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March 2010

Online at <http://mpra.ub.uni-muenchen.de/28440/>
MPRA Paper No. 28440, posted 27. January 2011 / 14:32

Industry Concentration and the Cross-section of Stock Returns:

Evidence from the UK

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***Abstract:** In this paper, I examine the relationship between industry concentration and the cross-section of stock returns in the London Stock Exchange between 1985 and 2010. Using Multifactor asset pricing theory, I test whether industry concentration is a new asset pricing factor in addition to conventional risk factors such as beta, firm size, book-to-market ratio, momentum, and leverage. I find that industry concentration is negatively related to the expected stock returns in all Fama and MacBeth cross-sectional regressions. In addition, the negative relationship between industry concentration and expected stock returns remain significantly negative after beta, size, book-to-market, momentum, and leverage are included, while beta is never significant. The results are robust to firm- and industry-level regressions and the formation of firms into 100 size-beta portfolios. The findings indicate that competitive industries earn, on average, higher risk-adjusted returns compared to concentrated industries which is consistent with Schumpeter's concept of creative destruction.*

Keywords: Industry concentration, Stock returns, Multifactor asset pricing theory, Competitive industries, Concentrated industries, Creative destruction, London Stock Exchange

1. Introduction

Many studies in asset pricing literature document different risk factors that explain stock returns. Starting with rational theories in asset pricing, the traditional approach to explain stock returns is to determine the source of risk factors supported by theoretical assumptions. Examples of rational asset pricing theories include Capital Asset Pricing Model (CAPM) by Sharpe and Lintner (1964-5), Intertemporal Capital Asset Pricing Model (ICAPM) by Merton (1973a), and Arbitrage Pricing Theory (APT) by Ross (1976). In addition, Berk (1995) advances theoretical assumptions to justify the ability of market capitalisation in explaining expected stock returns.

However, empirical studies in asset pricing indicate contradictory empirical results with rational asset pricing theories, signifying either market inefficiency or possibility of essential errors in rational asset pricing models. In addition, most empirical studies in asset pricing show that firm-specific characteristics can proxy for various risk factors that explain stock returns. For instance, Basu (1977) reports that firms with high earning-to-price ratios (E/P) earn higher abnormal returns. In addition, Banz (1981) documents a size effect, noting that small firm size tends to earn higher returns compared to large firm size. In 1985, Rosenberg, Reid, and Lanstein observe the existence of value effect (Book-to-Market) in the US stock market, acknowledging that firms with high book-to-market value earn higher abnormal returns. Fama and French (1992) assess the joint effects of previous factors in one model, documenting the existence of both size and book-to-market effects. In 1993, Fama and French report their well-known three-factor model: size (SMB) (small minus big size portfolios), value (HML) (high minus low value portfolios) and excess returns on market portfolios. However, Black (1993), Kothari, Shanken, and Sloan (1995), and Shumway (1997) point out that Fama and French models suffer from data snooping and survivorship

bias. Barber and Lyon (1997) conclude that Fama and French three-factor model is valid and the results are conducted using biasfree data. Other authors, including Jegadeesh and Titman (1993), Lakonishok, Shleifer, and Vishny (1994) show the existence of momentum and value stock strategies in the US market.

In addition to aforementioned risk factors, there are various potential reasons why the structure of products markets may influence the cross-section of stock returns. For instance, firms generate cash flows through their product markets. Moreover, firms' production decisions are based on the equilibrium of product markets. Therefore, firms' production decisions which are based on a specific market structure may affect the risk of firms' cash flows and consequently the firms' equilibrium rate of returns (Hou and Robinson, 2006). Recent asset pricing studies in the UK by Hou and Robinson (2006) and in Australia by Gallagher and Ignatiev (2010) demonstrate that industry concentration can explain stock returns through the channel of distress risk. In their study, Hou and Robinson (2006) prove that industry concentration premium includes independent information in explaining the cross-section of stock returns. Similarly, Gallagher and Ignatiev (2010) verify that industry concentration premium can partly include information about the cross-section of stock returns which is already spanned by other risk factors such as conventional size and book-to-market ratio.

Although Hou and Robinson (2006), and Gallagher and Ignatiev (2010) show that industry concentration is a priced risk factor in both the US and Australian markets respectively, existing studies in asset pricing have not used industry concentration as a new pricing factor in the UK stock market. Therefore, in this study, I present first out-of-sample support from the US and Australian markets applied to the UK market. Moreover, I test whether industry concentration is a new risk factor in addition to conventional stock market anomalies and risk factors using data from the UK. Mainly, I argue that if industry

concentration has different risk characteristics compared to other risk factors and stock market anomalies, I should anticipate that the inclusion of industry concentration in an asset pricing model will enhance the explanatory power of this model in explaining the cross-section of stock returns.

The motives for using data from the UK data are summarized as follows. First, existing asset pricing literature in the UK pays far too little attention in examining whether industry concentration can explain stock returns. Second, the UK empirical asset pricing literature documents contradictory results compared to the US literature and entails contrary findings. For instance, Fama and French (1992-3), and Jegadeesh and Titman (1993) support the existence of size effect in the US market. Contrary, Miles and Timmermann (1995), and Strong and Xu (1997) argue that size effect does not exist in the UK stock market, while Charitou and Constantinidi (2003), Leledakis, Davidson, and Smith (2004) indicate that size effect is active in the UK stock market. Third, given the differences in the UK-US empirical asset pricing literature, the UK is a large open economy and has similar characteristics in terms of market structure compared to the US. Therefore, I intend to test the robustness of the relationship between industry concentration and stock returns established in the US by using data from the UK market.

In this study, I also aim to shed additional light on the answers to the following questions. First, what determines the cross-section of stock returns in the UK stock market? Second, can industry concentration be a new risk factor in addition to conventional stock market anomalies and other risk factors? Third, will the results of industry concentration remain significant in explaining the cross-section of stock returns when beta, size, book-to-market, momentum, and leverage are accounted for? Forth, will the results of industry concentration remain robust to firm-and industry-level regressions and the formation of firms into 100 size-beta portfolios?

