ROYALTY RATE AND INDUSTRY STRUCTURE: SOME CROSS–INDUSTRY EVIDENCE

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ABSTRACT

This paper continues where Kemmerer and Lu (2008) left off, and explores the relationship between royalty rates and market structure among industries. Economists have studied innovation, R&D, and market structure for decades, and also have investigated patent licensing methods across industries. However, there is very little research on the relationships between market structure and royalty rates. In this paper, we first show that royalty rates are positively associated with price markup, a market power and market performance measure, and then move to explore the relationship between royalty rates and market structure. Two complementary sets of market structure factors are discussed. The first one is technology intensiveness or technology opportunity, on which we demonstrate that technology intensive sectors tend to have higher royalty rates than other sectors. The second set covers the traditional measures of barriers of entry. Regression analysis reveal that royalty rates exhibit a negative linear relationship with two measures of barriers to entry, the ratio of sales to capital invested and the ratio of sales to operating costs. Finally, cluster analysis is conducted to reveal group pattern among the industries studied, using royalty rate, markup, and the ratio of sales to capital invested as variables. The analysis yields four distinguishable groups of industries, and the characteristics of each group are discussed. Cluster analysis also corroborates our conclusion that while both traditional barriers of entry and technology intensiveness contribute to determining market power, one set of factors can exert more dominant and pronounced impact than the other one in a specific industry, as evidenced by media and internet/software sectors, in which market power is mainly created by their technology and know-how embedded in legally-protected IP.

Keywords: *Royalty rate, market structure, market performance, market power, markup, barriers to entry, regression analysis, cluster analysis*

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1. INTRODUCTION

Economists over the past decades have conducted comprehensive studies on R&D, innovation, and patent licensing. They created versions of models to address strategic issues in patent licensing and fee structuring. They also tried to identify the determinants of R&D activity and quantify the contribution of R&D outcomes to economic growth and profitability. These research efforts, through empirical studies or theoretical modeling, demonstrated that R&D activities in general, and patenting and licensing specifically, are clearly associated with the market structure and industry characteristics.

In contrast with the vast amount of the research devoted to the economic studies in R&D and innovation, there is surprisingly little research on royalty rates, especially on how royalty rates behave across a wide range of industries. The lack of such research is likely due to the scarcity of the required data. First, there is limited publicly-available data on royalty rates as the terms of licensing transactions are typically kept confidential. Second, significant challenges remain with the actual use of the available royalty rate data.

While the data issues continue to pose hurdles for comprehensive empirical research on royalty rates, data vendors and practitioners have in recent years developed several fairly consistent royalty rate databases that cover a wide range of industries. For example, in Kemmerer and Lu (2008), we analyzed the royalty rate data from one such vendor, RoyaltySource, and reached some meaningful results on royalty rates and profitability across 14 industries.

This paper extends the work presented in Kemmerer and Lu (2008) and addresses a more general topic of royalty rate and market structure across industries. The major question we try to answer is, "To what extent can the variation in royalty rates across industries be explained by the differences in market structure?" As shown in Kemmerer and Lu (2008), royalty rates across industries reflect the profitability of the industry, one of several possible market performance measures. Using the same royalty data and industry classification, coupled with newly calculated financial data from CompuStat, Section 3 of this paper shows that royalty rates are also positively associated with price markup, another important measure of market performance. Section 3 also discusses the relationship between royalty rates and one of the important industry characteristics, technology intensiveness or technology opportunity.

We further explore the relationship between the royalty rates and market structure in Section 4. There we analyze royalty rates, price markup and barriers to entry. Although the statistical significance level did not reach 5%, the coefficients on two indicators have the expected negative signs, implying that royalty rates increase with the higher barriers to entry.

In Section 5, cluster analysis shows that royalty rate, markup, and sales to capital ratio have the discriminating power in revealing the group pattern among 14 industries. Based on the three variables, cluster analysis reveals a significant structural difference between the software-based and IP-intensive media and Internet/software industries and the 12 other industries studied. The cluster analysis reveals 3 distinguishable groups within these remaining 12 industries. The implications of these groupings and the characteristics of each group are discussed in Section 5.

Finally, Section 6 includes conclusive comments and a list of issues for further research.

2. THE LITERATURE, RESEARCH SCOPE, AND DATA

2.1 Related Literature

There is very little literature in addressing royalty rates and market structure or industry characteristics across industries. However, economists have long recognized the importance of industrial characteristics and market structure in structuring licensing transactions, determining R&D activities, and facilitating innovation's contribution to output and performance. Relevant research has been conducted in various fields. A comprehensive literature review, however, is beyond the scope of this paper. The following brief review highlights the major conclusions reached by the majority of the literature.

