assets (*H_ASSETS*) and the book value of equity (*H_EQUITY*). The last three columns show the Spearman-Pearson correlation matrix among three measures of industry concentration. Figures above the main diagonal represent the Pearson correlation coefficients, whereas figures below the main diagonal are Spearman rank correlation coefficients.

Table 2. Mean characteristics of H_SALES sorted quintile portfolios

Rank	*H_SALES*	Firm Return	Industry Return	*SIZE*	*ASSETS*	*SALES*	*R&D*	*R&D/A*	*LEV*	*B/M*	*PBETA*
Q1 (Low)	.1185	.0004	.0003	220.8116	241598.6	296767.5	3644.741	.0324	3.2374	.9414	.7934
Q2	.2276	.0015	.0015	481.8460	573222.6	490065.7	6863.404	.0707	3.0265	.7330	.8444
Q3	.3352	–.0012	–.0011	579.9622	839980.3	746634.6	9892.196	.0747	3.0241	.7640	.8306
Q4	.5032	–.0027	–.0026	2157.979	2322140	2496584	92509.74	.0787	3.3921	.8419	.7704
Q5 (High)	.8094	–.0018	–.0018	1768.650	2353596	1398816	46782.13	.0573	3.2701	.7575	.8539

Notes: Quintile 1 refers to the bottom 20% of industries with the lowest concentration ratios, while quintile 5 corresponds to the top 20% of industries with the highest concentration ratios. *SIZE* is the annual market value of equity; *B/M* is the book value divided by the market value of common equity; *LEV* is the ratio of total debt and common equity; *ASSETS* is the book value of total assets; *SALES* is net salesrevenue; *R&D* is research and development expenses; *R&D/A* is the ratio of *R&D* and total assets; *PBETA* is the post-ranking beta calculated according to Fama and French (1992).

3.2. Regressions of industry concentration on industry average characteristics

To explore the relationship between industry concentration and industry average characteristics more fully, we adopt the Fama-MacBeth (1973) approach and conduct our empirical analysis in two steps. In the first step, we estimate the following cross-section regression for each year from 1985 to 2010:

$$H\_SALES_{j,t} = \alpha_t + \sum_{k=1}^{K} \beta_{k,t} X_{k,j,t} + \varepsilon_{j,t}, \quad (2)$$

where $H\_SALES_{j,t}$ is the Herfindahl index based on net sales for industry j in year t, $X_{k,j,t}$ denotes industry average characteristics, including *LNSIZE*, *LNASSETS*, *LNSALES*, *R&D/A*, *LEV*, *LNB/M*and *PBETA*. In the second step, we compute the time-series average of the coefficient estimates as well as their *t*-statistics. Table 3 contains estimation results from the Fama-MacBeth two-step procedure.

As shown in Table 3, firm size, total assets, and net sales are positively related to industry concentration, as the coefficient estimates for *LNSIZE*, *LNASSETS* and *LNSALES* are individually significant at the 1% level, with or without other characteristic

Table 3. Fama and MacBeth regressions of industry concentration on industry average characteristics

Panel A: simple regressions						
LNSIZE	*LNASSETS*	*LNSALES*	*R&D/A*	*LEV*	*LNB/M*	*PBETA*
.01453 *28.55**	.0119 *19.09**	.0030 *5.31**	–.0352 *–0.80*	.0079 *11.72**	–.01570 *–17.95**	.0030 *3.07**
Panel B: multiple regressions						
LNSIZE	*LNASSETS*	*LNSALES*	*R&D/A*	*LEV*	*LNB/M*	*PBETA*
			–.0855 *–2.37**	.01486 *11.97**	–.0399 *–15.18**	–.0020 *–0.58*
.0277 *39.31**			.0451 *0.99*	.0066 *5.73**	–.0266 *–10.03**	–.0333 *–6.83**
	.0266 *36.36**		.0931 *2.01***	.0022 *1.8****	–.0444 *–16.39**	–.0308 *–6.30**
		.0202 *24.69**	.0617 *1.34*	.0052 *4.25**	–.0437 *–15.62**	–.0275 –5.64*
.0110 *2.92**	.0790 *8.39**	–.0657 *–9.66**	–.0432 *–0.80*	–.0010 *–0.43*	–.04217 *–10.64**	–.0359 *–7.60**