Consistent with Hou and Robson (2006) study in the US, I find that industry concentration is negatively related to the expected stock returns in all Fama and MacBeth cross-sectional regressions. In addition, the negative relationship between industry concentration and expected stock returns remain significantly negative after beta, size, book-to-market, momentum, and leverage are accounted for, while beta is never significant. The results are robust to firm- and industry-level regressions and the formation of firms into 100 size-beta portfolios. The findings indicate that competitive industries earn, on average, higher returns compared to concentrated industries which is consistent with Schumpeter's concept of creative destruction.

The overall structure of this paper is as follows. Section 2 discusses the literature the review and develops the hypotheses. Section 3 describes the data, the variables, the measurements of industry concentration, and presents descriptive statistics on the measurements of industry concentration. Section 4 reports industry average characteristics across industry concentration quintile portfolios. Section 4 also carries out Fama and MacBeth cross-section regression to account for the correlation between the cross-section of industry concentration and industry average characteristics. Section 5 applies Fama and MacBeth cross-section regression to examine the relationship between industry concentration and the cross-section of stock returns using firm-and-industry level regressions the formation of firms into 100 size-beta portfolios. Section 6 concludes and recommends areas for further research.

2. Literature Review and Hypotheses Development

Prior US asset pricing literature determines different risk factors that explain stock returns. For instance, Fama and French (1992) use earning-to-price ratio, book-to-market ratio, leverage, beta, and firm size as explanatory factors in describing the cross-section of stock returns. The findings confirm that the cross-section of stock returns appear to be significantly explained by firm size and book-to-market ratio. In 1993, Fama and French report their well-known three-factor model including size (SMB) (small minus big size portfolios), value (HML) (high minus low value portfolios), and excess returns on market portfolios. Fama and French (1993) find that market excess returns and other risk factors associated with size and book-to-market have an important role in explaining the time-series variation of stock returns.

Black (1993), Kothari, Shanken, and Sloan (1995), and Shumway (1997) document that Fama and French' data suffer from data snooping and survivorship bias. Conversely, Barber and Lyon (1997) conclude that Fama and French three-factor model is valid and the results are conducted using biasfree data. Moreover, Lewellen (1999) tests the predictability of stock returns using time-series technique in the US stock markets and finds that book-to-market value predicts expected stock returns, and the three-factor model can interpret the time-series variations in expected returns.

Jegadeesh and Titman (1993) report the existence of momentum strategies in the US stock market. Lakonishok, Shleifer, and Vishny (1994), Chen and Zhang (1998) show that stocks with high value of book-to-market ratios earn higher returns compared to stock with low value book-to-market ratios according to value strategies. With regard to size and book-to-market risk factors, He and Ng (1994) find that that both size and book-to-market detect different risk features that are crucial in asset pricing. Moreover, Daniel and Titman (1997) point out that firm size and book-to-market ratio are procurators of the distress risk and the

latter pushes stock returns to move. Davis, Fama, & French (2000) conclude that book-to-market ratio does a better job compared to firm size in explaining the cross-section of stock returns. Hawawini and Keim (1998) argue that firm size, book-to-market ratio, and dividend yield can explain average stock returns, while beta of CAPM does not explain the cross-section of stock returns. Gutierrez (2001) examines whether size or book-to-market is a proxy for distress risk and finds that size effect has the highest chance to be associated with distress risk if compared to book-to-market in case of stock and bond pricing. With regard to leverage, Korteweg (2004), and Dimitrov and Jain (2006) test the role of financial leverage in explaining the cross-section of stock returns in the US stock market, and find that there exists a negative relationship between stock returns and highly leveraged firms

In contrast to US asset pricing literature, the UK empirical asset pricing studies are not voluminous and appear to be contradictory compared to the US studies. For instance, while value, size, and momentum effects appear in the US empirical studies (e.g., Fama and French 1992, Jegadeesh and Titman 1993); the UK empirical studies remain ambiguous to document the effects of different stock market anomalies. Particularly, Miles and Timmermann (1995), Strong and Xu (1997), Malin and Veeraraghavan (2004) and others show that size effect does not exist. Other researchers including Charitou and Constantinidi (2003), and Leledakis, Davidson, and Smith (2004) find that size effect exists. In terms of momentum effect, Liu, Strong, and Xu (1999) indicate that momentum effect plays a vital role in the UK stock exchange. However, Hon and Tonks (2003) reveal that momentum effect is not a general feature of the UK stock market.

Gregory, Harris, and Michou (2001) examine the investment strategy of buying value stocks and selling glamour stocks and find that stocks with high book-to-market ratios earn on average higher returns compared to stock with low book-to-market ratios. Dimson, Nagel, and Quinley (2003) show that value premium has existed across small and large market

capitalisation (firm size) in explaining the cross-section of stock returns. With regard to leverage, Muradoglu and Whittington (2001) find inverse relationship between leverage and stock returns, contradicting the hypothesis of Modigliani-Miller assumption 2 which states that average stock returns should increase in the existence of financial leverage. Sivaprasad and Muradoglu (2009) find positive and significant relationship between leverage and average stock returns the Utilities sector; while the relationship appears to be negative and significant in other sectors such as Consumer Goods, Consumer Services, and Industrial sectors.

Hung, Shackleton and Xu (2004) show that the beta of CAPM and Fama-French three-factor model can explain stock returns in the UK stock market. The authors find that CAPM and Fama and French model hold in the UK stock market. However, Malin and Veeraraghavan (2004) show the existence of big size effect and growth effect (low book-to-market). The results contradict the Fama and French three-factor model findings that indicate the existence of small size and value stock effects. Moreover, Yurtsever and Zahor (2007) demonstrate that the capital asset pricing model (CAPM) does not hold and is not applicable in the UK stock market. Michou, Mouselli, and Stark (2007) also find that Fama and French (1993) cannot detect perfectly risk premium, since the constant term is significantly different from zero.

Accounting for different risk factors in the UK stock market will provide precise results in capturing the cross-section of stock returns. Therefore, I test whether industry concentration is a new risk factor in addition to other risk factors and stock market anomalies. I argue that if industry concentration captures the cross-section of stock returns; firms in concentrated industries should earn, on average, lower returns compared to firms in competitive industries.

