
Related Statistical Anomalies in the Determination of Royalty Rates – Comments on the Problem

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Abstract:

Purpose: This study aims at synthesising the impact of the human factor on the occurrence of statistical anomalies in the distribution of the incidence of royalty rates in license contracts. As a research basis for our study we have used the results of two empirical studies on royalty rates in contracts.

Design/methodology/approach: The methods used to value intangible rights for licensing purposes should theoretically ensure objectivity. As a result, the analysis of statistical data on the frequency of royalty percentages should provide information on the profitability of licensing specific rights, both in the industry studied and in the economy as a whole. However, statistics of actual royalty rates show an above-average use of some percentage rates (e.g., 5%, 10%) against a relatively low representation of others.

Findings: This paper points to the human factor as the cause of the anomalies found. This influence manifests itself in arbitrary decision-making without economic justification in the valuation process, as well as in the negotiation of royalty rates. The arbitrariness of valuation experts and negotiators, as indicated in the paper, manifests itself primarily in a tendency to round up and rely on numerical schemes.

Practical implications: The research we have carried out can contribute to analyses covering the broad spectrum of human factor influences in the royalty valuation and negotiation process.

Originality value: Analysis of the fee for services on statistical anomalies in determining Royalty Rates. The human factor was indicated as the source of these anomalies.

Keywords: License agreements, royalties, arbitrariness in economics.

JEL Classification: A10, C10.

Paper Type: Case study.

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1. Introduction

Valuation theories assume that prices of assets are derived from their fundamental values (Ariely, Loewenstein, and Prelec, 2003). Determining them involves one of a variety of methods, primarily, the income and comparison methods. The comparative method can be considered secondary to the income method because, among other things, it cannot be applied to incidental transactions (Jankiewicz, 2021).

Therefore, the income method is a foundation for determining royalty rates for the use of intangible rights (Goldscheider, 2011). One of its anomalies when applied in practice is that certain values are overrepresented for setting rates. There has been little investigation into the causes of statistical anomalies in the source literature. The most authors only state that the anomalies prevail.

We find one instance in *Royalty Rates for Pharmaceuticals and Biotechnology* which states that, “*For unknown reasons one of the most popular royalty rates is 5% of sales... It shows up in a lot of different industries. It is associated with embryonic technology and mature trademarks. It has been found in the food, industrial equipment, electronics, construction and medical device industries.*” (BVR, 2010, p. 27).

This means that the actual licensing royalty rates depend not only on economic factors (including the actual profitability of the use of an intangible right), but also on non-economic factors, the most significant of which is the human factor.

This study aims at synthesising the impact of the human factor on the occurrence of statistical anomalies in the distribution of the incidence of royalty rates in license contracts. As a research basis for our study we have used the results of two empirical studies on royalty rates in contracts presented in the papers of Kapitsa and Aralova (2015, p. 51-68) and *Royalty Rates for Pharmaceuticals and Biotechnology* (BVR, 2010).

We have also employed behavioural theory related conclusions drawn from research on human factor in choice-making, and exploited the authors’ own experience, which, in one case, involves expertise in the field of, for example, intangible asset valuation, and in the other case, many years of hands-on expertise in mergers, acquisitions and strategic management.

2. Anomalies in the Distribution of Royalty Rates in License Agreements

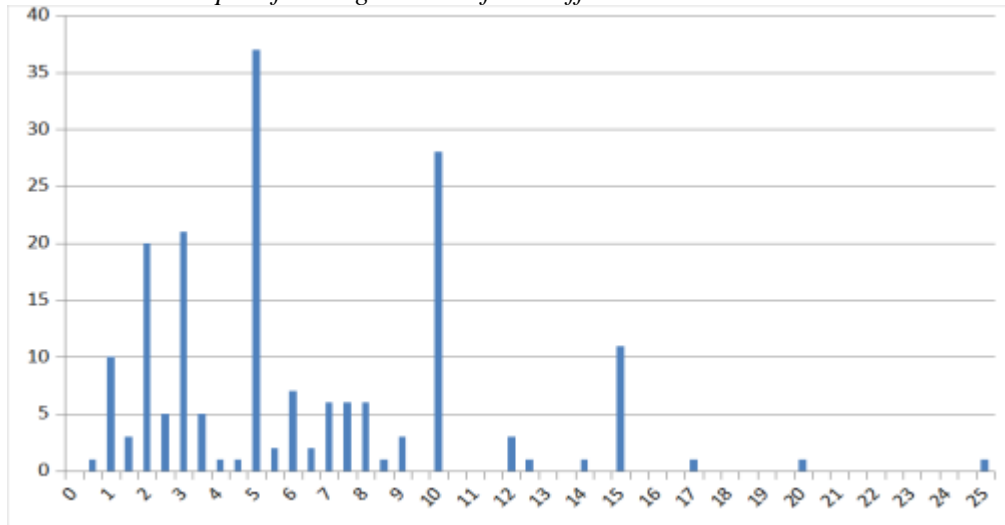
From a theoretical point of view, the royalty rates for the use of an intangible right should meet the postulate of a statistically elusive difference in frequency of occurrence between the rates immediately following one another (e.g., 3 and 3.5%, 10% and 11%, 12 and 12.5%). In practice, however, these differences do exist, as