Notes: Panel A contains results from bivariate cross-sectional regressions of industry concentration on each of the 7 industry characteristics. Panel B contains results from multiple cross-sectional regressions of industry concentration on a group of characteristic variables. *LNSIZE, LNASSETS,* and *LNSALES* are the logarithms of average firm size, total assets, and net sales, respectively. *R&D/A* is the ratio between R&D expenses and total assets. *LEV, LNB/M,* and *PBETA* are leverage, the logarithm of book-to-market equity ratio, and post ranking beta, respectively. Numbers in *italics* are *t*-statistics. *, **, and *** denote statistically significant at the 1%, 5% and 10% level, respectively.

variables. When we include all 7 variables in one regression, *LNSIZE* and *LNASSETS* remain significantly positive, while *LNSALES* becomes significantly negative, all at the 1% level. The results suggest that firms in concentrated industries have higher market value of equity, book value of assets and net sales than those in competitive industries. In addition, the coefficient estimates for *LEV* are significantly positive at the 1% level in all but the last regressions, and the coefficient estimates for *LNB/M* are significantly negative at the 1% level in all regressions. Therefore, industry concentration is positively related to leverage but negatively related to book-to-market equity, indicating that firms in concentrated industries have higher market value of equity and use more debt than those in competitive industries. Finally, the coefficient estimates for *PBETA* are significantly positive at the 1% level in simple regressions, but are significantly negative at the 1% level in most of the multiple regressions. Taken together, firms in concentrated industries appear to be less risky than those in the competitive industries.

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

4.1. Empirical results based on firm-level regressions

To examine the relationship between industry concentration and the cross-section of stock returns, we implement Fama-MacBeth regressions of monthly individual stock returns on Herfindahl index (based on net sales) and other firm-specific characteristics. In particular, we estimate the following cross-section regression each month from 1985 to 2010:

$$R_i = \gamma_0 + \gamma_1 H\_SALES_i + \gamma_2 LNSIZE_i + \gamma_3 LNB/M_i + \gamma_4 MOMENTUM_i + \gamma_5 PBETA_i + \gamma_6 LEV_i + u_i, \quad (3)$$

where the subscript i denotes firm-level data and the number of companies is 1300; $MOMENTUM_i$ is the past one-year return for each firm; firms within the same Data stream level-6 industry have the same *H_SALES*. We then compute time-series average slope coefficient estimates and their *t*-statistics. Table 4 presents estimation results from Fama-MacBeth regressions of firm-level returns.

As shown in the table, the time-series average coefficient estimates for *H_SALES* are negative and statistically significant at the 5% level, implying that companies operating in concentrated industries earn, on average, lower risk-adjusted returns compared to those operating in competitive industries. The results echo our findings in Section 3.1 in that the mean value of stock returns decreases from the least concentration quintile to the highest concentration quintile. An explanation is that firms in concentrated industries face less competition and less distress risks compared with those in competitive industries.

In addition, there is strong evidence that average stock returns are negatively related to book-to-market equity ratio, as the average coefficient estimates for *LNB/M* are all significantly negative at the 1% level, with or without controlling for other firm characteristics. The results are consistent with Malin and Veeraraghavan (2004), which documents a significant growth effect in the UK stock market.

