Framework for the valuation of intellectual property

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Jason Hall, B.Com (Hons) CFA PhD
Cardinal Economics & Finance, jason.hall@cardinaleconomicsandfinance.com
+1 734 926 6989

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Welcome

Thank you for joining today's seminar. My name is Jason Hall and I teach finance in the Ross School of Business at The University of Michigan and am part-owner and director of the consulting firm, Cardinal Economics & Finance. I have a prepared presentation on the valuation of intellectual property. But we do not need to stick to the scripted presentation. Please take the opportunity to ask questions throughout the seminar.

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Agenda

In this presentation I will outline a framework for estimation of damages when the holder of intellectual property (IP) believes that the holder's ability to realize full value for that IP has been damaged by another firm's poor conduct. I will illustrate this with an example of a research firm which has developed a new drug, and a large pharmaceutical company which may have engaged in wrongful conduct by exploiting its knowledge of the IP, which was disclosed in confidential deal negotiations.

The steps I will walk through for estimation of damages are:

- Estimating total value of the intellectual property;
- Allocating total value between the parties according to two approaches:
  - Direct estimation from prior transactions; and
  - Consideration of alternative pathways to market for:
    - the holder of the IP (becoming a commercial firm); and
    - the firm accused of wrongful conduct (developing its own IP).

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Example

The fictional research company "Research Inc" has developed a treatment for rheumatoid arthritis, which it has patented. We will simply refer to rheumatoid arthritis as joint pain. Research Inc entered into confidential negotiations with the fictional pharmaceutical company "Big Phil." Research Inc disclosed information about the research which led to the patent, including the laboratory results, results of clinical trials, and promising results which suggest that the drug could also be used to treat back pain. Research Inc does not have approval from the Food and Drug Administration (FDA) for either joint pain or back pain.

The reason Research Inc approached Big Phil for a deal is that Big Phil currently does not market a drug for joint pain or back pain, but other large pharmaceutical companies do. So there is more upside potential for Big Phil to increase sales, compared to the potential at other large pharmaceutical companies.

The proposed deal with Big Phil would be that Big Phil would pay the costs of seeking FDA approval for use in joint pain, fund the costs of commercialization of the drug for joint pain, and pay for more research into the benefits for back pain. In return, Big Phil would have the exclusive right to sell the drug and would pay Research Inc a proportion of sales.

Terms were never agreed to by the parties. Prior to terms being agreed upon, Big Phil announced that it would walk away from the deal and would pursue development of a similar drug. The chemical make-up of Big Phil's drug looks similar, but not identical, to that developed by Research Inc. Big Phil's proposed series of clinical trials also looks similar, but not identical, to that used in the development of the original drug by Research Inc. So there is disagreement as to whether Big Phil has engaged in wrongful conduct by attempting to develop a similar drug in breach of Research Inc's patent. Further, there is disagreement over whether Big Phil has breached the terms of confidential negotiations.

The issue for us is, "If Research Inc is able to establish that Big Phil has engaged in wrongful conduct, how could we estimate the damages suffered by Research Inc?"

For the purposes of simplicity – this is a damages seminar not an "everything about litigation seminar" – we will ignore the possibility of obtaining an injunction to prevent development of Big Phil's drug. So we will assume that the conduct of Big Phil leads to Research Inc being unable to exploit its patent. Research Inc had something of value, it no longer has something of value due to the poor conduct of Big Phil, and we want to estimate what an appropriate amount of compensation is.

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Total value of intellectual property and the allocation of value

Issues

To estimate the damages Research Inc should receive as compensation for Big Phil's wrongful conduct we could proceed in two stages.

First, we could estimate the *total value* of the drug at the point immediately prior to Big Phil's poor conduct. This value would account for the risk of future success or failure of development of the drug, the risk associated with FDA approval, and the time and cost it would take before the drug would be expected to generate revenue. Note that we have one drug but two proposed applications, and the two applications are at different stages of progression.