In order to derive the risk-based link between industry concentration and average stock returns, I use some theories in industrial organisations and identify the sources of risk forces where the structures of product markets may affect average stock returns. Particularly, theories in industrial organisations specify two main channels where the structure of product markets may influence stock returns. Those channels are based on the following hypotheses: creative destruction hypothesis and barriers to entry hypothesis (e.g., Hou and Robinson, 2006). The first hypothesis concerning creative destruction is related to innovation risk. In particular, Schumpeter's creative destruction hypothesis (1912) states that competitive industries are more likely to engage in innovation compared to concentrated industries. Therefore, if innovation is risky, and if this risk is priced in financial markets; then competitive industries should earn, on average, higher returns compared to concentrated industries. I illustrate the relationship between the structure of product markets and stock returns through the channel of innovation risk as below.

Competitive industries → more innovations → higher risks → higher returns

The second hypothesis is the barriers to entry which is related to distress risk. The hypothesis states that if barriers to entry in product markets affect firms, I should expect distress risk to fluctuate with market structure. That is, if barriers to entry in product markets expose some firms to aggregate demand shocks, while protecting other firms, then I would anticipate distress risk to fluctuate with market structure. For instance, in concentrated industries where the barrier to entry is high; the increase in demand shocks will lead the firms in concentrated industries either to increase their prices or production to meet this increasing demand without having the risk of new firms' entry (high barrier to entry restrictions in concentrated industries). The subsequent implications of this reaction will appear as an increase in the firms' long-term expected profitability. Accordingly, firms will use this high rate of profitability in the case of economic down-turn. That is, these firms in concentrated

industries will have the ability not to exist from the market in the case of economic downturn. As a result, if the priced risks induced by the increase in demand shocks are related to concept of exit from the industries, the concentrated industries will have low degree of distress risks. In other words, the less distress the risks concentrated firms encounter, the less the average returns the concentrated firms expect. This hypothesis can be illustrated:

Concentrated industries → high barriers to entry → high profitability → ability not to exit from the industry (in the case of economic downturn) → less distress risks → less rate of returns.

3. Data and the Measurement of Industry Concentration

3.1. The Measurement of Industry Concentration

I follow Hou and Robison (2006) in using the Herfindahl index to measure industry concentration and link it to the cross-section of stock returns. Church and Ware (2000:429) show how to calculate industry concentration by using Herfindahl-Hirschman index as follows:

$$H_j = \sum_{i=1}^I S_{ij}^2$$

Where:

H_j represents the sum squares of market shares for a firm (i) in the industry (j) for a given year. I conduct Herfindahl index using net sales, total assets, and book value of equity. I refer to the previous types of Herfindahl index as $H(Sales)$, $H(Assets)$, and $H(Equity)$. If the value of Herfindahl index is high, the market shares will be distributed to small number of firms, indicating that the industry is concentrated. On the other hand, if the index has a small value, the market shares will be distributed to a large number of firms, indicating that the industry is more competitive.

3.2. Data and Descriptive Statistics

In this study, I use publicly listed companies from the London Stock Exchange (LSE) between 1985 and 2010 to examine the relationship between industry concentration and the cross-section of stock returns. I collect both accounting data and monthly return data from *DataStream*. For each publicly listed company, *DataStream* includes information on share prices, accounting ratios, company name, and industry classification code level 6. Variables on accounting and firm-specific characteristics data include: Firm Size (*SIZE*) is defined as annual market value of equity, which is calculated as share price multiplied by the number of ordinary shares in issue, Book-to-market ratio (*B/M*) is calculated as the balance sheet value of the ordinary (common) equity divided by the market value of ordinary (common) equity, Total Assets (*ASSETS*), Net Sales or revenue (*SALES*), Research and Development Expenses (*R&D*), Research and Development Expenses to Sales (*R&D/SALES*), Research and Development Expenses to Total Assets (*R&D/A*), Leverage (*LEV*) is defined as total debt to common equity, and Fama and French (1992) post ranking Beta (*Post. Beta*).

I follow Miles and Timmermann (1995), Strong and Xu (1997), Al-Horani, Pope, and Stark 2003, and Michou, Mouselli, and Stark (2007) in selecting the sample. In addition, I include in the sample all publicly listed companies in the London Stock Exchange (LSE). Moreover, I include listed companies in the sample in year t if data on market value of equity and book value of equity are available for the financial year ending in calendar year t , and if data on share prices are available for previous 36 month prior of July of calendar year $t+1$. I 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. I also exclude firms that do not have previous 36 month returns to calculate post ranking beta. The total number of listed firms in the sample is 1300 and the total number of industries is 88.

Table 1 reports descriptive statistics of industry concentration measurements for all 88 industries that I use in this research. In my analysis, I calculate Herfindahl Index as the sum square of market shares for the firms in a given industry in each single year. I use net sales $H(Sales)$, total assets $H(Assets)$, and book equity $H(Equity)$ to construct Herfindahl Index.

From Table 1, I observe that the mean value of $H(Sales)$ is (0.3988) and slightly higher compared to the mean values of other concentration measurements: (0.3852) for $H(Assets)$ and (0.3709) for $H(Equity)$. While $H(sales)$ ranges between (0) (indicating competition drives the industry) and (1) (indicating high level of concentration among firms), $H(assets)$ and $H(Equity)$ range between (0.045907) and (1), (0.043607) and (1) respectively. In addition, 75% of $H(Sales)$ observations range between (0) and (0.5302), while 75% of both $H(Assets)$ and $H(Equity)$ range between (0.045907) and (0.5259), (0.043607) and (0.504) respectively. However, the Spearman- Pearson correlation matrix represented by the last three columns in Table 1 indicates that $H(Assets)$ and $H(Equity)$ are highly correlated with correlation of (0.9604). Moreover, while $H(Sales)$ is highly correlated with $H(Assets)$ with correlation of (0.9197), correlation for $H(Sales)$ with $H(equity)$ decreases to (0.8837).

Table 1 Descriptive Statistics

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)	.3988639	.3344858	.260666	1	0	.11454	.1955	.5302	.84378	1	0.9195	0.8837
H(Assets)	.3852407	.3143526	.264169	1	.045907	.0989	.1788	.5259	.84678	0.9197	1	0.9604
H(Equity)	.3709617	.2986895	.265331	1	.043607	.09177	.171	.504	.8372	0.8837	0.9604	1

Table 1 presents descriptive statistics of industry concentration measurements. I calculate Herfindahl Index as the sum square of market shares for the firms in a given industry in each single year. I use net sales H (*Sales*), total assets H (*Assets*), and book equity H (*Equity*) to construct Herfindahl Index. The last three columns in Panel (A) show the Spearman- Pearson correlation matrix among different concentration measures.