Table 4. Fama-MacBeth regressions of firm-level returns

H_SALES	*LNSIZE*	*LNB/M*	*MOMENTUM*	*PBETA*	*LEV*
–.0037 *–2.03***					
	.0007 *1.34*				
		–.0064 *–7.22**			
			.0046 *1.32*		
				–.0025 *–.84*	
					–.0008 *–2.43***
	.0004 *1.00*	–.0069 *–7.69**	.0043 *1.25*	–.0040 *–1.28*	–.0015 *–4.89**
–.0050 *–2.76**	–.0001 *–0.26*	–.0068 *–7.09**	.0036 *1.05*		
–.0037 *–2.06***	.0005 *1.14*	–.0069 *–7.78**	.0039552 *1.14*	–.0041 *–1.32*	–.0015 *–4.96**

Notes: This table reports Fama and MacBeth (1973) regression of individual stock returns on *H_SALES* and firm-specific characteristics. Monthly individual firms' returns are regressed on *H_SALES* of the industry which the firm belongs to, and firms-specific characteristics such as *LNSIZE, LNB/M,* and *MOMENTUM* (past 12 months stock returns), *LEV,* and *PBETA*. Cross-sectional regressions are estimated monthly and the time-series *t*-statistics appear in *italic* under the time-series average coefficient estimates of the monthly cross-section regressions. *, **, and *** denote statistically significant at the 1%, 5% and 10% level, respectively.

Moreover, highly levered firms earn, on average, significantly lower returns than low leverage firms, as the coefficient estimates for *LEV* are all significantly negative at the 5% level. The results are consistent with Sivaprasad and Muradoglu (2009), which report significantly negative relationship between leverage and stock returns in the UK. Finally, firm size, momentum and post-ranking beta are unrelated to the cross-section of firm-level returns, as none of the average coefficient estimates for *LNSIZE*, *MOMENTUM* and *PBETA* is statistically significant. The results are consistent with many existing studies of the UK stock market (see, for instance, Miles and Timmermann 1996; Strong and Xu 1997; Al-Horani *et al.* 2003; among others). In contrast, Hou and Robinson (2006) document negative firm size effect and positive momentum effect in the US stock markets. Gallagher and Ignatieve (2010) show that average stock returns are positively related to size and market beta, while unrelated to momentum in Australia.

4.2. Empirical results based on industry-level regressions

To shed more light on the relationship between industry concentration and stock returns, we conduct Fama-MacBeth regressions of monthly industry-level returns on *H_SALES*

and other industry characteristics. The cross-section regression is as follows:

$$R_j = \varphi_0 + \varphi_1 H\_SALES_j + \varphi_2 LNSIZE_j + \varphi_3 LNB/M_j + \varphi_4 MOMENTUM_j + \varphi_5 PBETA_j + \varphi_6 LEV_j + u_j, \quad (4)$$

where the subscript *j* denotes industry-level data and the number of industries is 88. Table 5 contains time-series average slope coefficient estimates and their *t*-statistics from Fama-MacBeth regressions of industry average returns.

Table 5. Fama-MacBeth regressions of industry-level returns

H_SALES	*LNSIZE*	*LNB/M*	*MOMENTUM*	*PBETA*	*LEV*
.0037 *–2.02***					
	.00103 *2.18***				
		–.0048 *–3.28**			
			.02662 *3.07**		
				–.0044 *–1.26*	
					.0004 *0.47*
	.0007 *1.49*	–.0044 *–3.12**	.0181 *2.34***	–.0040 *–1.15*	–.0007 *0.97*
–.0051 *–2.81**	.0007 *1.31*	–.0046 *–2.81**	.0219 *2.55***		
–.0044 *–2.50***	.0009 *1.85****	–.0045 *–3.27**	.0159 *2.05***	–.0044 *–1.26*	–.0006 *–0.98*

Notes: This table reports Fama and MacBeth (1973) regression of industry-level returns on H_SALES and industry average characteristics. Monthly industry average returns are regressed on industry average values of LNSIZE, LNB/M, LEV, and PBETA as well as industry H_SALES index, and the past one year industry portfolio returns MOMENTUM. Cross-sectional regressions are estimated monthly and the time-series t-statistics appear in italic under the time-series average coefficient estimates of the monthly cross-section regressions. *, **, and *** denote statistically significant at the 1%, 5% and 10% level, respectively.