Second, we could estimate an *allocation of total value* between Research Inc and Big Phil. This allocation of total value should account for the relative bargaining position of the two parties. On the one hand, Research Inc has developed a drug with a high chance of success in one application, and a moderate chance of success in another application. Research Inc would have had other commercialization options by conducting a deal with another large pharmaceutical company, but these options are less valuable than the deal with Big Phil, which currently does not sell an arthritis drug. Research Inc could also have commercialized the drugs itself, which means Research Inc bears all the risk of success or failure.

In short, the allocation of total drug value between Research Inc and Big Phil depends upon each party's bargaining position. Both parties benefit from a deal, trading intellectual property for commercialization capability, and would attempt to negotiate the best deal possible for themselves.

Having made the distinction between total value of the drug and the allocation of value, it becomes important that valuation and revenue figures obtained in discovery be correctly interpreted. It is also important that information is used to estimate damages at the point in time when the poor conduct occurred. The basic principle is to place Research Inc in the position it would have been in the absence of the poor conduct. So we need to conduct a careful *if-then* exercise, being:

> ***If** Big Phil had not engaged in poor conduct, **then** what deal would have been struck between Research Inc and Big Phil after accounting for the value of the drug and the relative bargaining position of the parties?*

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Issue 1: Estimating total value of the drug

To estimate the total value of the drug we can conduct a real options valuation of each drug. A real options valuation is a way of accounting for the probability that a successful drug will be developed, the timing when revenue would begin, and the investment required at different stages of development.

The first step in real options valuation is to correctly estimate expected payoffs at each stage of development of the drug. The term *expected payoff* means the probability-weighted average of the possible payoffs. For example, suppose there was a 60 per cent chance of success at a given stage and

the payoff in the event of success was $100, and a 40 per cent chance of failure and a payoff in the event of failure was $10. In this example the expected payoff is 0.60 × $100 + 0.40 × $10 = $60 + $4 = $64. Then, these expected payoffs need to be discounted to the time of the investment to account for risk and time value of money. The valuation from this stage is often called the *risk-weighted valuation*. It is also termed *discounted cash flow valuation*, based upon the expected cash flows (rather than the cash flows from a single scenario).

The second step in real options valuation is to account for the *lower risk of a multi-stage investment*, compared to an investment in which there is a commitment to make investments regardless of success or failure at intermediate stages. Multi-stage investments decrease risk because they create the option to abandon the project if results are poor, or the option to apply the drug to more clinical indications.

To estimate total value we would need to make estimates of the potential cash flows the drug would generate, the costs of developing the drug, the timeframe for development and the odds of successfully transitioning through each stage. The analysis already conducted by Research Inc would provide relevant information for this analysis, because ultimately we are trying to estimate the value of a deal that would have been struck between Research Inc and Big Phil in the absence of Big Phil's poor conduct. So the views of Research Inc and Big Phil on potential cash flows and the timing and risk associated with those cash flows is important for estimating total value.

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Issue 2: Allocating total value amongst the parties to a deal

Allocation of value can proceed in two directions

Estimating relative bargaining power between two parties is challenging because it is not directly observable. We can observe transaction terms, but these terms jointly reflect the total value of the deal and the relative bargaining power between two parties. So we need to place ourselves in the situation of the two negotiating parties and estimate what the strengths and weaknesses of their positions are.

We can proceed in two directions in addressing this issue.

First, we can directly estimate the value to Research Inc with reference to prior transactions (adjusted for the probability of commercialization and the expenditures required by Big Phil to achieve commercialization). What is left over from the total value is the value of the drug to Big Phil. We will call this the *direct approach*.

Second, we can estimate the value of the drug to Big Phil by considering Big Phil's alternative pathways to development, and what is left over from the total value is the value of the drug to Research Inc. We will call this the *residual approach*.

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Direction 1: The direct approach based upon prior transactions

We mentioned above that the terms of prior transactions are the outcome of total value of a drug, and the negotiations between two parties who each contribute to development of the drug. The outcome reflects each party's alternative courses of action, as well as their risk tolerance. For instance, the holder of a patent could have one unique opportunity to monetize the value of the patent, so could accept a low offer for the patent. The patent holder's high risk aversion places the patent holder in a weak bargaining position. Alternatively, if there is competition amongst bidders, the patent holder is in a strong position.