4. Industry Concentration and Industry Characteristic

4.1 Industry Average Characteristics and Concentration Quintiles

In this section, I form Concentration Quintiles based on Herfindahl index H (*Sales*) using net sales in each year (Table 2). Quintile (1) is equivalent to the 20% of the industries with the lowest concentration, while quintile (5) corresponds to the 20% of the industries with the highest concentration. Then, according to each quintile from (1 to 5), I report firms and industry levels returns as well as industry average characteristics. Firm level returns and industry average characteristics are calculated at firm level and consequently averaged within each of the concentration Quintile portfolios, while industry level returns are calculated at industry level and then averaged within each of the concentration Quintile portfolios. This will help to give an indication about the characteristics of the sorted portfolios based on concentration Quintiles. Variables on industry characteristics will include: Firm Size (*SIZE*), Total Assets (*ASSETS*), Net Sales (*SALES*), research and development expenses (*R&D*), Research and Development Expenses to Sales (*R&D/SALES*), Research and Development Expenses to Total Assets (*R&D/A*), Leverage (*LEV*), Book-to-Market ratio (*B/M*), and Fama and French (1992) post ranking Beta (*Post. Beta*).

Table 2 Industry Average Characteristics and Concentration Quintiles

Industry Mean Characteristics across H(Sales) Sorted Quintile Portfolios												
Rank	H(Sales)	Fir Ret	Ind. Ret	Size	Assets	Sales	R&D	R&D/Sales	R&D/A	Lev.	B/M	Post.Beta
Low	.118529	.0003998	.0003135	220.8116	241598.6	296767.5	3644.741	42.49226	.0323811	3.237415	.9413545	.7933587
Q2	.2276496	.0014769	.0014524	481.846	573222.6	490065.7	6863.404	26.37399	.0707379	3.026455	.7329813	.844444
Q3	.3351732	-.001212	-.001122	579.9622	839980.3	746634.6	9892.196	202.0061	.0747343	3.024124	.7640258	.8306208
Q4	.5032425	-.002666	-.002648	2157.979	2322140	2496584	92509.74	382.2384	.0787082	3.392106	.8419025	.7703922
High	.8094307	-.001833	-.001822	1768.65	2353596	1398816	46782.13	285.0641	.0572807	3.270083	.757451	.8539171

Table 2 above reports industry average characteristics across H (Sales) sorted quintile portfolios. Quintile (1) is equivalent to the 20% of the industries with the lowest concentration, while quintile (5) corresponds to the 20% of the industries with the highest concentration.

From Table 2, I find that the mean returns on firm level are decreasing across concentration Quintiles. For instance, while the mean returns on firm level for both (Quintile 1) and (Quintile 2) are positive (.03998% and .14769% respectively), the mean returns for Quintiles 3, 4, and 5 are negative (-.1212%, -.2666% and -.1833% respectively), indicating that the mean returns for firms across concentration Quintiles significantly decrease. Although the mean returns of firm level increase between Quintile 1 and Quintile 2 from .03998% to 0.14769% respectively, the mean returns on Quintiles 1 and 2 are positive compared to the mean returns in Quintiles 3, 4, and 5, indicating that the companies in the highest concentration Quintiles (Quintiles 3,4,and 5) witness negative mean returns. This in turn validates the assumption that companies in low concentration Quintiles earn, on average, higher returns compared to companies in higher concentration Quintiles. Therefore, an inference can be made stating that the mean returns for individual stocks have decreased significantly when I move from competitive industries (low concentration Quintile) to more concentrated industries (higher concentration Quintile). This, in turn, lead to an initial conclusion stating that the highest concentrated industries earn, on average, lower returns compared to less concentrated industries. I also conclude that the industry concentration seems to be negatively related to average returns in the sample between 1985 and 2010. Accordingly, when the industry is concentrated, the average stock returns decrease. Generally, the concentration effect seems to be active in the London Stock Exchange (LSE) during the period of the study.

Similarly, the industry level returns across concentration Quintiles appear to be positive at the first two Quintiles (Quintiles 1 and 2), whereas the mean returns at industry level are negative for the subsequent Quintiles (3, 4, and 5). For instance, the mean returns at industry level slightly increase from Quintile 1 to Quintile 2 from .03135% to .14524%. However, subsequent Quintiles show that the mean returns at industry level decrease to reach

-.1122%, -.2648%, and -.1822% for Quintiles 3, 4, and 5 respectively. This in turn supports the assumption that industries that are highly competitive (low concentrated) earn, on average, higher returns compared to industries that are highly concentrated. Therefore, both firm and industry levels returns are associated with the degree of competition and concentration. In other words, an inference can be made stating that not only the mean returns for individual stocks decrease across concentration Quintiles, but also industry average return do.

The average size, assets, and net sales are higher for the most concentrated industries compared to highly competitive industries. For instance, the average size for both Quintile 4 and 5 are 2157.979 and 1768.65 respectively and are higher compared to Quintiles 1, 2, and 3 that show average size of 220.8116, 481.846, and 579.9622 respectively. Moreover, the average total assets increase significantly to reach 2322140, and 2353596 at Quintile 4, and 5 respectively, whereas the average total assets at Quintile 1, 2 are 241598.6 and 573222.6. Likewise, average net sales witness significant increase across concentration Quintiles to reach 1398816 at Quintile 5. Overall, I observe that the firms in concentrated industries seem to be large firms (*Size*) with high values of total assets (*Assets*) and larger revenues(*Sales*).

The average Research and Development expenditures (*R&D*) increase across concentration Quintiles from £ 3.64 Million in Quintile 1 to reach £ 92.5 Million in Quintiles 4 and then decrease to reach £ 46.78 Million in Quintile 5 (the most concentrated industries). Following the same direction, R&D to sales (*R&D/S*) and research and R&D to total assets (*R&D/A*) increase throughout concentration Quintiles 1 to 5.

