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Price volatility and indemnification clauses: an empirical study on licensing contracts

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Abstract

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Keywords

Technology licensing, indemnification clauses, intellectual property rights, pharmaceutical industry

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Introduction

Despite the extraordinary diffusion of technology licensing contracts in the last two decades (Arora & Gambardella, 2010a; WIPO, 2012), technology licensing deals remain highly uncertain in their process due to information asymmetry between the licensee and licensor (Anton & Yao, 2002; Kamien & Tauman, 2002; Katz & Shapiro, 1985, 1986). Particularly, due to unpredictability on technological development and the value of intellectual property (IP) rights licensing parts could experience contractual hazard and endure a more volatile payment structure, which in turn requires more intense monitoring effort and exposes to higher risk (Anton & Yao, 2002; Zuniga & Guellec, 2009).

A viable option to mitigate information asymmetry consists in the disclosure of intellectual property IP rights in the agreement (Anton & Yao, 2002; Beggs, 1992). When IP rights are fully revealed and clearly stated in the contract, the licensee is enabled to perform her own IP due diligence and could better assess the importance and the potential use of the transferred technology. As a result, disclosure of IP rights increases information available during the negotiation, so that licensing price is less volatile and the likelihood of contractual moral hazard is lower, because it is less likely to take advantage of counterpart's bewilderment (Anton & Yao, 2002; Cebrian, 2009; Choi, 2001; Mendi, 2005; Vishwasrao, 2007). However, disclosure of IP rights does not operate in isolation, as other instruments have been created to decrease the effect of IP uncertainty. Another available strategy dwells on drawing contract warranties and indemnification clauses within the main agreement (Furlotti, 2007; Grossman, 1981; Hagedoorn & Hesen, 2007). Warranties and indemnification clauses are promises to take responsibility against losses suffered by the counterpart due to scant product quality (Courville & Hausman, 1979; Lutz, 1989). Thus, warranties and indemnification clauses enforce contracts and guarantee negotiators in situations where it is costly verifying and communicating ex-ante complete information on products quality (Dyer, 1997; Grossman, 1981). Warranties and indemnification clauses in licensing contracts typically protect against patent infringement and product liability (Hagedoorn & Hesen, 2007); thus, they are important tools to equilibrate the risk that licensed technology might be proved invalid or useless during technological development, damaging the downstream commercialization of products (Hagedoorn & Hesen, 2007; Vukowich, 1968).

However, to the best of our knowledge, the use of IP warranties and indemnification clauses to lessen information asymmetry and lower price volatility in technology licensing still remains in a vacuum. Despite the theoretical acknowledgement (Hagedoorn & Hesen, 2007; Ramsay, 2003; Vukowich, 1968), practitioners [1] assert contrasting opinions [2] on the use of IP warranties and indemnification clauses, which in any case should be *"heavily qualified when adopted"* (legal and business counsel, focus group). That is to say, from an empirical

[1] Researcher collected explorative data on the use of IP warranties and indemnification through a web focus group hosted by Licensing Executive Society: 11 practitioners intervened in the discussion on the use warranties and indemnification clauses in licensing contracts by describing their understanding on these legal instruments and providing examples from practice. Practitioners that attended the focus group were legal and business counsels in private practice or organizations. Furthermore, researcher personally interviewed three licensing senior managers working in the biotech and pharmaceutical companies.

[2] For instance, one focus group participant claimed *"(We) never use. We explicitly provide* no *warranty. Licensees' lawyers only raise it try to flush out any known potential problems"*, meanwhile another participant stated *"To say warranties regarding validity and enforceability in negotiated IP* licenses never occur is too strong. They are not un*common"*.

standpoint we still miss to understand to what extent warranties and indemnification clauses absolve to their function and impact on information asymmetry. Particularly, it is still fuzzy how the impact of warranties on information asymmetry is reflected on licensing price volatility. According to previous studies, when both parts are highly uncertain about licensing conditions, they would be more likely to opt for a fixed payment (Gallini & Winter, 1985; Katz & Shapiro, 1985). Meanwhile, if just one part has critical information, it is more likely to select royalty based payment (Choi, 2001; Mendi, 2005). Finally, for intermediate levels of information asymmetry, licensor and licensee would optimally opt for a hybrid scheme based on a combination of lump-sum tariffs and royalties. By transmitting a signal on products or patent quality and licensor's future commitment, warranties and indemnification clauses lower information asymmetry for both the licensor and the licensee, so that we might expect these latter would be more likely to opt for a less volatile payment. However, we still need to appreciate the relative magnitude of this effect. The research tackles this gap and aims to answer to the following question: To what extents do indemnification clauses lower information asymmetry and price volatility in licensing contracts?

The research develops an econometric investigation on licensing contracts in the pharmaceutical industry. Data are extracted from Recap dataset. Research hypotheses are tested on a sample of 151 technology-licensing agreements in the pharmaceutical industry over the period 1984-2005. The research develops a multinomial logit model to correlate pricing scheme with the use of indemnification clauses, controlling for technological characteristics of the deals.