shown in the empirical research of Kapitsa and Aralova (2015) and *Royalty Rates for Pharmaceuticals and Biotechnology* (BVR, 2010).

They show that fractional rates (e.g., 1.5%, 2.5%, etc.) are several times less 'popular' than rates defined as natural numbers. It is irrelevant in this case whether the data presented in the study are in fact rates at only 0.5% increments, or whether the authors, for their research purposes, have rounded up the actual values to the 0.5% progression indicated in the graph.

In the latter case, the whole percentage rates are observed to be overrepresented compared to fractional percentages (0.5%), which also points to a more frequent use of the former. Otherwise, the numbers of rates rounded to a whole percentage and rates rounded to the fractional 0.5 value should have been similar with such a large study group.

Figure 1. Frequency of use of royalty rates (% of sales) in license agreements (pcs) in a research sample of 184 agreements from different industries



Source: Kapitsa and Aralova, 2015.

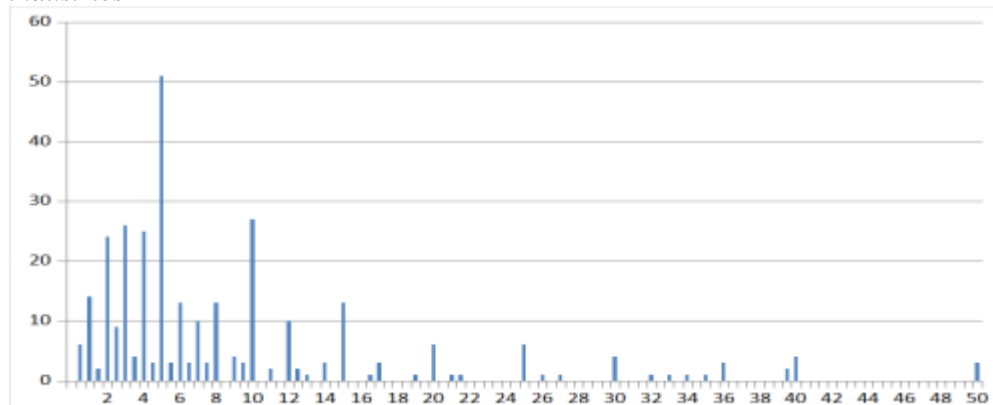
The data presented by Kapitsa and Aralov included 184 agreements, only 27 of which (less than 15%) were not expressed with a natural number. The rates above 10%, with only one exception in this study group, were expressed in natural numbers. The distribution of rates in the material presented by *Royalty Rates for Pharmaceuticals and Biotechnology* was similar.

Among the group comprising 315 license agreements, only 42(13%) were not expressed as a natural number. The proportion of the rates above 10% defined by non-natural numbers fell to just 6%. The rates of 5%, 10%, 15% and further

multiples of 5 are clearly overrepresented.⁴ They represent only 10% of the possible choices, and were used in practice in as many as 42% of signed license agreements, according to the data from the first study, and 31% from the second study. The rates of 5% and 10% proved to be the two most frequently used in both studies analysed. A high proportion of the rates are also multiples of 2.5 (which are in fact half a multiple of 5), which are more represented than other fractional rates.

What is more, the 12.5% rate in both cases is several times more represented than the following 13% rate, despite the fact that fractional rates are less represented than those expressed in natural numbers (in the Kapitsa and Aralov study, rate '13' did not occur at all).

Figure 2. Frequency of use of royalty rates (% of sales) in license agreements (pcs) in a research sample of 315 agreements in the pharmaceutical and biotechnology industries



Source: BVR, 2010.

Although the research samples in the two studies were significantly different (as the first one comprised 184 agreements from different industries, while the second one comprised 315 agreements from the pharmaceutical and biotechnology industries, i.e., relatively homogeneous agreements), significant similarities can be seen in the results of the distribution of the applied royalty rates.

These may be due to the fact that the process of valuing and negotiating the royalty rate is influenced by non-economic determinants in addition to economic factors. Among the former ones is the human, attributed with making irrational decisions in the process of valuing and negotiating the royalty rate for a particular intangible asset.