Leverage for highly concentrated industries (Quintiles 4 and 5) appear to be higher compared with low concentrated industries (Quintiles 1 and 2). The average leverage ratio for competitive industries in Quintile 1 is 3.2374, while the average leverage ratio increases to

reach 3.39 and 3.27 in both concentration Quintiles 4 and 5 consequently. The average value of book-to-market ratio (B/M) decreases from 0.9414 in Quintile 1 to 0.7575 in Quintile 5, indicating that the average book-to-market ratio is lower for more concentrated industries compared to higher competitive industries. That is, in the case of highly concentrated industries, the market values of equity are high compared to their book values. Consequently, highly concentrated industries have lower book-to-market ratios, provided that companies in similar Quintiles have similar book values of equity. Since less risky investments are more likely to have higher market values of equity, companies in highly concentrated industries are less risky compared to companies in highly competitive industries. Finally, the average betas increase across concentration Quintiles. For instance, the average betas increase from 0.7933 in Quintile 1 to reach 0.8306 in Quintile 3, and 0.8539 in Quintile 5.

4.2. Cross-section Regression of H (Sales) on Industry Average Characteristics:

To account for the correlation between the cross-section of industry concentration and average industry characteristics, I apply Fama and MacBeth cross-sectional regression (1973). Therefore, I follow Hou and Robinson (2006) in estimating the following model:

$$H(Sales)_{jt} = \alpha_t + \sum_{n=1}^N \lambda_{nt} X_{jt} + \varepsilon_{jt} \quad (\text{Hou and Robinson, 2006:1936})$$

Where:

$H(Sales)$ is the Herfindahl Index used as a proxy for industry concentration.

X_{jt} is the industry average characteristics, including different industry characteristics ratios as reported in Table 2.

I estimate Fama and MacBeth cross-section regression (single and multiple) for each year (annual basis) during the period of study. I also report T-statistics accompanied with the time-series averages of the yearly cross-sectional coefficients for the simple and multiple regressions (for each variable and for a group of variables). This will help to account for the

simple and conditional correlations respectively between industry concentration and average industry characteristics. In addition, Fama and MacBeth cross-sectional regression' tests are very helpful with respect to analysing the multiple correlations between the industry concentration and the average industry characteristics. Moreover, the Fama and MacBeth (1973)' tests are robust in conducting the cross-correlation of the residuals.

Panel (A) of Table 3 shows the results from Fama and MacBeth (1973) Cross-section Regressions of Industry concentration measurement H (Sales) on each of industry characteristics (Simple Regressions). Panel (B) of Table 3 shows the results of Fama and MacBeth Cross-section Regression of industry concentration measurement on multiple industry characteristics in which multiple industry characteristics are included as independent variables concurrently. The time series test statistics are reported in *italic* under the time-series averages of the yearly cross-sectional coefficients for the simple and multiple regressions.

Table 3 Fama and MacBeth Regressions of H (Sales) on Industry Average Characteristics

Panel A: Simple Regressions						
Ln(Size)	Ln(Assets)	Ln(Sales)	R&D/A	Lev.	Ln(B/M)	PostBeta
.0145283	.0119131	.0029929	-.035216	.007924	-.0156958	.0029629
28.55*	19.09*	5.31*	-0.80	11.72*	-17.95*	3.07*
Panel B: Multiple Regressions						
Ln(Size)	Ln(Assets)	Ln(Sales)	R&D/A	Lev.	Ln(B/M)	PostBeta
			-.0855476	.0148575	-.0398782	-.0020253
			-2.37*	11.97*	-15.18*	-0.58
.027685			.0451302	.0066083	-.0266408	-.0333
39.31*			0.99	5.73*	-10.03*	-6.83*
	.0266077		.0930626	.002171	-.0443531	-.0308
	36.36*		2.01**	1.8***	-16.39*	-6.30*
		.0202161	.0617377	.0051784	-.0436781	-.0274931
		24.69*	1.34	4.25*	-15.62*	-5.64*
.0110126	.0789912	-.0656835	-.0431959	-.0010494	-.0421686	-.0358695
2.92*	8.39*	-9.66*	-0.80	-0.43	-10.64*	-7.60*

*(significant at 1%) ** (significant at 5%) *** (Significant at 10%)

When I combine Descriptive Statistics in Table 2 with Fama and MacBeth cross-section regressions in Table 3, I observe that the natural logarithms of firm size, total assets, and net sales are significantly and positively related to industry concentration measurement *H (Sales)* at 1% level of significance in simple regression. Moreover, the positive effects of size, total assets, and net sales remain positively significant after accounting for industry characteristics including research and development to total assets (*R&D/A*), Leverage (*Lev.*), natural logarithm of book-to-market ratio *Ln (B/M)*, and post ranking beta (*PostBeta*). However, when all variables are accounted for in the last row of Table 3, the natural logarithm of net sales becomes significantly negative a 1% level of significance with

a test statistics of (-9.66). The effect of $(R\&D/A)$ on industry concentration is insignificant in simple and multiple regressions (when I control for all variables). However, depending on the control variables, the effect of $(R\&D/A)$ is negative and significant at 1% level of significance after accounting Leverage ($Lev.$), $Ln(B/M)$, and post ranking beta ($PostBeta$). On the other hand, when the natural logarithm of total assets is accounted for in addition to aforementioned control variables, $(R\&D/A)$ seems to be positively and significantly related to $H(Sales)$. While positive effect of $(R\&D/A)$ on $H(Sales)$ indicates that highly concentrated industries involve in risky innovations, the impact of $(R\&D/A)$ on $H(Sales)$ is not clear when different control variables are accounted for.

The effect of leverage on industry concentration is positive and significant in both single and multiple regressions. Accounting for different variables, the leverage effect remains significantly positive except in the case of all control variables are accounted for where the leverage effect becomes insignificant (see the last row of Table 3). Positive effect of leverage on industry concentration measurement $H(Sales)$ indicates that highly concentrated industries use debts to fund investments. Looking at natural logarithm of book-to-market ratio $Ln(B/M)$, the effect of $Ln(B/M)$ on industry concentration $H(Sales)$ is significantly negative in both simple and multiple regressions at 1% level of significance in reported regressions. This indicates that highly concentrated industries are less risky compared to more competitive industries. Finally, the effect of beta on industry concentration appears to be positive in simple regression. However, when other variables are accounted for, the beta effect on industry concentration is negatively significant, indicating that highly concentrated are less risky in comparison with more competitive industries.