Contributions of the research are threefold. First, the research expands the economic literature on the design of licensing contract and on tools available to model information asymmetry (Laursen, Leone, Moreira, & Reichstein, 2013; Leone &

Reichstein, 2012; Somaya, Kim, & Vonortas, 2010). Second, the research provides additional empirical evidence on licensing practices and licensing pricing options, which still remains a limited explored research area (Anand & Khanna, 2000; Sakakibara, 2010). Third, the research is relevant for its practical implications, since it aims at corroborating through a systematic study previous anecdotal evidence on the best practices to optimally draft license agreements (Ramsay, 2003).

The article proceeds as follows. Next section reviews previous theoretical and empirical contributions and develops research hypotheses on the use of indemnification clauses and their impact on price volatility. Section three describers the research design and methodology. It follows the main findings and a discussion with references to managerial implications.

Price volatility and contractual provisions in technology licensing

Licensing contracts regulate the transfer of technology and know how from the licensor to the licensee. However, arm's length contracts are intrinsically uncertain due to both the nature technology and negotiators. Licensed technology might evolve and lead to unexpected future implementations, exposing licensing parts to the risk of rapid obsolescence and additional investments (Arora & Gambardella, 2010b). Furthermore, both the licensee and the licensor can be exposed to the risk of information asymmetry and bargaining power when one of the counterparts possesses more relevant information or when it is not possible monitoring the right degree of effort the two parts would commit to provide for the duration of the agreement (Arora, 1995). Therefore contractors might experience difficulties in the formal agreement, slow down successful commercialization (Shane & Somaya, 2007) and experience information asymmetry in the selection of licensing price scheme.

Indeed, licensing price could be arranged through three main types of arrangements: lump-sum, royalty-based and hybrid payments, which are disposed through a combination of the previous two schemes (Kamien, Oren, & Tauman, 1992; Kamien & Tauman, 2002; Katz & Shapiro, 1986; Vishwasrao, 2007). Theoretically, licensing parts are more likely to opt for a lump-sum payment either when information between negotiators is perfect between negotiators or when information asymmetry is very high among contractors, so that it is less risky obtaining an economic transfer immediately (Choi, 2001; Gallini & Wright, 1990). By accepting a fixed amount, the licensor avoids any type of opportunistic behavior from the licensee concerning future payments, meanwhile the licensee refrains from increasing royalties' adjustment along the duration of the agreement. Likewise, the licensor would agree to opt for a royalty-based scheme just when it is possible forecasting the expected outcome of the licensee. However, this payment scheme is more risky and costly to monitor and might suffer of higher volatility in future returns if conditions on the commercialization of innovation would change (Vishwasrao, 2007). Meanwhile, for intermediate levels of information asymmetry on both sides, negotiators are more likely to design licensing contracts with hybrid payments (Beggs, 1992; Cebrian, 2009; Gallini & Wright, 1990). Indeed, contracts with payments that include both fixed fees and royalties balance the economic risk over the time among parts (Choi, 2001; Mendi, 2005; Sen & Tauman, 2007). Empirical research on technology licensing found a positive correlation between relatedness of licensor's and licensee's patent portfolio and fixed payment scheme (Sakakibara, 2010).

Scholars have identified formal clauses as solutions to overcome uncertainty in licensing transactions (Hagedoorn & Hesen, 2007). Indeed, by including provisions and clauses in the design of licensing agreement, contractors aim at limiting moral hazard and adding relevant information to the contract. A more complete contract decreases the risk of moral hazard, improves the quality and the amount of information shared between parts, and allows more flexibility in the remuneration (Furlotti, 2007). Inclusion of formal clauses to overcome contractual incompleteness permits either to monitor contractual partners' behaviour or to enforce specific rights in case contingent events might occur.

Scholars that analysed the design of licensing contracts focused on exclusivity clause and proved that this provision contributes to align complementary capabilities of both licensor and licensee. Indeed, Somaya and colleagues provided empirical evidence that exclusivity clause is adopted as formal safeguard to protect licensee's investments on complementary assets and to facilitate contractibility of early stage technologies (Somaya et al., 2010). Within exclusivity clause, geography or products restrictions might be included to lower the risk of the licensor of working exclusively with the licensee. Furthermore, licensor and license could monitor moral hazard on future use and development of technology through the use of grant back clause (Leone & Reichstein, 2012). Indeed, grant back clause is an obligation to return to the licensor inventive upgrades to the technology. Grant back clauses are generally designed in contracts, in which the licensee and the licensor share common technological background. Moreover, technological uncertainty increases the odds to include grant back clause on the contract, particularly when the licensed technology is core for the licensee (Laursen et al., 2013). Grant back clauses clearly shift incentives on the licensor's side and lower the probability that the licensee would act opportunistically with the licensed technology, decreasing therefore the chances of moral hazard. However, empirical research proved that the inclusion of grant back clause has detrimental effects on licensee's future inventive efforts. Since licensee cannot fully appropriate from future developments of innovation, it is less likely that she would invest energy and time in improving the licensed technology (Leone & Reichstein, 2012).