Economic studies in R&D, innovation and patent licensing

First, economists have shown that market structure and competition play an important role in strategic decision-making regarding patent licensing and fee structuring. Since Katz and Shapiro (1985, 1986) and Kamien and Tauman (1986), economists have applied industry organization theory and game theory to model licensing strategy and methods, as well as to determine fee structure such as fixed fee vs. running royalty rate under various market structure assumptions. For a detailed review of research, see Kamien (1992).

Second, competition, especially firm size and market concentration, affect R&D activity and innovation, although economists still disagree with the nature and direction of the causality and with the sign (positive or negative) of the effects. Schumpeter first discussed the issue and implied that innovation might increase with the firm size and industry concentration, resulting in a negative relationship between competition and innovation. However, Arrow (1962) found a positive relationship, meaning that competition bolsters innovation. Since then, generations of economists have generated a large pool of literature in this area. A detailed review of research up to 1980s can be found in Cohen and Levin (1989).

Third, industrial characteristics account for the majority of differences in R&D activity across industries. Economists basically agree that technology opportunity, appropriablity condition, and demand level can explain a significant portion of inter-industry difference in R&D and patenting activity (Levin and Reiss 1984). For example, Bound et al (1984) found that R&D intensity and patenting activity were higher in sectors that had large sales or more science-based sectors such as drug, chemical, engines, and computer industries.

Finally, Patents and other R&D contribute to output and performance, but marginal effects vary across industries. Economists have recognized that R&D capital and patents contribute to company's market valuation and output growth (Pakes, 1984; Griliches, 1984). The econometric models adopted by economists make them easy to incorporate industry-specific dummy variables to capture the industry characteristics. A typical example is Hall (2005), in which he used Tobin's q as a measure of market valuation. He reported that among six sectors covered by his model, drugs and computer sectors enjoyed a higher premium.

Empirical studies on licensing methods and structure

Empirical studies on licensing methods and structure have revealed common patterns across industries. One of the major observations from such studies is that certain licensing methods are more commonly seen in some industries than in others. For example, chemical and pharmaceutical industries tend to have more exclusive licensing contracts while others such as computer, software, communications and semiconductor industries tend to have non-exclusive licensing contracts. (Anand and Khanna, 2000; Bessen and Maskin, 1999; Kim and Vonortas, 2006, and Benoit et al, 2000). The studies tended to attribute such differences in exclusivity to the appropriability condition. These studies further proposed that the harder to define the boundary of IP rights, the weaker the IP protection, leading to lower use of exclusive contracts.

Another major observation concerns the practice of cross-licensing. According to the studies cited above, the industries such as computer, electronics, semiconductors, and communications usually have larger share of contracts in cross-licensing than others. One of the factors that may have caused such industry patterns is the nature or characteristics of innovations. Innovations in these industries are characterized as more cumulative or sequential in nature, which makes it more difficult to specify the content and boundary of the innovations. To avoid expensive patent auditing, tedious negotiations over the quality of patents, and the high costs associated with patent litigation, the industries may find cross-licensing more effective and efficient.

Studies in royalty rates and market structure

While the literature clearly demonstrates the importance of market structure in determining R&D, forming licensing strategy, and facilitating innovation's contribution to output growth, very little has been done to address the royalty rates across industries. Kemmerer and Lu (2008) is one of the few papers devoted to this issue. Kemmerer and Lu (2008) concluded that royalty rates across industries are positively associated with profitability. More specifically, industrial characteristics appear to be the driver of the observed relationship, with sectors that are technology-intensive and produce differentiated products generally having high margins and hence being able to afford higher royalty rates.

Another published study along this line is Nagaoka (2004) which analyzed licensing transactions from Japan's technology import contracts in nine industries and 39 sub-sectors. The price of technology is defined as the share of licensing contracts with the royalty rate of 8% or more in all royalty based contracts. Their descriptive statistics shows that nearly 63% of the contracts in computer industries are high royalty contracts, while drug and medicines, precision machinery and precious metal products also have large share in high-royalty contracts. By contrast, prime mover, radio and TV products, and other electric machinery has the lowest share of high-royalty contracts in the range of 2% to 4%.

Nagaoka (2004) used regression analysis to explore the determinants of high-royalty licensing contracts. The analysis indicated that types of IP, and especially R&D intensity and share of exclusive contracts have a significant positive impact on higher incidence of high-royalty contracts. The study also shows that the inclusion of initial payment or upfront payment tends to lower such incidence.

2.2 Research Scope and Data Description

Based on the literature, it is clear that market structure plays an important role in determining R&D and in converting innovation to output growth and market value. Royalty pricing is an integrated part of the life cycle from R&D to the commercial use of technology and represents a mechanism for the licensor and licensee to share the benefits and risks during the course. As a result, we hypothesize that royalty rates across industries will tend to reflect the market structure and industrial characteristics, just as prior research has demonstrated that R&D, innovation, and patent counts reflect such characteristics.