We can estimate the value of a deal with direct reference to prior transactions with similar risk and magnitude. The obvious limitation of prior transaction analysis is the limited comparability of prior transactions – each new drug is unique. But we can analyze transactions for drugs with similar market

sizes, similar willingness of consumer and insurance companies to pay, similar time frames for development and similar risks of success or failure.

A first stage in this approach is to identify prior transactions that are comparable to the deal which would have been struck between Research Inc and Big Phil, had the parties reached this stage. There are databases which describe royalty rates and other deal terms. At a simple level we could estimate a royalty rate of 5 per cent for prior pharmaceutical company deals. So for example, if the projected revenue stream for Big Phil is $800 million per year over 20 years (this is not a risk-weighted cash flow in the example, but is a possible cash flow from both drugs), growing at 3 per cent annually, and an estimated discount rate is 9 per cent a year, the present value of the projected royalty stream is $452 million.[1]

However, the damages bill is not merely the sum of the projected royalty stream in present value terms. We need to account for (1) the probability this royalty stream will be achieved; and (2) make adjustments to the baseline royalty rate to account for deal-specific issues. This means we need to account for the exclusivity of a deal (which could relate to the particular application of the drug or a particular geographic region) and what further research could stem from a particular piece of intellectual property and who is entitled to exploit the benefits of further research.

In this example we have two drugs to account for. Suppose the present value of potential royalties for the joint pain drug is $200 million and the present value of potential royalties for the back pain drug is $252 million, for total present value of $452 million.

- Suppose there is a 90 per cent chance that the joint pain drug receives FDA approval. We could say that the risk-weighted present value is $200 million × 90 per cent = $180 million.
- Now suppose there is a 50 per cent chance that the back pain drug receives FDA approval (which is an aggregate probability of completing different stages of trials). We could say that the risk-weighted present value is $252 million × 50 per cent = $126 million.
- The risk-weighted present value of the projected royalty stream is $180 million + $126 million = $306 million.

Note that in the above example we did not need to consider the research funding that would have been provided by Big Phil to progress development of the drug.

The royalty rate transactions are not the only type of prior transactions that are worth considering. There are deals relating to the achievement of milestones. For example, a large pharmaceutical company does a deal with a research firm to fund research and then makes a milestone payment upon success at a particular stage. This sort of transaction can be applied to the case of Research Inc and Big Phil. The damages estimate would be the present value of the risk-adjusted milestone payments, which account for the probability of achieving a given milestone and milestone payments in comparable transactions.

[1] The prospective cash flows in year 1 are $800 million × 0.05 = $40 million; the prospective cash flows in year two are $40 million × 1.03 = $41.2 million; and so on to year 20 in which the prospective cash flows are $40 million × 1.03^{19} = $70.1 million. We need to convert each prospective cash flow to present value using the equation: Present value = Cash flow in year t ÷ (1 + discount rate)^t. So the projected cash flow of $40 million in year 1 has present value of $40 million ÷ 1.09^1 = $36.7 million; the projected cash flow of $41.2 million in year 2 has present value of $41.2 million ÷ 1.09^2 = $34.7 million; and the projected cash flow of $70.1 million in year 20 has present value of $70.1 million ÷ 1.09^{20} = $12.5 million. In aggregate, the present value of each year of projected cash flow is $452 million.

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Direction 2: The residual approach based upon the relative bargaining position of the two parties

Under this approach we need to consider the alternative pathways to taking a drug to market that the two parties could have taken. These alternative pathways are likely to be less valuable than working together – after all, the value of working together is how we arrived at this question to begin with – but we can use alternative pathways and the bargaining position of the parties to arrive at an allocation of drug value.