Contract theory points out that contractual features that sustain enforcement of rights among parts are another option to overcome information asymmetry and outcome volatility (Furlotti, 2007; Grossman, 1981; Hagedoorn & Hesen, 2007). With enforcement clauses, parts are guaranteed that courts would easily verify the fulfilment of contractual obligations whenever specified contingencies would occur. Therefore, enforcement clauses decrease uncertainty on proper execution of contracts and allocation of rights among parts. Disposal of enforcement clauses decreases contract incompleteness, making sure that counterparts would have enough specifications to prove opportunistic behaviour in case certain condition would happen. Research on technology alliances in the biotech field found that enforcement clauses such as termination rights coupled with access to intellectual property rights achieve a higher payoffs respect to cases that omit the formal option. Explanation for these findings relies in the fact that through the inclusion of termination rights contractors overcome problems related to technological uncertainty and allocate decision rights. Warranties and dispute mechanisms are contractual features that parts might agree to draft in the licensing agreement in addition to termination rights in order to share the risk of defeated products or infringements of patents from third parties (Hagedoorn & Hesen, 2007; Vukowich, 1968). Warranties act as an ex ante risk allocation mechanisms, through which contractors display the reciprocal knowledge on a particular state of affairs of a product and carry the risk of misrepresentation (Grossman, 1981). Warranties are often associated with indemnities, which are promises by one party to take responsibility for the loss of the other parties would suffer if contingent circumstances would happen.

In licensing agreements we can distinguish enforcement clauses associated with the indemnification of product liability, patents infringements or a combination of these two (Ramsay, 2003). Indemnification clauses against patent infringements are warranties that cover the negotiators in the future in the case the patent(s) would be sued in a court for violation of the exclusivity of registered invention. This is an occurrence that increasingly happens in different technological fields, with a strong a impact on the organizations' budget (Galasso, Schankerman, & Serrano, 2013). Products liability clauses protect the insured parts against economic and reputational damages due to faulty products launched in the markets. Those types of indemnification clauses are particularly relevant for early stage technologies, which still do not present a clear pattern in terms of fields of applications and future evolutions. Finally, contracts could combine warranties for IP and products and offer the most extensive insurance on future negative events. Following previous reasoning, the inclusion of a single indemnification provision would decrease information asymmetry and therefore, it would decrease price volatility. We can imagine that this mechanism might operate for both indemnification clauses on intellectual property rights and products, since the occurrence of a plaintiff on either patens or products would negatively impact on financial performances of the involved contractors. Therefore, the inclusion of the clause would lower uncertainty in this respect, so that parts would be more prone to opt for a more flexible and less volatile payment scheme. We can draw the following hypotheses.

H1a: The inclusion of intellectual properties indemnification clause increases the likelihood of selecting a less volatile (i.e. two-tariff) payment scheme.

H1b: The inclusion of products indemnification clauses increases the likelihood of selecting a less volatile (i.e. two-tariff) payment scheme.

The inclusion of the indemnification clause in the design of the agreement is the outcome of a rational exercise where contractors consider i) the cost of specifying either unilateral or reciprocal duties, ii) the likelihood of the verification of contingent events, iii) the chance that the counterpart might act opportunistically in the future and eventually iv) the costs to be sustained in case certain provisions would be left apart from the agreement (Crocker & Reynolds, 1993). Therefore, the inclusion of indemnification clauses that consider both products and intellectual property rights infringements mitigates moral hazard and information asymmetry by reducing contract incompleteness but it increases the initial effort of negotiating the terms. Indeed, it requires that contractors properly understand the likelihood for the occurrence of the negative events –i.e. a plaintiff for both patent infringements and product liability- and design a comprehensive contract. As contract theory suggests (Crocker & Reynolds, 1993; Furlotti, 2007), complete contracts decrease information asymmetry but they are costly and ask for a secure payment –i.e. a lump sum transfer- in order to monetize immediately the effort of drafting an exhausting agreement. As a result of this increasing effort, contractual parts could be less prone to agree for a less volatile yet flexible payment scheme, as the two-part tariff is. Therefore we might hypothesize the following statement.

H2: The inclusion of an indemnification clause for both intellectual property rights and products decreases the likelihood of selecting a flexible (i.e. two-tariff) payment scheme.

Volatility of licensing price and technological relatedness

Previous research on the use of clauses in technology licensing agreements demonstrates that the adoption of certain obligations is correlated with technological relatedness and common expertise between the licensor and the licensee (Laursen et al., 2013; Leone & Reichstein, 2012). On one side, licensor should be more advanced on the technological expertise as the originator of the licensed technology. Indeed, the licensor should possess a more in-depth technological understanding that guarantees an increasing ability of judging potential opportunities and threats (Fosfuri, 2006; Kim, Vonortas, & Wiley, 2006). Therefore, licensor would generally benefit from a favorable information asymmetry, apart the case in which uncertainty on technological future development is very high. On the other side, research reported an improvement in the transfer of knowledge and in the absorption of know how if the licensee already masters some technological background related to the licensed technology (Ceccagnoli, Higgins, & Palermo, 2013; Ceccagnoli & Jiang, 2013). The rationale consists in the existence of similarities in the knowledge base that decreases information asymmetry on previous investments and required capabilities to license in the technology, and helps at disentangling uncertainty about future technological patterns. Indeed, firms with similar knowledge background tend to show similarities in skills, cognitive structures and frameworks that reduces the searching costs for potential technological partner and the screening for technology (Argote & Ingram, 2000; Katila & Ahuja, 2013; Zander & Kogut, 1995) Previous empirical research demonstrated that dissimilarities in partners' technological specialization are detrimental for the establishment of the alliance contract, while if partners have developed technological expertise in the same fields, mutual learning would be more likely and it is less necessary developing structured formal arrangements to coordinate actions (Colombo, 2003).