The purpose of this paper is to test our hypothesis, through analyzing royalty rates and a set of indicators of market structure. When doing this, we follow the classical approach of structure-conduct-performance analysis to measure effects in both performance and structure dimensions. This paper extends Kemmerer and Lu (2008) and moves beyond profitability and into several broad measures of market power and market structure.

This paper differs from Nagaoka (2004) in three important aspects. First, while Nagaoka (2004) used share of high-royalty (higher than 8%) contracts as a pricing indicator, we use actual average royalty rates for each of the industries. Second, Nagaoka (2004) collected the royalty data from the contracts in Japanese technology imports, and as a result, the conclusions reflect mainly the situation of technology imports and domestic industries in Japan. Our royalty rate data is from RoyaltySource, with financial data from CompuStat. These sources consist predominantly of US content with some global entities. Finally and most importantly, Nagaoka (2004) focuses on explaining the pricing of technologies embedded in Japanese technology imports, and we are more interested in revealing the relationship between the royalty rates and market structure.

As in Kemmerer and Lu (2008), the royalty rate data for 14 industries studied in this paper is from RoyaltySource and is current as of December 2007. The data for calculating indicators of market structure and performance was retrieved from CompuStat Research Insight North America Data. Industry classification data from RoyaltySource was matched with CompuStat's SIC-based classification. For detailed description of industrial classifications, royalty rates, and CompuStat data, please refer to Kemmerer and Lu (2008).[1]

3. Royalty Rates and Industry Performance

3.1 Regression Analysis on Royalty Rate and Price Markup

To pick up where Kemmerer and Lu (2008) left off, we first examine the relationship between royalty rates and various measures of market performance. In structure-conduct-performance analysis, the most commonly-used performance indicators are profitability measures and price markup, among several others. (Carlton and Perloff, 2000). In this section, we will address the issues using profitability and especially markup.

As shown in Kemmerer and Lu (2008), royalty rates across industries do increase with various profitability measures. In other words, the higher the profitability, the higher royalty rate. We also show that the linear relationship was associated with the degree of technology intensiveness, similar to technology opportunity as referred in economics literature. Basically, royalty rates are higher for the industrial sectors with higher profit margins such as pharmaceutical, medical, software, and computers. By contrast, in traditional sectors such as food, auto and consumer sectors, profit margins are lower and so are royalty rates.

For an industry with perfect competition, price would be same as marginal cost, yielding a zero profit. Profitability, hence, is an important measure of market performance with the presence of some degree of market power. Another indicator economists use to gauge market power and market performance is price markup ratio, which reflects both the demand elasticity for the company's products or services and the technology's comparative advantage in charging price premium or saving costs. Economists have created two major indicators for this purpose. The first one is Lerner Index, which is the difference between price and marginal cost as a share of price. Mathematically, the Index is simply the inverse of the absolute value of demand elasticity.

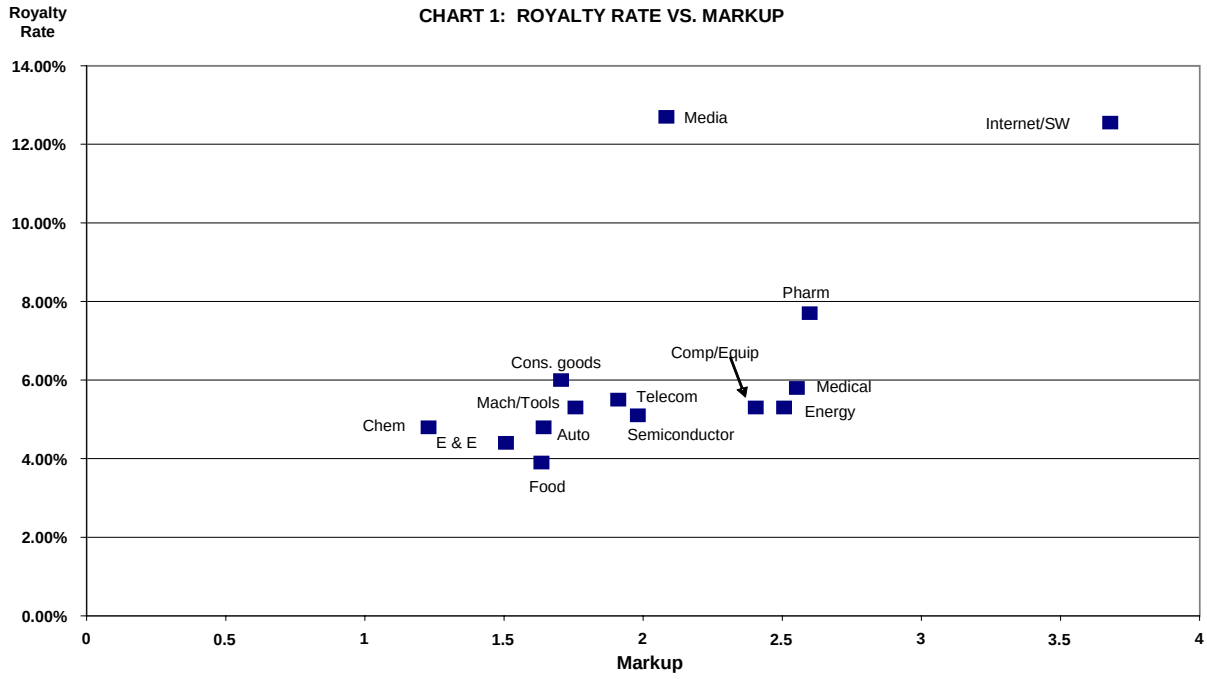
The other one is defined as a ratio of the difference between price and marginal cost to marginal cost. A variant of such index is simply the ratio of price to marginal cost. Some economists and analysts favor this index, because it intuitively reflects the meaning of markup, but can still be formulated as a simple function of demand elasticity. Due to the difficulty in measuring marginal costs, most empirical studies use a measure of average cost as a proxy of marginal cost when calculating the Lerner Index and marginal cost markup variables. For simplicity, we define and calculate price markup for each of the 14 industries as the ratio of revenue to cost of goods sold (COGS).