As shown in the table, consistent with firm-level results, the time-series average coefficient estimates for *H_SALES* remain significantly negative at the 5% level, suggesting that concentrated industries earn significantly lower returns than competitive industries. The average coefficient estimates for *LNB/M*are significantly negative at the 1% level, providing strong evidence of a growth effect for the UK industries. The average coefficient estimates for *PBETA* remain statistically insignificant, indicating that market risks are not priced for the cross-section of industry returns.

4.3. Empirical results using beta estimates based on 100 size-beta portfolios

To further examine the robustness of our results, we calculate post-ranking beta (*PBETA*) using 100 size-beta portfolios based on the methodology of Fama and French (1992), and conduct Fama-MacBeth regressions of monthly individual stock returns on industry-level *H_SALES*, portfolio-level *PBETA* and firm-level characteristic variables. In particular, we first sort individual companies according to their firm size into 10 deciles in year *t*. For each size group, we further sort companies according to their pre-ranking beta into 10 deciles. The intersection between 10 size portfolios and 10 beta portfolios gives 100 size-beta portfolios. We then calculate the post-ranking average monthly returns for each of the 100 size-beta portfolios from year *t* to year *t* + 1. We repeat the aforementioned steps in each year for the whole sample period, and estimate the post-ranking betas for each of the 100 size-beta portfolios by regressing the post-ranking average monthly portfolio returns on market returns over the full sample period. For all monthly Fama-MacBeth cross-section regressions, we assign each firm in every 100 size-beta portfolios during entire year *t*a post-ranking portfolio beta corresponding to the firm's portfolio group. Finally, we estimate cross-section regression (3) each month over the entire sample period. Table 6 contains time-series average slope coefficient estimates and their *t*-statistics from Fama-MacBeth regressions of portfolio average returns.

Table 6. Fama-MacBeth regressions of returns on 100 size-beta portfolios

H_SALES	*LNSIZE*	*LNB/M*	*MOMENTUM*	*PBETA*	*LEV*
–.0037 *–2.03***					
	.0006 *1.34*				
		–.0064 *–7.22**			
			.0046 *1.32*		
				–.0034 *–1.19*	
					–.0008 *–2.43***
	.0004 *1.02*	–.0068 *–7.62**	.0052 *1.51*	–.0041 *–1.44*	–.0013 *–4.35**
–.0050 *–2.76**	–.0001 *–0.26*	–.0068 *–7.09**	.0036 *1.05*		
–.0042 *–2.37***	.0005 *1.18*	–.0068 *–7.70**	.0048 *1.39*		–.0013 *–4.39**

Notes: This table reports Fama and MacBeth (1973) regression of firm-level stock returns on *H_SALES*, post-ranking beta (*PBETA*) formed by 100 size-beta portfolios according to Fama and French (2002), and firm-specific characteristic variables. Monthly individual firms' returns are regressed on *H_SALES* of the industry to which the firm belongs, *PBETA*, and firms-specific characteristics such as *LNSIZE, LNB/M,* and *MOMENTUM* and *LEV*. Cross-sectional regressions are estimated monthly and the time-series *t*-statistics appear in *italic* under the time-series average coefficient estimates of the monthly cross-section regressions. *, **, and *** denote statistically significant at the 1%, 5% and 10% level, respectively.

As shown in the table, the results from portfolio-level regressions are almost identical to those from firm-level regressions. In particular, the time-series average coefficient estimates for *H_SALES* are significantly negative at the 5% level with or without other characteristic variables, suggesting that average portfolio returns decrease in industry concentration. The average coefficient estimates for *LNB/M* and *LEV* are all significantly negative, confirming the presence of growth effect and leverage effect in the UK stock market.

Conclusions

In this paper, we empirically examine the relationship between market structure and the cross-section of expected stock returns in the UK stock market. Using data of 1300 companies publicly listed in the LSE during 1985 and 2010, we find that industry concentration is negatively related to the average stock returns in all Fama-MacBeth regressions. In fact, the inclusion of existing risk factors such as beta, firm size, book-to-market, momentum, and leverage does not ruin the ability of industry concentration in explaining the cross-section of average stock returns. Rather, the relationship appears to be strong. The relationship is also robust to firm- and industry-level regressions and the formation of firms into 100 size-beta portfolios. There is a strong evidence that investors of competitive industries in the UK stock market require higher risk premiums to compensate for greater distress risks associated with these industries.