Furthermore, technological relatedness between licensing partners is correlated with payment scheme. When technological competences are aligned and there is a common understanding of capabilities and skills necessary to develop the licensed technology, information asymmetry between contractors is lower and there is less risk that opportunistic behavior takes place (Beggs, 1992). Therefore, we might imagine that when technological diversity is very high between licensing partners, a royalty payment method would be selected. This method would allow the licensee to share future risks with the licensor –i.e. if future commercialization would be unsuccessful for the licensee, the licensor would receive just a small outcome based on the royalty percentage- and the licensor to induce the counterpart to commit into the commercialization process of licensed technology to sustain positive profits in front of the royalty costs. However, information asymmetry among parts might be manipulated with the inclusion of clauses. Clauses can be generally inserted to decrease information asymmetry and allow flexibility and adjustments in case specified contingencies would occur (Crocker & Masten, 1988; Crocker & Reynolds, 1993; Furlotti, 2007; Hagedoorn & Hesen, 2007). When information asymmetry is high due to technological diversity, indemnification clause would allow sharing future risks so that parts would not face the risk of opportunistic behavior. Thus, the inclusion of the clause as a risk-sharing mechanism is reflected on pricing, as negotiators would select a mixed method pricing scheme that would allow to internalize the risk of contingencies (Cebrian, 2009; Furlotti, 2007; Gallini & Wright, 1990; Lyons, 1996). Therefore, in case of high technological diversity, parties might opt to include the clause in the contract allow for a mixed payment method instead of pure royalties system. We can therefore posit that:

H3: When licensing contract includes an indemnification clause and degree of technological diversity is high, licensing negotiators will opt for a less volatile (i.e. two-tariff) payment scheme.

Data and Methodology

Data

The research hypotheses are tested on a dataset based on the coding of 1830 agreements in the pharmaceutical industry over the time period 1985-2004. Licensing data were retrieved from ReCap database.

A number of considerations led to the exploration of the research question through ReCap database. Firstly, the dataset has been extensively used in the alliance and licensing literature, making this research comparable with previous findings (Schilling, 2009). Secondly, the dataset offers detailed information on the contractual specifications, the technology involved and the parts, which subscribed the deal. Particularly, we focused on contracts that satisfied the following requirements: i) the contract is a license; ii) information on patents and payment scheme is available; iii) the contractors involved are not under the same ownership chain –therefore, we excluded cross-group deals; iv) only unilateral agreements were selected, excluding cross-licensing deals; v) contracts with universities and public institutions were excluded. At the end of this selection, we ended with 151 contracts to use for our analysis.

Finally, the pharmaceutical industry is an interesting setting where to test our initial hypotheses because of the frequency of licensing deals. Indeed, in the pharmaceutical industry it is very common that small biotech firms generate innovation that then are licensed out to larger organizations, which then commercialize technology into the market thanks to larger scale capabilities. Hence, the selected industry is often exposed to arm's length transactions, in which pricing is a crucial determinant for the licensee to recover initial investment from innovation. Given the frequency of the phenomenon in the pharmaceutical industry, our investigation is also enforced for its practical relevance investigation.

We combined patent data available licensing contracts in ReCap dataset with additional information available through NBER Patent dataset. This step allows us to build several measures to characterize technological features of the contracts. However, it is worth pointing that use of patent data is a sufficient yet imperfect proxy of innovation at firm level. Indeed, some firms from the contracts are not listed as assignees on patents in NBER dataset, but still they might be innovators in their area. Therefore, our approach missed to include those firms in the analysis, despite the fact that they might have a technological profile. Although we are aware that this approach is not perfect, we relied on the fact that other studies in the field of market for technology literature could not overcome the same problem (Ziedonis, 2007).

Econometric model

The observed outcome is a multi-categorical variable that codes three different payment schemes: lump sum, royalties and a combination of the previous two ones. Thus, we adopted multinomial logistic as a model to estimate the likelihood of selecting a payment scheme, given the presence of indemnification clauses and technological features in the agreement. We used lump sum payment as baseline category and then estimated two parameters for each explanatory variable. On one side, the first coefficient $\beta_{i,1}$ describes how the independent variable X_i influences the probability of selecting a royalty based payment respect to the baseline option –i.e. lump sum. On the other side, the second coefficient expresses the likelihood of selecting a two-tariff scheme instead of a lump sum. We also estimated models where the baseline category is royalty payment, in order to control for consistency in the results of two-tariff scheme respect to the likelihood of selecting either a lump sum or a royalty-based payment.