Regression analysis was conducted to test the relationship between royalty rates and markup ratios. As shown in Table 1, the coefficients for both specifications are significant, and the models explain 41% of the variations in royalty rates across industries.

TABLE 1: REGRESSION ANALYSIS
ROYALTY RATES AGAINST PRICE MARKUPS

Dependent Variable and P-value	Intercept	Independent Variable: Markup	R^2
Royalty Rate	0.004	0.029	0.412
P-value	86.2%	1.3%	
Royalty Rate	0	0.03	0.411
P-value	NA	0.0%	

This relationship is also clearly demonstrated by Chart 1. This confirms the conclusions reached in Kemmerer and Lu (2008) and demonstrates that royalty rates are positively associated with the market power measures of profitability and markup.



3.2 Technology Intensiveness, Industry Performance, and Royalty Rate

While regression analysis does demonstrate that royalty rates increase with the measures of market power and performance, the analysis does not address the sources of market power. Obviously, there are many factors that can contribute to the formation of market power, as shown in the literature review. For example, market power can be granted by superior technology, especially technologies embedded with IP rights such as patents. This is consistent with observations from the literature that technology opportunity is among the major factors accounting for the industrial R&D activity. Since R&D intensive sectors generally have higher propensity to seek legally-protected intellectual property rights, they are also more IP-intensive as compared to traditional sectors. The purpose of IP laws, by design, is to grant an innovation owner the monopoly rights to use the technology, and to protect such monopoly for a fixed period of time. As a result, the intensiveness and superiority of technologies in a sector has an impact on the market power and profitability of the sector, because the superior technology can give a licensee comparative advantage in charging price premium or reducing costs.

The observation above is corroborated by Chart 1, as well as the earlier evidences presented in Kemmerer and Lu (2008). As shown in the chart, technology-intensive sectors such as software, semiconductor, medicals/health, and pharmaceuticals/bio-tech do have higher price markups and higher royalty rates than traditional sectors such as food and auto sectors.

More interestingly, two sectors, media and internet/software, stand out as outliers in Chart 1. Both sectors have high markups and royalty rates as compared to their peers in the chart. According to the analysis above, it is highly plausible that it is the technology-intensiveness and IP-richness in the two sectors that distinguish them from all others. First of all, software technology plays dominant role in both sectors. More importantly, the two sectors are IP-intensive due to the critical role played by patents, copyrights, subscription lists, distribution rights, and many other forms of know-how and trade secrets. As a result,

the high markups in these industries could be mainly from the market power granted by the legal protection of such rights.

Nakaoga (2004) provides empirical evidences to our hypothesis above. According to the study, patent licenses accompanied by other IP licenses such as trademark licenses usually have higher royalty rates than pure patent licenses. In practice, most patent licensing agreements in media and internet/software sectors either contain or are supported by licensing transactions with other IPs and know-how. This may explain why the two sectors have the highest royalty rates among all industries we studied.

This said, the pricing power and profitability an industry enjoys could well come from more "traditional" sources of barriers to entry such as capital intensity. Under this scenario, high barriers of entry determines market power and leads to higher market performance, which in turn is associated with increased royalty rates. The next section of this paper addresses the role of traditional barriers of entry.

4. Royalty Rates and Market Structure

In this section, we move to explore the relationship between royalty rates and the market structure. There are various indicators to measure market structure. One way is to detect whether barriers to entry exist. The ability for firms to enter an industry is an important structural factor in determining market power and industry performance. The higher the barriers to entry the more market power an industry has. Measures used by economists to detect barriers to entry typically include advertising intensity and fixed capital required, among many other industry-specific measures.