⁴In *Royalty Rates for Pharmaceuticals and Biotechnology*, the 36% rate occurred several times in the research sample, which is an error and it should have been indicated in the chart as the 35% rate instead.

3. Methodological Basis for the Arbitrariness of a License Agreement Expert and Negotiator

The theory of the rationality of choices is still one of the paradigms of modern microeconomics⁵, but it cannot be upheld in the light of empirical research and the progress of modern economic thought (including behavioural economics) (Becker, 1978). Person can function in everyday life (also in the professional sphere) without full information, constant monitoring and conscious control. The fact that people regularly rely upon intuition in the conduct of business is also pointed out by Leavitt (1975), and Peters and Waterman (1982). Kiełtyka and Jędrzejczyk (2015) even give intuition a permanent place in the managerial decision-making tool kits. It applies particularly to poorly structured problems, when decision making cannot employ measurable criteria (Kiełtyka and Jędrzejczyk, 2015, p. 133-142).

Studies by Tversky and Kahneman (1974, pp. 1124-1131 and 1982, pp. 160-173), Strack and Mussweiler (1997, pp. 437-446), among others, indicate that not only do people not act rationally, but their decision making (choices) show many contradictions. This means a fundamental irrationality of choices made by people.

This view is correct because, as Miłaszewicz states, “...*the traditional model of a decision-making individual striving to maximise expected utility, having well-defined, transitive, stable preferences and unlimited intellectual resources to analyse all relevant factors, is not an accurate model of the human individual as a decision-maker, as it is far from reality*” (Miłaszewicz, 2017, p. 70). The roots of this include habit driven psychosocial burdens, errors regularly made in thinking, placing too much weight on previous experiences, or drawing conclusions on the basis of a single fact or an unrepresentative sample (Kahneman and Tversky, 1992; Ariely, Loewenstein and Prelec, 2003; Ellsberg, 1961; Einhorn and Hogarth, 1986).

Regarding the realistic, rather than methodological, rationality of clients, Fisher expressed doubts long before the behaviourists. In developing his earlier research, culminating in his *The Money Illusion*, he concluded that, in order to maintain consistency between his early theory of money and the results of empirical work, the conceptual apparatus needed to be extended to include the *money illusion* effect, an expression of the irrationality of thinking about the value of money in, for instance, inflation conditions (Fisher, 1928).

This means that the psychosocial burden⁶ in the decision-making process of determining the royalty rate for an intangible good affects both the experts and those negotiating the final terms of the contracts. The human factor may therefore be

⁵*In thinking about rationality in economics, Irving Fisher, one of the fathers of the mathematization of this field of knowledge, went so far as to compare the rationality of economic laws with the rationality of laws in physics and astronomy (Fisher, 1907, p. 107).*

⁶*Understood according to the definition presented by D. Ariely (2009).*

responsible for the rates defined by natural numbers being overrepresented compared to the fraction ones. Using natural figures in everyday life, people tend to round up.

Likewise, the overrepresented rates that are multiples of 5 may be the case here. From a mathematical point of view, they do not stand out in any particular way from other numerical series (e.g., multiples of 3, 4, or 6).⁷ Numbers that are multiples of 5, however, reflect the decimal system currently in use, also arbitrary in its essence⁸.

In the same manner, a multiple of 12 (a dozen) had once had a major role when a mathematical and economic system based on that number was in use. Whether this reasoning is correct must be verified by analysing royalties in countries using units of measurement other than those based on the decimal system. This supposition will be confirmed when the anomaly of frequency the 'multiples of 5' rates are used with would be lower, while a rate that is a multiple of another number would be represented to a greater extent.

Arbitrariness in the valuation process of intangibles is also a source of anomaly. The choice of valuation method is always the decision of experts unless it is imposed on him by the principal. At the first stage of valuation, they usually determine several values, calculated with a number of methods in use. Then, they identify a range within which the final value is most likely to be found and, finally, establish it.

Again, they do so according to an arbitrary model, for example, using the arithmetic mean or weighted mean, giving their chosen sub-value greater or lesser weight. They can also determine the final expected value using only their authority of an expert, i.e., also arbitrarily. Finally, again arbitrarily, they round the calculated value up.

Another factor contributing to the anomalies may be the 25% rule applied in the valuation of intangibles (Sung-Soo, 2010, pp. 145-162), which, as stated by many authors (e.g., Goldscheider, 2011; Svacina, 2015) or institutions (e.g., Random House Dictionary), stems from practice rather than scientific knowledge (Goldscheider, 2011). In its inflexible form⁹, it abstracts from the specifics of a particular intangible right, the industry to which it relates, and changes in the distribution of effects between owner and user¹⁰.