Variables

Dependent variable

The dependent variable is a three level categorical variable indicating the licensing pricing mechanisms selected by the parts. Research grouped each agreement into one of those following categories: contracts with lump sum, royalties or ones with both lump sum and royalties. The category lump sum includes up-front fees, milestones payment and minimum annual royalties. Royalty category comprises royalties on net sales, royalties on gross sales and licensee’s profit share. The third category, i.e. two-part tariff, incorporates deals that combine both fixed and outcome-based payment schemes.

Independent variables

The presence of indemnification clauses is captured by three dichotomous variables, namely IP indemnification, product indemnification and indemnification bundle. IP indemnification is a dummy variable equal to one if the contract includes a warranty against patent infringements. Product indemnification assumes values equal to one if the deal insures one of the negotiators against faulty products that could derive from the licensed technology. Finally, contracts could combine the previous two warranties and in that case we operationalize a dichotomous variable equal to one to operationalize the indemnification bundle.

The other explanatory variable is technological diversity. Following previous research (Branstetter & Sakakibara, 2002; Jaffe, 1986; Sakakibara, 2010), we operationalized technological diversity between licensing partners by looking at the distribution of patents across three digits USPTO patent classes in the five years previous licensing agreement and measuring the degree of technological overlap. Therefore, we calculate the following measure

$$Technological\ diversity = 1 - \frac{F_i F_j'}{\sqrt{(F_i F_i')(F_j F_j')}}$$

Where the multimensional vector $F_i=(F^1_i, F^S_i)$ represents the number of patents assigned to firm i from class 1 to S. The variable ranges from 0 to 1, where value close to 0 indicating the highest degree of technological diversity.

Controls

In order to account for other effects, we include a number of controls that past research demonstrated to affect licensing process and the selection of pricing options.

Patents and technology specialization measures

We control for patenting experience of both licensee and licensor in the 5 years before the establishment of the licensing agreement. We control for patents' generality and the number of backwards citations. We control for technological specialization by calculating a Herfindhal index for the total number of patents in the firm J's patent portfolio accumulated during 5 years before the license agreement. For the licensor, the measure can be operationalized as follow. An equal operationalization has been used to monitor licensee's technological specialization.

$$licensor\ technological\ specialization \sum_{j=1} (\frac{N_{ij}}{N_i})^2$$

Trust

Previous studies found that transactions do not always occur as stand-alone events, yet they could be contextualized into on-going relationships (Cebrian, 2009; Kim et al., 2006). To operationalize this variable, the research would control though a dichotomous variable whether the licensing parts were already involved in previous negotiations.

Bargaining power.

Differences in bargaining power among parts might produce different effects on the pricing outcome. Allocation of rights between the licensee and the licensor might reflect bargaining power (Somaya et al., 2010). Therefore, the research controls with three dichotomous variables if the indemnified part is either the licensee, or the licensor or both of them.

Results

Table 1 provides an overview of the data and some descriptive statistics, while table 2 reports correlates of variables included in the analysis. The sample consists of

151 contracts. For those contracts, we estimated our analysis at technology level, using 227 observations.

****INSERT TABLE 1****

****INSERT TABLE 2***

Correlations among variables are below the threshold level of 0.5-0.6, suggesting that multi-collinearity does not affect estimation.

The results of the multinomial logistic model are reported in tables 3 (baseline payment scheme: lump sum) and 4 (baseline payment scheme: royalty).

****INSERT TABLES 3.1 AND 3.2****

****INSERT TABLE 4.1 AND 4.2***

Results (tables 2 and 3) from multinomial logistic confirm both hypotheses 1b and 2. The use of indemnification clauses on products increases the likelihood of opting for a payment scheme that combines both lump sum and royalties, while the introduction of a clause that combines both products and IP indemnification has a negative effect on the likelihood of selecting a two-tariff payment. Rationale behind this result could be that through the introduction of the bundling clause, contracts are then so complete that parts would opt for a lump sum payment, which is demonstrated to be efficient when information asymmetry is absent and parts could fully monitor opportunistic behavior. Yet, hypothesis 1a lacks statistical significance and cannot be fully supported, despite the confirmed expected sign and the effect. Indeed, patent litigation is a highly uncertain and costly process (Galasso et al., 2013; Shane & Somaya, 2007) and the inclusion of the indemnification clause could not be sufficient to decrease information asymmetry. Finally, hypothesis 3 is rejected and data would suggest instead that parts would rather more likely opt for a royalty-based scheme.

Discussion and Conclusions

Research develops an econometric investigation on licensing contracts in the biotech industry through a multinomial logistic model to correlate licensing price schemes with indemnification clauses, controlling for technological features.

We propose that price volatility in licensing deals could be manipulated through the use of indemnification clauses. Building on market for technology literature and contract theory, we suggest that the inclusion of a single provision in technology licensing deals decreases price volatility; yet, the effect is weaken when the bundling of IP and product liability indemnification clauses increases the costs of drafting licensing contracts.