Using the data from CompuStat, we calculate two ratios as proxies for the barriers to entry. The first one is sales to capital ratio, calculated as average sales over the average capital invested. Capital invested includes long-term debt plus common and preferred equity. The ratio measures the dollars of capital that must be committed to generate each dollar of sales. Lower sales to capital ratio would imply that the sector is more capital-intensive and with higher barriers to entry, which, in turn, implies higher market power in the industry.

The second ratio is sales to operating costs. Operating costs is approximated by selling, general and administrative expenses, which include a long list of cost items, but mainly outlays in advertising, marketing, R&D, and general administration. Like sales to capital ratio, sales to operating cost ratio measures the level of operating expense that must be funded for each dollar of sales. The lower the ratio is, the more marketing and advertising expenditure the industry needs to compete in the market. Since higher marketing and advertising expenses represents a barrier to entry, a lower ratio of sales to operating expenses would mean higher market power.

Results from regression analysis are shown in Table 2. Sales to capital and sales to operating cost ratio explain 21% and 15% of total variation in royalty rates across 14 industries, respectively. The coefficients for both ratios are not significant at 5% level, with that of sales to capital ratio at 10% and sales to operating cost 17%. However, both coefficients have the negative signs as expected. In other words, lower ratios or equivalently higher capital invested and operating costs are associated with higher the royalty rates.

TABLE 2: REGRESSION ANALYSIS ROYALTY RATES AGAINST BARRIERS TO ENTRY MEASURES

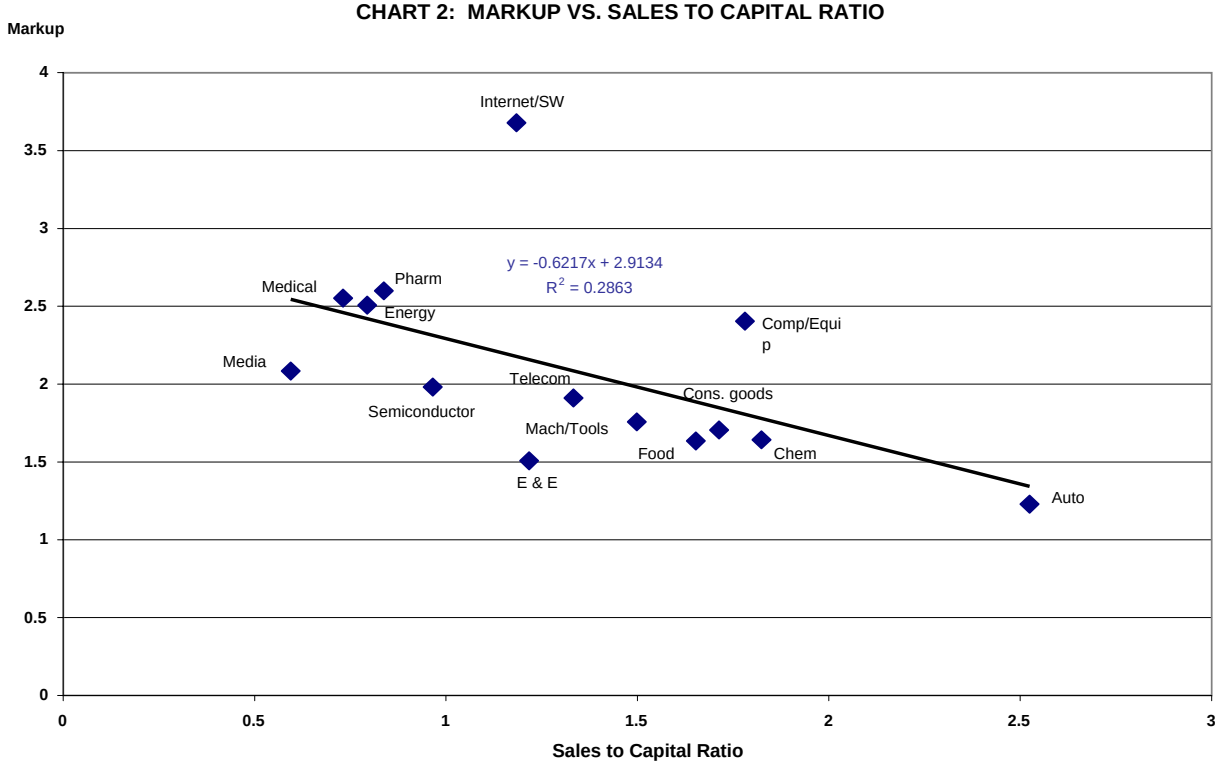
Dependent Variable and P-value	Intercept	Independent Variables		R^2
		Sales to Capital Invested Ratio	Sales to OPEX Ratio	
Royalty Rate	0.095	-0.0237		0.207
P-value	0.0%	10.2%		
Royalty Rate	0.081		-0.0034	0.150
P-value	0.0%		17.1%	

Table 2 lends further evidence to the conclusions we draw from the market performance analysis in Section 3 and confirms that market power and market structure are among the determinants of royalty rates across industries. High capital invested and operating costs indicate high the barriers to entry, high pricing power, and profitability, which eventually would raise the royalty rate to what the industry can afford.