5. Industry Concentration and the Cross-section of Stock Returns

5.1. Empirical Results Based on Firm Level Regressions

To test the relationship between industry concentration and the cross-section of stock returns without using Quintiles limits, I perform Fama and MacBeth (FM) (1973) cross-sectional regression. In applying Fama and MacBeth (1973) cross-sectional regression, I use firm level to test the relationship between industry concentration and average stock returns. Therefore, I carry out this test by regressing monthly stock returns for individual stocks (*Ret*) on the following factors: the industry concentration measurement $H(Sales)$, the natural logarithm of annual market value of equity for individual firms $Ln(size)$, the natural logarithm of book-to-market ratio $Ln(B/M)$, momentum, beta on the market portfolios for individual stocks (*Beta*), and leverage (*Lev.*).

I implement (FM) test on each aforementioned factor (individually) and by adding other factors gradually. In Fama and MacBeth (1972) cross-section regression, the cross-section regression is estimated in each single period by averaging the value of the slope coefficient estimates from the previous step in order to get the final coefficients estimates. The Fama and MacBeth cross-section regressions (1973) are implemented on individual stocks over a period of 25 years from 1985 to 2010 in the London Stock Exchange (LSE). The number of companies in different industries is 1300 companies. Using the time-series of monthly returns, in each month, I run a cross-section regression on 1300 firms as follows:

$$\bar{R}_i = \gamma_0 + \gamma_1 H(Sales) + \gamma_2 Ln(Size) + \gamma_3 Ln(B/M) + \gamma_4 Momentum + \gamma_5 Beta + \gamma_6 Leverage + \nu_i$$

The regression is implemented each month for 25 years. Some gaps in the data have existed, since I use unbalanced panel data. Therefore, the research has time-series of 298 (months) of each cross-section parameter γ_i . The average test statistics with the average

time-series coefficients are reported in the regression results. Table 4 shows Fama and MacBeth cross-sectional regression (1973) applied on firm level.

Table 4 Fama-Macbeth Cross-Sectional Regressions of Firm-Level Returns

Firm-Level Regressions					
H(Sales)	Ln(Size)	Ln(B/M)	Momentum	Beta	Leverage
-.0037452					
<i>-2.03**</i>					
	.0006267				
	<i>1.34</i>				
		-.0064298			
		<i>-7.22*</i>			
			.0046084		
			<i>1.32</i>		
				-.0024565	
				<i>-.84</i>	
					-.0008108
					<i>-2.43**</i>
	.0004476	-.006898	.0043183	-.004032	-.0014895
	<i>1.00</i>	<i>-7.69*</i>	<i>1.25</i>	<i>-1.28</i>	<i>-4.89*</i>
-.005036	-.000128	-.006833	.0036097		
<i>-2.76*</i>	<i>-0.26</i>	<i>-7.09*</i>	<i>1.05</i>		
-.0036981	.0005134	-.006929	.0039552	-.0041186	-.0015
<i>-2.06**</i>	<i>1.14</i>	<i>-7.78*</i>	<i>1.14</i>	<i>-1.32</i>	<i>-4.96*</i>

*(significant at 1%) ** (significant at 5%) *** (Significant at 10%)

The first six rows in Table 4 show the results of single regressions between the cross-section of stock returns and different characteristics (simple correlation), while the last three rows show the results of multiple regressions after accounting for different variables (conditional correlation). The numbers in *italics* are the time-series of the test statistics, while all other numbers represent the time-series average of the cross-sectional coefficients.

The first row of Table 4 shows that industry concentration H (*Sales*) is negatively and significantly related to the cross-section of stock returns. The time-series average of the cross-sectional coefficients of industry concentration is significant at 5% level of significance with a test statistics of (-2.03). Therefore, it is possible to verify that the relationship between industry concentration and cross-section of stock returns is negative and significant. In other words, companies that belong to concentrated industries earn, on average, lower returns compared to companies that belong to highly competitive industries. These results are consistent with the reported summary statistics on concentration Quintile portfolios, in which I show that the mean value of stock returns decrease significantly from the lowest concentration Quintiles to the highest concentration Quintiles.

The next seven rows (rows 2 to 8) in Table 4 show that individual stock returns are negatively and significantly related to natural logarithm of book-to-market ratio $Ln(B/M)$, and leverage (*Lev.*) with high test statistics in all reported single and multiple regressions. My results are consistent with Muradoglu and Whittington (2001), and Sivaprasad and Muradoglu (2009) studies that find negative and significant relationship between leverage and stock returns. My results are also in line with Malin and Veeraraghavan (2004) which shows the existence of big size effect and growth effect (low book-to-market).

I also observe that the cross-section of individual stock returns is insignificantly related to the natural logarithm of firm size $Ln(Size)$, *Momentum* (past 12 months returns), and beta (*Beta*) in all reported single and multiple regressions. The insignificant relationships between the cross-section of stock returns and both natural logarithm of firm size beta, and momentum are consistent with the reported literature in the UK stock market (e.g., Miles and Timmermann 1996, and Strong and Xu 1997, Al-Horani, Pope, and Stark 2003 and Hon and Tonks 2003). I conclude that size effect seems be inactive (statistically insignificant) in the London Stock Exchange Market (LSE) between 1979 and 2005. In

addition, the inability of beta to explain the cross-section of stock returns verifies the conclusion that the beta of the capital asset pricing model is dead. If beta is included with other variables, the results show that beta is still not able to explain the cross-section of stock returns.

In the last two rows, I re-examine the relationship between industry concentration $H(Sales)$ and average stock returns for individual stocks, accounting for different characteristics. For instance, when I account for the natural logarithm of both firm size and book-to-market ratio, and momentum; the industry concentration is still significant and negatively related to the cross-section of stock returns at 1% level of significance with a test statistics of (-2.76). In addition, I observe that the magnitude of industry concentration increases in absolute value by (0.0013). Further, when I account for all variables including leverage and beta, I find that the coefficients of industry concentration is still negative and significant at 5% level of significance, indicating that highly concentrated industries earn, on average, lower returns compared to competitive industries. Therefore, I conclude that industry concentration $H(Sales)$ is negatively and significantly related to the cross-section of stock returns. This relation is strong, since the inclusion of other factors does not bias the results. Rather, the inclusion of different characteristics in Fama and MacBeth (1973) cross-sectional regression enhances both ability and the magnitude of industry concentration to explain the cross-section variation of stock returns. The results are consistent with the reported results in the US stock market. For instance, Hou and Robinson (2006) document a negative and significant relationship between industry concentration and the cross-section of stock returns in the US stock market using Fama and MacBeth (1973) cross-sectional regression.