From a managerial perspective, our research contributes in shedding lights on the optimal drafting of contracts, with a particular focus on licensing deals. In fact, our investigation demonstrates that indemnification clauses could be an interesting and flexible tool to overcome information asymmetry. Yet, negotiators should optimally balance their insurance mechanisms in the drafting of the contract and should avoid a too extensive use of warranties, which are costly to draft in front of the occurrence of uncertain events.

As a major limitation, the model focuses solely on the biotechnology field, and it does not control for industry variance. Yet, it is fair to say that biotech is one of the industry, in which licensing occurs with highest frequency (Anand & Khanna, 2000), thus results have a distinguished practical implication.

Contributions are threefold. First, the research expands the economic literature on the design of licensing contract and on tools available to model information asymmetry (Leone & Reichstein, 2012; Somaya et al., 2010). Second, the research contributes by providing additional empirical evidence on licensing practices and licensing pricing options, which still remains a limited explored research area (Anand & Khanna, 2000; Sakakibara, 2010). Third, the research has relevance for its practical implications, since it aims at corroborating through a systematic study previous anecdotal evidence on the best practices to optimally draft license agreements (Ramsay, 2003).

Tables

Table 1

Variable	Obs	Mean	Std. Dev.	Min	Max
jaffe_rev	227	0.7218544	0.2755225	0.0144212	1
count_inter	227	374.9119	573.946	0	1560
ip_indm	227	0.0176211	0.1318607	0	1
ins_see	227	0.0220264	0.1470938	0	1
ins_sor	227	0.3259912	0.4697799	0	1
ins_both	227	0.5110132	0.5009834	0	1
prod_indm	227	0.4757709	0.5005163	0	1
indm_bundle	227	0.3656388	0.4826732	0	1
see_pat_exp	227	9.528634	5.067056	1	19
see_herf	227	0.6616938	0.3085483	0	0.9683427
see_backwdn	227	16.53717	34.95976	0	183
see_generay	227	0.6359891	0.2887421	0	1
sor_pat_exp	227	8.436123	3.864877	2	19
sor_herf	227	0.5488314	0.2383375	0	0.9745993
sor_backwdn	227	12.53157	13.46412	0	94
sor_generay	227	0.6977218	0.2062661	0	1

Table 2, 3.1, 3.1, 4.1 to 4.2

	jaffe_rev	count_inter	ip_indm	ins_see	ins_sor	ins_both	prod_indm	indm_bundlee	see_pat_exp	see_herf	see_backwdn	see_generality	sor_pat_exp	sor_herf	sor_backwdn	sor_generality
jaffe_rev	1															
count_inter	0.1552*	1														
ip_indm	-0.0214	-0.0415	1													
ins_see	0.0008	-0.0465	0.8937*	1												
ins_sor	-0.0362	-0.2228*	-0.0553	-0.0618	1											
ins_both	0.0028	0.3721*	-0.079	-0.0884*	-0.6473*	1										
prod_indm	-0.1657*	0.3192*	-0.1056*	-0.0802	0.3590*	0.1949*	1									
indm_bundle	0.1632*	-0.1934*	-0.0373	-0.0417	-0.0940*	0.2758*	-0.5837*	1								
see_pat_exp	0.1063*	0.7918*	-0.0618	-0.0706	-0.2861*	0.3584*	0.3070*	-0.2384*	1							
see_herf	-0.0088	0.3924*	0.0188	0.0374	-0.0679	0.2165*	0.2747*	-0.1303*	0.7328*	1						
see_backwd~n	0.2013*	0.0955*	-0.0155	-0.0239	-0.1086*	0.2190*	-0.0861	0.2438*	-0.0434	-0.1511*	1					
see_genera~y	0.0435	0.3072*	-0.0027	0.0125	-0.0151	0.1196*	0.1319*	-0.0255	0.2600*	0.1982*	0.0271	1				
sor_pat_exp	-0.0147	-0.2460*	-0.062	-0.0809	0.0512	-0.1489*	-0.2883*	0.2298*	-0.4950*	-0.5694*	-0.1789*	-0.1897*	1			
sor_herf	-0.0711	-0.0068	-0.0139	-0.0063	-0.0761	-0.2390*	-0.1566*	-0.2052*	-0.2356*	-0.4470*	0.1936*	-0.0382	0.2112*	1		
sor_backwd~n	0.1471*	-0.0075	-0.0178	-0.0217	-0.1678*	-0.1224*	-0.2119*	-0.0963*	-0.1830*	-0.4132*	-0.1684*	-0.3131*	0.4426*	0.081	1	
sor_genera~y	0.2729*	0.0188	0.0258	0.0378	-0.0436	-0.0488	-0.2489*	0.1902*	-0.1394*	-0.2297*	0.2310*	-0.0142	0.2977*	0.1958*	-0.0963*	1