Although the coefficients in Table 2 are not statistically significant (and thus the results need to be taken with caution), the regression analyses tend to complement the conclusion we reached in Section 3. In other words, based on the regression analysis on the measures of barriers to entry, market structure and market power help explain royalty rate levels across industries.

To further illustrate this relationship, we plot the price markup against the ratio of sales to capital invested in Chart 2. As seen in the chart, pricing power has a negative linear relationship with sales to capital ratio. In other words, the lower the ratio or the higher capital invested required, the higher the ability in price markup. Another way to interpret the relationship is through the link of capital invested to market concentration ratio. Early studies cited by Carlton and Perloff (2000) indicated that higher capital invested is associated with higher concentration ratio, which in turn, leads to higher market power.

CHART 2: MARKUP VS. SALES TO CAPITAL RATIO

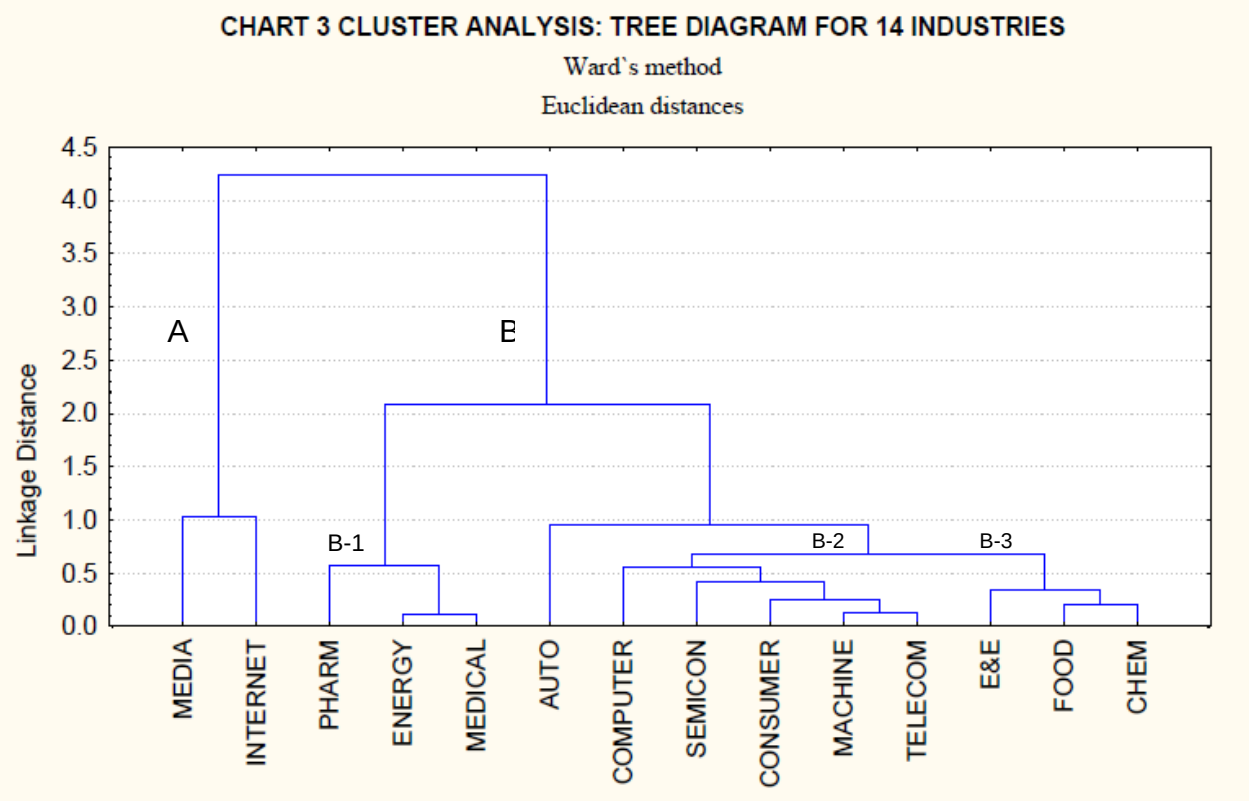


5. CLUSTER ANALYSIS ON ROYALTY RATES, MARKET POWER AND MARKET STRUCTURE

So far in this paper we have illustrated that royalty rates are positively associated with market power and market structure. In Section 2, the literature review shows that licensing methods and structures vary among industries, and that certain methods are more commonly seen in some industries than in others. Following such an approach of exploring industrial patterns, our next step is to try to reveal potential patterns among industries based on royalty rate, market power measure and market structure measures. For example, which industries have similar royalty rates and similar measures in market power and market structure? How does a specific group of industries differ from all others?