Relying on the structure-conduct-performance (SCP) paradigm in industrial organization, we can provide two risk-based explanations on our findings. First, concentrated industries engage less in innovations and face lower innovation risk compared with competitive industries. Second, concentrated industries have higher barriers to entry, which protects their firms from distress risk. Therefore, investors should anticipate lower risk-adjusted stock returns associated with lower innovation and distress risks in concentrated industries.

The implications for our results are three folds. First, industry structure plays a pivotal role in determining the cross-section of asset returns in the UK. Excess stock returns are compensation for the increased risk to corporate cash flows associated with more intensive market competition. Second, while there is a strong documented value effect for the US stocks, shares in the UK market exhibit significant growth effect. Investors in the UK may have bought growth stocks (low book-to-market stocks) for their high earnings potentials, but overestimated the earnings and performance of this type of assets. Thus, growth stocks are actually more risky than value stocks. Third, while there are negative size effect and positive momentum effect in the US stock markets, firm size and momentum are unrelated to the cross-section of firm-level returns in the UK. The results indicate that large firms dominate concentrated industries and small firm premium can be subsumed by concentration premium.

Although we obtain some interesting findings in this paper, several extensions remain possible. First, it should be of interest to investigate whether industry concentration premium can explain the time-series variation of stock returns in the UK. Second, a major

limitation is that we only use Herfindahl index based on net sales to measure industry concentration, which can be imprecise especially when survivorship bias and sample selection bias are present. It might be necessary to use other measures such as entropy index and Lerner index to test the robustness of our results. Third, the sample used in this study only covers firms listed in the LSE. Further research can use more distinctive data under other institutional settings.

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APPENDIX

Description of industries classification

Datastream classifies each company into an industry based on the firm's primary business activity published by the FTSE Actuaries. There are a total of six levels of industrial classifications. Throughout this study, we use the most detailed level 6 classification consisting of 82 industries.

Table 7. Industries name

Aerospace	Exploration & Prod.	Paper
Airlines	Farming & Fishing	Personal Products
Alt. Electricity	Fixed Line Telecom.	Pharmaceuticals
Alternative Fuels	Food Products	Plat.& Precious Metal
Apparel Retailers	Food Retail, Wholesale	Publishing
Auto Parts	Footwear	Recreational Products
Biotechnology	Forestry	Recreational Services
Brewers	Furnishings	Renewable Energy Eq.
Broadcast & Entertain	Gas Distribution	Restaurants & Bars
Broadline Retailers	General Mining	Semiconductors
Building Mat.& Fix.	Gold Mining	Soft Drinks
Bus.Train& Employment	Healthcare Providers	Software
Business Support Svs.	Heavy Construction	Spec. Consumer Service
Clothing & Accessory	Home Construction	Specialty Chemicals
Coal	Home Improvement Ret.	Specialty Retailers
Comm. Vehicles, Trucks	Hotels	Telecom. Equipment
Computer Hardware	Industrial Machinery	Tobacco
Computer Services	Industrial Suppliers	Toys
Con. Electricity	Integrated Oil & Gas	Transport Services
Consumer Electronics	Internet	Travel & Tourism
Containers & Package	Iron & Steel	Waste, Disposal Svs.
Defence	Marine Transportation	Water
Delivery Services	Media Agencies	
Diamonds & Gemstones	Medical Equipment	
Distillers & Vintners	Medical Supplies	
Divers. Industrials	Mobile Telecom.	
Drug Retailers	Multiutilities	
Dur. Household Prod.	Nondur. Household Prod.	
Electrical Equipment	Nonferrous Metals	
Electronic Equipment	Oil Equip. & Services	

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