Overall, combining the results from Table 4 with the results from Table 2, in which I regress the industry concentration measurement $H(Sales)$ on industry average

characteristics, I find that concentrated industries are dominated by large companies with high market values of equity (and hence low book-to-market ratios), and those concentrated industries generate lower returns, as they engage in less risky activities compared to competitive industries that are dominated by small companies and engage in more risky activities.

5.2. Empirical Results Based on Industry Portfolio Level Regressions

In this section, I re-examine the relationship between industry concentration and the cross-section of stock returns, using Fama and MacBeth (1973) cross-section regression on industry portfolio level. Therefore, I regress industry average returns (*Ind. Ret*) on industry natural logarithm of firm size *Ind. (Size)*, industry natural logarithm of book-to-market ratio *Ind. (B/M)*, industry momentum *Ind. Momentum* (past 12 months returns on industry portfolio), industry beta *Ind. Beta*, and industry leverage *Ind. leverage*.

The use of industry portfolio level to re-investigate the relationship between industry concentration and cross-section of stock returns will give the opportunity to see whether the relationship between industry concentration and the cross-section of stock returns is still exist and robust. Consequently, performing industry portfolio level will give the opportunity to compare the results between industry level analysis and firm level analysis. In addition, Fama and MacBeth (1973) cross-sectional regression will give the opportunity to check precisely the relationship between industry concentration and stock returns.

Table 5 reports the results from Fama and MacBeth cross-sectional regression (1973) on industry portfolio level. The time series test statistics are reported in *italic* under the time-series averages of the monthly cross-sectional coefficients for the simple and multiple regressions.

Table 5 Fama-Macbeth Cross-Sectional Regressions of Industry-Level Returns

Industry-Level Regressions					
H(Sales)	Ind.(Size)	Ind. (B/M)	Ind. Momentum	Ind. Beta	Ind. Leverage
-0.0037336 <i>-2.02**</i>					
	.0010303 <i>2.18**</i>				
		-.004764 <i>-3.28*</i>			
			.0266252 <i>3.07*</i>		
				-.0044415 <i>-1.26</i>	
					.0003969 <i>0.47</i>
	.0007333 <i>1.49</i>	-.0044 <i>-3.12*</i>	.0181485 <i>2.34**</i>	-.0040019 <i>-1.15</i>	-.0006646 <i>0.97</i>
-.0051175 <i>-2.81*</i>	.0007273 <i>1.31</i>	-.0046 <i>-2.81*</i>	.0218922 <i>2.55**</i>		
-.0044103 <i>-2.50**</i>	.0009296 <i>1.85***</i>	-.0045 <i>-3.27*</i>	.0159469 <i>2.05**</i>	-.004369 <i>-1.26</i>	-.0005929 <i>-0.98</i>

* (significant at 1%) ** (significant at 5%) *** (Significant at 10%)

The first six rows in Table 5 show the results of single regressions between the cross-section of stock returns and different characteristics (simple correlation), while the last three rows show the results of multiple regressions after accounting for different variables (conditional correlation). The numbers in *italics* are the time-series of the test statistics, while all other numbers represent the time-series average of the cross-sectional coefficients.

Consistent with firm level results, the first column in Table 5 demonstrates that highly concentrated industries earn, on average, lower returns compared to highly competitive industries. The time-series average of the cross-sectional coefficients for Herfindahl index *H (Sales)* is always negative and significant in different regressions. For instance, when

industry average returns are regressed on $H(Sales)$ alone, the time-series average of the cross-sectional coefficients of $H(Sales)$ is negatively significant at 1 % level of significance. Further, when I account for industry natural logarithm of firm size $Ind.(Size)$, industry natural logarithm of book-to-market ratio $Ind.(B/M)$, and industry momentum $Ind.Momentum$ (past 12 months returns on industry portfolio), the coefficient of industry concentration $H(Sales)$ is still negative and significant at 5 % level of significance. Finally, when I account for industry beta $Ind.Beta$, and industry leverage $Ind.leverage$ in addition to aforementioned variables, the industry concentration measurement $H(Sales)$ is still negative and significant at 5% level of significance.

The first seven rows in Table 5 show that the industry average returns is negatively related to industry book-to-market ratio, positively related to industry momentum and insignificantly related to both industry beta and industry leverage. Depending on the control variable, the industry size is insignificantly related to industry average returns when I control for industry book-to-market, industry momentum, industry beta, and industry leverage. However, when industry concentration measurement $H(Sales)$ is accounted for, the industry size seems to be positively and significantly related to the cross-section of industry returns at 10% level of significance. The results are consistent with Malin and Veeraraghavan (2004) study which shows the existence of big size effect and growth effect (low book-to-market). With regards to momentum effect and beta, my results are also in line with the studies of Liu, Strong, and Xu (1999), and Yurtsever and Zahor (2007) respectively.

Comparing firm level and industry level results; it is plausible to see that both results are consistent. Therefore, the industry level results reflect those results that are conducted on firm level. Thus, an inference can be made indicating that not only individual companies' returns fluctuate with industry concentration, but also industries average returns do. That is, competitive industries earn, on average, higher returns compared to concentrated industries.

These results remain stable under different empirical tests in simple and conditional cross sectional regression(s), and the results are robust, since both firm and industry levels' results are consistent.

5.3. Empirical Results Based on 100 Size-Beta Portfolios Level Regressions

In order to re-evaluate the role of industry concentration with other characteristics on stock returns, I perform Fama and MacBeth (1973) cross-section regression using Fama and French (1992) method. Fama and French (FF) (1992) form 100 size-beta portfolios to assess the joint role of size, beta, and other risk factors on the cross-section of stock returns. Therefore, I use Fama and French (1992) method in order to have clear evidence regarding the existence of industry concentration effect in the UK stock market. This in turn will help clarify whether the existence of industry concentration effect is robust by comparing different empirical strategies in estimating the role of industry concentration. That is, after testing the role of industry concentration using Fama and French (1992) 100 size-beta portfolios; I compare different results under different levels of analysis including firm and industry levels.