To answer these questions, we conducted cluster analysis on 14 industries, using royalty rate, market power measure and market structure as variables. Cluster analysis is a multivariate statistical method traditionally used to classify objects based on a set of certain characteristic indicators. The similarity of the objects is measured by some distance metric such as Euclidean Distance. The shorter the distance the more similar the objects on the dimensions tested. Cluster analysis computes these Euclidean distances between and within the groups of objects, which in our case are industries. Objects within each cluster are more like other objects in the same cluster than those objects in other clusters on the dimensions of royalty rate, market power and market structure. For a detailed discussion on applying cluster analysis to economic data, please refer to Galbraith and Lu (2001).

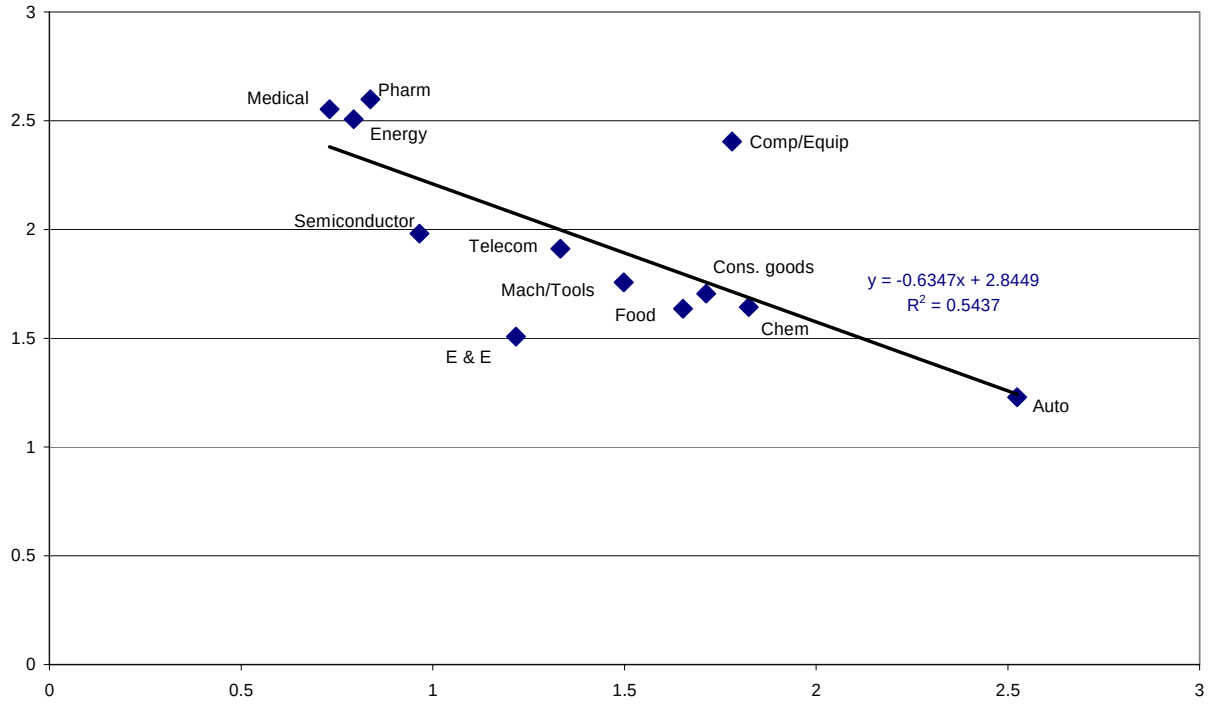
Chart 3 shows the grouping pattern yielded by the cluster analysis. Several important observations can be made. First and foremost, there is a clear and significant grouping of Media and Internet on the one hand (indicated as cluster “A” on Chart 3) and the other 12 industries on the other hand (indicated as “B” on Chart 3). Within cluster B, we see three additional meaningful clusters, labeled “B-1” through “B-3” in the chart. The auto sector appears to be an outlier on the royalty rate and market structure dimensions.



The first group (Cluster A) includes only two sectors, media and internet/software. These two sectors have very high royalty rates (around 13%), high pricing power, and relatively low ratios of sales to capital invested. These sectors are "light" in the sense that they do not require large physical capital commitment. However, as we point out in Section 3.2, the two sectors are IP-intensive due to the critical role played by patents, copyrights, subscription lists, distribution rights, and many other forms of know-how and trade secrets. In other words, the cluster analysis lend further support to what we discussed in Section 3.2, that is, while both capital intensiveness and technology intensiveness exert market power across industries, technology intensiveness – especially IP-richness – plays a more dominant and pronounced role in these two Cluster A sectors than in the others.