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8	
	Lump sum		Lump sum		Lump sum		Lump sum		Lump sum		Lump sum		Lump sum		Lump sum	
	Royalty	Two-tariff	Royalty	Two-tariff	Royalty	Two-tariff	Royalty	Two-tariff	Royalty	Two-tariff	Royalty	Two-tariff	Royalty	Two-tariff	Royalty	Two-tariff
jaffe_rev			0.2696	-2.6693*	0.3772	-2.4575	0.7265	-2.1609	4.1333	0.7679	0.6223	-1.9363	-0.5503	-2.9945*	-0.6186	-3.0151*
			(2.6250)	(1.2814)	(2.6637)	(1.3481)	(2.6821)	(1.3680)	(3.2487)	(1.8369)	(3.1157)	(1.3392)	(2.7581)	(1.2635)	(2.8407)	(1.2713)
ip_indm					2.7479	15.2382	20.4949	35.4939	5.0107	17.1602	5.2502	17.2708				
					(2820.0348)	(2237.6646)	(22309.7434)	(15330.7444)	(2096.8851)	(1558.8436)	(6300.2524)	(6090.4161)				
prod_indm													2.2286	2.4465**	2.1917	2.4994**
													(1.3096)	(0.8988)	(1.3297)	(0.9136)
indm_bundle																
ins_see							-18.0706	-20.3656							-13.3699	0.4470
							(22078.5626)	(15116.1585)							(2842.2512)	(1.4009)
ins_sor									5.9386**	5.0517***						
									(1.8313)	(1.4415)						
ins_both											-6.9601***	-0.8016				
											(2.0354)	(0.7326)				
count_inter			0.0139***	0.0024	0.0140***	0.0024	0.0144**	0.0028	0.0114*	0.0005	0.0130**	0.0037	0.0150**	0.0035	0.0149**	0.0035
			(0.0042)	(0.0034)	(0.0042)	(0.0034)	(0.0044)	(0.0036)	(0.0048)	(0.0042)	(0.0046)	(0.0037)	(0.0050)	(0.0043)	(0.0049)	(0.0043)
see_pat_exp	0.1488	0.0521	-0.2666	0.1295	-0.2535	0.1411	-0.3103	0.0853	0.0066	0.3613**	0.1349	0.1609	-0.0792	0.3041*	-0.0699	0.3223*
	(0.1159)	(0.1021)	(0.2040)	(0.1051)	(0.2038)	(0.1047)	(0.2091)	(0.1138)	(0.2302)	(0.1384)	(0.3454)	(0.1138)	(0.2416)	(0.1476)	(0.2483)	(0.1585)
see_herf	13.0689***	5.4631**	19.1772***	5.4912**	18.9293***	5.3078**	19.3995***	5.7504**	17.4294***	2.3936	13.3954*	4.0796*	18.4954***	5.0886**	18.3587***	4.9751**
	(3.2035)	(1.6912)	(4.6162)	(1.7315)	(4.5809)	(1.7251)	(4.6169)	(1.7871)	(5.2966)	(2.0449)	(6.7324)	(1.8644)	(4.6883)	(1.7991)	(4.6646)	(1.8336)
see_backwd_mean	0.0597**	-0.0110	0.0459**	-0.0141	0.0460**	-0.0125	0.0425*	-0.0158	0.0483*	-0.0422	0.0820*	-0.0018	0.0543**	-0.0217	0.0535**	-0.0208
	(0.0187)	(0.0164)	(0.0163)	(0.0212)	(0.0164)	(0.0210)	(0.0166)	(0.0217)	(0.0218)	(0.0298)	(0.0326)	(0.0160)	(0.0193)	(0.0254)	(0.0199)	(0.0256)
see_generality	-0.2611	-4.6179**	-5.4627	-4.7093*	-5.2199	-4.3028*	-5.2897	-4.2492*	-2.3409	-2.6164	-4.4548	-2.6757	-6.6260*	-6.9575**	-6.6793	-6.8747*
	(2.0656)	(1.7701)	(2.9147)	(1.9266)	(2.9320)	(1.9050)	(2.9169)	(1.9109)	(3.3894)	(1.8041)	(4.4977)	(1.6551)	(3.3621)	(2.6943)	(3.4134)	(2.7064)
sor_pat_exp	0.4586***	0.2739*	0.8748***	0.3082*	0.8749***	0.3199*	0.8255***	0.2685*	0.7811***	0.2378	0.9098***	0.2673*	0.9765***	0.4220**	0.9695***	0.4385**
	(0.1330)	(0.1092)	(0.2102)	(0.1261)	(0.2109)	(0.1251)	(0.2137)	(0.1287)	(0.2142)	(0.1382)	(0.2659)	(0.1259)	(0.2304)	(0.1524)	(0.2389)	(0.1608)
sor_herf	-3.2329	-1.9157	5.8454*	-0.0903	5.8545*	-0.1819	5.9548*	-0.1266	5.3481	-1.1666	-5.2048	-0.4259	6.2420*	0.4281	6.4750*	0.4626
	(1.8462)	(1.6240)	(2.7336)	(1.7042)	(2.7365)	(1.7226)	(2.7530)	(1.7579)	(2.9712)	(2.1222)	(4.7453)	(1.7668)	(2.9114)	(1.7014)	(2.9480)	(1.6942)
sor_backwd_mean	0.0972*	0.0525	-0.6018**	0.0927	-0.6094**	0.0852	-0.6171**	0.0828	-0.4815*	0.1846**	-0.6241**	0.0844	-0.4663*	0.1892**	-0.4639*	0.1886**
	(0.0482)	(0.0458)	(0.2257)	(0.0521)	(0.2241)	(0.0519)	(0.2242)	(0.0521)	(0.2261)	(0.0681)	(0.2258)	(0.0494)	(0.2307)	(0.0679)	(0.2274)	(0.0681)
sor_generality	-1.1731	-1.3877	-3.6419	-0.9604	-3.8221	-1.3574	-3.4483	-0.8441	-1.6466	-1.9822	1.9668	-1.1393	-1.9029	-0.1657	-1.8809	-0.3426
	(2.1553)	(1.7056)	(2.9838)	(1.7326)	(3.1306)	(1.8816)	(3.1304)	(1.9371)	(3.8488)	(2.2592)	(4.4722)	(1.7766)	(3.3947)	(1.8106)	(3.5261)	(1.9103)
_cons	-12.4825***	0.8057	-14.3155***	-0.0625	-14.3892***	-0.2865	-14.1636***	-0.1878	-22.7352***	-3.0220	-11.1796*	-0.6111	-18.1121***	-2.5914	-18.0692***	-2.8019
	(3.6735)	(2.1044)	(4.0190)	(2.1027)	(3.9966)	(2.0888)	(3.9949)	(2.1015)	(5.6030)	(2.2717)	(4.4668)	(1.9991)	(4.8884)	(2.3904)	(4.9422)	(2.4866)
N	227	227	227	227	227	227	227	227	227	227	227	227	227	227	227	227
ll	-143.4631	-143.4631	-83.9198	-83.9198	-83.2093	-83.2093	-82.0812	-82.0812	-71.5019	-71.5019	-71.5495	-71.5495	-78.9094	-78.9094	-78.7579	-78.7579