To perform 100 size-beta portfolios according to Fama and French (1992), I first sort the companies in each year according to size (the natural logarithm of annual market value of equity for individual companies). Then, I form size deciles according to firms' size. Therefore, up to this stage, I have 10 size portfolios. Afterwards, the companies are sorted in each year according to the beta. Consequently, I form deciles according to beta. Therefore, I will have 10 portfolios formed according to beta. The intersection between 10 size portfolios and 10 beta portfolios will give 100 size-beta portfolios.

Subsequently, I calculate the post-ranking mean returns for each of the 100 size-beta portfolios in each year. In order to estimate the post ranking betas, I run time series regression by regressing the post ranking excess returns for each of the 100 size-beta portfolios in each year on market excess returns. Afterwards, I use the estimated betas (post ranking betas)

Post.Beta in Fama and MacBeth cross-section regression (1973) with other firms' characteristics including: the industry concentration measurement *H (Sales)*, the natural logarithm of annual market value of equity for individual firms *Ln (size)*, the natural logarithm of book-to-market ratio *Ln (B/M)*, momentum, and leverage (*Lev.*).

Table 6 Fama-Macbeth Cross-Sectional Regressions of Firm-Level Returns using FF (1992)

Firm-Level Regressions Using Fama and French 1992 post ranking beta					
H(Sales)	Ln(Size)	Ln(B/M)	Momentum	Post.Beta	Leverage
-.003745					
<i>-2.03**</i>					
	.0006267				
	<i>1.34</i>				
		-.0064298			
		<i>-7.22*</i>			
			.0046084		
			<i>1.32</i>		
				-.003434	
				<i>-1.19</i>	
					-.000810
					<i>-2.43**</i>
	.0004397	-.00682	.0052269	-.004111	-.001292
	<i>1.02</i>	<i>-7.62*</i>	<i>1.51</i>	<i>-1.44</i>	<i>-4.35*</i>
-.005036	-.000128	-.00683	.0036097		
<i>-2.76*</i>	<i>-0.26</i>	<i>-7.09*</i>	<i>1.05</i>		
-.004166	.0005162	-.0068	.004817	-.004200	-.001298
<i>-2.37**</i>	<i>1.18</i>	<i>-7.70*</i>	<i>1.39</i>	<i>-1.47</i>	<i>-4.39*</i>

*(significant at 1%)

** (significant at 5%)

*** (Significant at 10%)

Table 6 reports the results from Fama and MacBeth cross-sectional regression (1973) on industry portfolio level. The time series test statistics are reported in *italic* under the time-series averages of the monthly cross-sectional coefficients for the simple and multiple regressions.

Consistent with both firm and industry level results; the first row in Table 6 shows that industry concentration $H(Sales)$ helps explain the cross-section of stock returns during the period of study. The time-series from the monthly cross-sectional regression of returns on industry concentration is (-.003745) with a test statistics of (-2.03). This authentic negative relationship remains strong regardless whether or not other explanatory variables are accounted for in all regressions. In fact, the inclusion of other factors such as the natural logarithm of annual market value of equity for individual firms $Ln(size)$, the natural logarithm of book-to-market ratio $Ln(B/M)$, momentum, and leverage ($Lev.$) in the model does not ruin the ability of industry concentration in explaining the cross-section of stock returns. Rather, the relationship appears to be strong. For instance, when I account for all variables including leverage and post ranking beta, I find that the coefficients of industry concentration is still negative and significant at 5% level of significance with a test statistics of (-2.37), indicating that highly concentrated industries earn, on average, lower returns compared to competitive industries. Therefore, I conclude that industry concentration $H(Sales)$ is negatively and significantly related to the cross-section of stock returns.

Rows 2 to 8 in Table 6 show that individual stock returns are negatively and significantly related to natural logarithm of book-to-market ratio $Ln(B/M)$, and leverage ($Lev.$) with high test statistics in all reported single and multiple regressions. In addition, the cross-section of individual stock returns is insignificantly related to the natural logarithm of firm size $Ln(Size)$, *Momentum* (past 12 months returns), and post ranking beta *Post.Beta* in all reported single and multiple regressions. The insignificant relationships between the cross-section of stock returns and both natural logarithm of firm size $Ln(Size)$ and post ranking beta *Post.Beta* are consistent with the reported literature in the UK stock market (e.g., Miles and Timmermann 1996, and Strong and Xu 1997, Al-Horani, Pope, and Stark 2003 and others). I conclude that size effect seems be inactive (statistically

insignificant) in the London Stock Exchange Market (LSE) between 1979 and 2005. In addition, the inability of post ranking beta *Post.Betato* explain the cross-section of stock returns verifies the conclusion that the beta of the capital asset pricing model is dead. If beta is included with other variables, the results show that beta is still not able to explain the cross-section of stock returns.

6. Conclusion

In this paper, I examine the relationship between industry concentration and the cross-section of stock returns in the London Stock Exchange between 1985 and 2010. Using Multifactor asset pricing theory, I test whether industry concentration is a new asset pricing factor in addition to conventional risk factors such as beta, firm size, book-to-market, momentum, and leverage. Consistent with Hou and Robinson (2006) study in the US, I find that industry concentration is negatively related to the expected stock returns in all Fama and MacBeth cross-sectional regressions. In addition, the negative relationship between industry concentration and expected stock returns remain significantly negative after $\ln(size)$, $\ln(B/M)$, momentum, leverage (*Lev.*), and beta (or post ranking beta) are included, while beta (post ranking beta) is significant. The results are robust to firm- and industry-level regressions and the formation of firms into 100 size-beta portfolios. The findings indicate that competitive industries earn, on average, higher returns compared to concentrated industries which is consistent with Schumpeter's concept of creative destruction. In further research, I will consider the use of time-series analysis to examine whether the industry concentration premium can explain the time-series variation of stock returns in addition to conventional risk premium associated with other risk factors.

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