The distinguishing pattern between Cluster A and other groups can also be seen intuitively in Chart 4, which basically redraws Chart 2 by dropping the two sectors in Cluster A. Essentially, after excluding media and internet/software sectors, the negative relationship between price markup and sales to capital ratio becomes much more significant. The regression analysis shown in Chart 4 also indicates that the sales to capital ratio explains nearly 54% of the variation in markup, nearly twice as much as that in Chart 2.

CHART 4: MARKUP VS. SALES TO CAPITAL RATIO



The second group (Cluster B-1) consists of pharmaceutical/biotech, medical/health, and energy sectors. These sectors are characterized by relatively high royalty rates, high markups, and low ratios of sales to capital invested or equivalently, high capital invested. It is not quite intuitive to see energy being included in the same group with medicals/health and pharmaceutical/biotech. However, these industries do have certain important common features, at least judged from the three variables used for cluster analysis. First, these sectors typically have low demand elasticity and are relatively less sensitive to economy cycle. This explains their high markups. Second, all sectors in this group required large capital invested in specialty equipment, which lowers the ratio of sales to capital ratio. Finally, these sectors have relatively high risks in product developments, with energy sectors facing high dry-hole risks, while the other two usually having to tolerate risks in prolonged clinic trial and FDA approval.

The third compact group (Cluster B-2) includes computer, semiconductor, consumer goods, machine tools and telecommunications industries. Compared to the other three groups, this cluster (really a group of clusters) is less clear in its similarities. They all have medium royalty rates, medium to high markup, and a wide dispersal in the ratios of sales to capital. It is this last measure that appears to be driving the distances between the industries. Within the group, consumer goods, machinery tools, and telecommunications are closer to each other than to others due to their relatively high royalty rates, high price markups, and medium ratios of sales to capital invested. Computer and semiconductor, as expected, have very similar royalty rates and markup, but very different ratios in sales to capital invested, which reflects the larger capital investment in sophisticated and expensive equipment in semiconductors.

The fourth compact group (Cluster B-3) includes food, electrical and electronics, and chemicals. The chemical sectors as defined by RoyaltySource include a large chunk of industrial and consumer products in addition to raw materials and chemical matters. These sectors have low royalty rates, low markup, and medium ratios of sales to capital. The low royalty rates appear to be the result of low pricing power present in these sectors

The automotive industry stands out as an outlier, mainly because of its lower royalty rate and low markup coupled with significant capital investment requirements. The fact that the industry exhibits low royalty rates and low markups in the face of high barriers to entry suggests that intense competition within the automotive industry effectively limits the market power of any one participant.

6. CONCLUSIONS

This paper continues where Kemmerer and Lu (2008) left off and explores the relationship between royalty rates and market structure among industries. Economists have studied innovation, R&D, and market structure for decades, and also discussed patent licensing methods across industries. However, there is very little research in royalty rate and market structure. In this paper, we first show that royalty rates are positively associated with price markup, a market power and market performance measure. The relationship among royalty rates, market power and technology intensiveness is discussed subsequently, which demonstrates that technology intensiveness, especially technologies embedded in legally-protected IP, plays an important role in determining market power.

We also address the issues how royalty rates are associated with traditional barriers of entry. Regression analysis indicates that royalty rates exhibit a negative linear relationship with two measures of barriers to entry, the ratio of sales to capital invested and the ratio of sales to operating costs.

Finally, cluster analysis is conducted to reveal group pattern among the industries studied, using royalty rate, markup, and the ratio of sales to capital invested as variables. The analysis yields four distinguishable groups of industries, and the characteristics of each group are discussed. Most importantly, cluster analysis corroborates a major conclusion reached by this paper, that is, while both traditional barriers of entry and technology intensiveness contribute to determining market power, one set of factors can exert more dominant and pronounced impact than the other one in a specific industry, as evidenced by media and internet/software sectors, in which market power is mainly created by their technologies and know-how embedded in legally-protected IP.

Several issues arising from this paper merit further research effort. First, more data needs to be collected and more industries need to be included in this type of analysis. A sample of 14 industries is certainly not sufficient for us to reach any comprehensive and systematic conclusions regarding the issues we are addressing. Special attention needs to be paid to matching industry classification among various data sources and vendors.

Second, with a larger and reliable data sample, more research can be done to explore the two-way causality between market power or market performance and royalty rates. Economists have proven that there is a two-way causality between innovation and market structure, measured mainly by firm size and concentration rate. These interactions merit further study, especially within the context of royalty rates and intellectual property licensing practices.

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