An alternative pathway for Research Inc is to raise capital and commercialize the drug itself. This means that Research Inc would bear the full risk associated with potential failure of the drug, and Research Inc would have had to develop its own process for manufacture, distribution and marketing of the drug.

This means that one estimate of the value to Research Inc would be the present value of expected cash flows to Research Inc from turning itself into a commercial pharmaceutical company. This would be a risky investment, because Research Inc does not have expertise in commercialization. But this remains an alternative approach that Research Inc could have taken and which can be used to determine an estimate of damages.

The downside of this pathway for Research Inc is the incremental time, cost and risk compared to a deal with Big Phil. The upside is that Research Inc bears all the rewards from successful commercialization. Let's call this first estimate of value the *Research Inc commercialization value*. To enter into a deal with Big Phil, Research Inc would want the value of the deal to be at least as large as the IP holder's commercialization value. As an equation we have:

$$\text{IP holder's commercialization value} \leq \text{Value of the deal}$$

Now consider the transaction from the perspective of Big Phil. Big Phil also has an alternative course of action. Big Phil could develop its own strategy for the treatment of joint pain and back pain. It could hire scientists to perform additional trials, and allocate some of its commercial development people to commercialize the research.

Big Phil can estimate the *present value of the expected costs* of generating its own intellectual property. The present value of expected costs is *not the same as the present value of the costs that Research Inc incurred* in developing its own intellectual property. The cost to Big Phil, *on average*, to achieve the same outcome is higher.

For example, suppose we observe a successful new drug and ask a company what it spent on development of that drug. A company might have spent $100 million on development. But if there is a 5 per cent chance of success it means that another 19 companies could have also spent $100 million on development and failed. In other words, the *expected* cost of development is $2 billion for the drug in the example, because there is only a 5 per cent chance of success.

This leads to an upper bound of the estimated value for the drug, which we can label *Big Phil internal development value*.

The internal development value is the present value of expected costs Big Phil would have incurred to create intellectual property of comparable quality to that which Research Inc brought to the table. The calculation needs to properly account for the risk and timing of development, rather than being a simple aggregation of the actual costs incurred by Research Inc. Now our equation reads:

$$\text{IP holder commercialization value} \leq \text{Value of the deal} \leq \text{Internal development value}$$

For a transaction between Research Inc and Big Phil to occur the deal must be worth at least as much as the Research Inc commercialization value (otherwise, Research Inc would remain independent) and no more than the Big Phil internal development value (otherwise, Big Phil would use its own resources to

develop a similar drug). So damages can be estimated by developing a valuation range from the two approaches mentioned above. This range can then be refined to a point estimate after considering the direct approach from comparable transactions as described above.

Summary of valuation approach

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To summarize, in valuing intellectual property we can estimate damages according to the following process.

First, we can estimate total value of the intellectual property, which in our example was a drug for use in two applications (treatment of joint pain and back pain). We can account for the probability that the intellectual property ultimately leads to success by generating positive cash flows, the timing of each stage of development, costs incurred in commercialization, and the risk reduction associated with multi-stage investments. Accounting for the chance of success, timing and investment costs leads to a risk-adjusted valuation, also called a discounted cash flow valuation (in which the valuation is based upon the probability-adjusted cash flows rather than a single scenario). The adjustment for the risk reduction associated with multi-stage investments is done via a real options valuation.

Second, we can estimate damages by allocating total value between the holder of the intellectual property (Research Inc in the example) and the party which engaged in the poor conduct (Big Phil in the example). We can arrive at a valuation range by estimating commercialization value should the holder of the intellectual property pursue its own development, and the internal development value of the firm that exploited the intellectual property to which it was not entitled. The internal development value would account for the riskiness of this approach, which has a low chance of success and could take a long time to achieve. In other words, the internal development value accounts for the risk exposure of a business which has not seen the intellectual property and therefore could fail several times in developing its own intellectual property.

We could arrive at a final allocation of value by considering prior transactions with similar characteristics. Selection of prior transactions would be based upon the size of the market for the end product, the odds of success or failure, willingness of purchasers to pay, and similar time frames for development.