⁷*With perhaps only one exception, in which a sequence of multiples of the number 2 is expressed as a set of even numbers.*

⁸*The overrepresentation of multiples of the number 5 could also be a kind of apophenia.*

⁹*R. Goldscheider (2011) points to the need for a flexible approach to this rule by defending its process adequacy and high practicality.*

¹⁰*This opinion is confirmed by, for example, the decisions of the US Federal Court, which on 4 January 2011, in *Uniloc v. Microsoft* held that, "the 25 per cent rule of thumb is a fundamentally flawed tool for determining a baseline royalty rate in a hypothetical negotiation" (Goldscheider, 2011, p. 1). Similarly, the Patent Court of England had long tended to point out in its decisions that the possible distribution of anticipated profits may tilt*

Valuation methods based on economic models are also to be included as subjective ones. These are determined by the valuation expert based on, among other things, a subjective assessment of the risk, as well as one's intuition about the adequacy of the assumptions made, or even rounding. Consequently, the model, including the results obtained through it, reflect the individual approach of the valuation expert.

How much information the valuation expert has can also influence a degree of anomalies in valuation. The more they have, the lower the cost of a non-optimal decision, but the cost of acquiring information increases. The optimal level of information acquisition is achieved when these two curves intersect. In practice, however, it is difficult to define.

Therefore, the extent of the collected material on which the valuation is based is arbitrarily decided by the valuation expert. Given that the data collected may be insufficient, they adopt, for example, valuation probability ranges and apply rounding.

All the above considerations indicate that, when estimating the value of a thing or right, one must accept that each time the result determined will be a figure resulting from an expert's arbitrariness and the valuation methods they adopted. This fact is accepted by both the valuation expert and the clients. As a result, the experts safeguard themselves by including a number of caveats to their calculations in the expert report.

The clients, on the other hand, are willing to accept a discrepancy (to a reasonable extent) between the valuation and the final agreed contractual terms of the license agreement. Consequently, the negotiator also plays a role in the process of determining the royalty rate by arbitrarily deviating from the expert's valuation. In such case, they apply their own rounding values and provide opinions on its justified level.

4. Conclusions

A statistical analysis of the actual percentage rates used in license agreements shows an above-average use of some of them, while others are relatively scarcely, or even not represented at all. Natural numbers prove to be particularly overrepresented, like 5 and its multiples.

The observed anomalies may be human related, which is in line with the trend of behavioural theory and the trend of a paradigm shift in economics, in which, when

more in favour of the owners of patents, brands and utility models than the so-called 25% rule implies, closer to a ratio of 1/3 : 2/3 or even 50% : 50%, e.g: E-UK Controls. Ltd's, License of Right (Copyright) Application (1998) R.P.C.. 833, as well as Sterling Fluid System Ltd's, License of Right (Copyright) Application (1999) R.P.C. 775.

studying economic processes and decisions, one looks at not only strictly rational behaviour, but also emotional, intuitive, arbitrary behaviour (Sokół and Surmacz, 2009). These anomalies may arise directly from the arbitrariness of the expert's decisions at many stages of the valuation, as well as the arbitrariness of decisions taken by decision-makers already during the final negotiation of contract terms.

It is manifested in the adoption of valuation methods based on one's own experience, a tendency to round off and simplify, and relying on numerical schemes, among other things. It should be noted, however, that the influence of the human factor on valuation results is a phenomenon inherent in the valuation process and cannot be eliminated. It can only be minimised.

Therefore, the valuation results should not be dismissed on the grounds of arbitrariness. Indeed, it is an intrinsic feature of the valuation process. Allegations can only be considered valid if they relate to unacceptable arbitrariness, i.e. one beyond the permissible limits. Nevertheless, the boundaries in this case are an issue because of not being sharply defined but variable.

The magnitude of the observed anomalies in the dispersion of license contract royalties, as presented in the article, indicates a high influence of human factors in the process of the final formation of contract rates or the presence of still other causal phenomena not anticipated until now. One of these factors can involve the practice of directly abstracting from the profitability of the use of an intangible asset when setting the royalty rate and basing it solely on the most common and easily perceived rates in the market, e.g., 5% and 10%.

However, such a practice would already be a manifestation of unacceptable decision-making arbitrariness. Completely abstracting from the profitability the use of a given intangible asset effects, and relying solely on patterns operating in the market, in the opinion of the authors of this paper, is simply a failure to make an economic choice, albeit one that entails significant economic consequences.

When decision-makers follow the rates most frequently used in the market, it can consequently lead to a further accumulation and distortion of the number of contracts with these particular royalty rates. Further research is therefore needed in this area.

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