Standard errors in parentheses
="* p<0.05 ** p<0.01 *** p<0.001"

	Model 9		Model 10		Model 11		Model 12		Model 13		Model 14	
	Lump sum		**Lump sum**		**Lump sum**		**Lump sum**		**Lump sum**		**Lump sum**	
	Royalty	**Two-tariff**	**Royalty**	**Two-tariff**	**Royalty**	**Two-tariff**	**Royalty**	**Two-tariff**	**Royalty**	**Two-tariff**	**Royalty**	**Two-tariff**
jaffe_rev	2.6881	-1.0831	-2.5443	-2.2358	0.3755	-2.6488*	0.3859	-2.6389*	-0.0097	-1.0729	0.1658	-2.3188
	(3.2783)	(1.5227)	(3.7162)	(1.2932)	(2.5445)	(1.1959)	(2.5447)	(1.1920)	(3.0641)	(1.5402)	(3.1037)	(1.2533)
ip_indm												
prod_indm	0.6282	1.5281	0.2458	2.3185**								
	(1.5061)	(0.9654)	(1.9478)	(0.8648)								
indm_bundle					-7.4140***	-1.1115	-7.4112***	-1.1096	-8.0693***	-0.5607	-5.5297**	-0.9477
					(1.7700)	(0.7962)	(1.7729)	(0.7961)	(2.2800)	(1.0238)	(2.0032)	(0.8306)
ins_see							-8.7365	-0.2505				
							(1392.6040)	(1.4089)				
ins_sor	5.4440**	3.9135**							0.6336	3.8365**		
	(1.9884)	(1.4105)							(2.9000)	(1.3228)		
ins_both			-8.6190***	-1.0635							-4.0113*	-0.5211
			(2.1758)	(0.8028)							(1.9800)	(0.7587)
count_inter	0.0137**	0.0024	0.0167**	0.0054	0.0129**	0.0055	0.0130**	0.0056	0.0129*	0.0036	0.0124**	0.0054
	(0.0049)	(0.0043)	(0.0057)	(0.0043)	(0.0048)	(0.0042)	(0.0049)	(0.0042)	(0.0053)	(0.0044)	(0.0048)	(0.0041)
see_pat_exp	-0.0253	0.3727*	0.3131	0.2667*	0.0502	0.1317	0.0437	0.1249	0.1049	0.2790*	0.2082	0.1504
	(0.2475)	(0.1514)	(0.3165)	(0.1353)	(0.2054)	(0.1101)	(0.2083)	(0.1167)	(0.2284)	(0.1363)	(0.2925)	(0.1149)
see_herf	18.3513***	2.6209	12.8330*	3.7712	14.2860**	4.8211**	14.3408**	4.8797**	10.1570*	2.7623	12.2917*	4.2642*
	(5.5003)	(2.1443)	(6.3605)	(2.0404)	(4.6577)	(1.7663)	(4.6655)	(1.8007)	(4.7539)	(2.1199)	(5.1776)	(1.9239)
see_backwd_mean	0.0460*	-0.0384	0.1075**	0.0012	0.1048***	0.0020	0.1043**	0.0015	0.1060***	-0.0213	0.1070**	0.0038
	(0.0217)	(0.0318)	(0.0371)	(0.0215)	(0.0316)	(0.0159)	(0.0318)	(0.0162)	(0.0320)	(0.0314)	(0.0370)	(0.0150)
see_generality	-5.0367	-4.9371	-8.2642	-4.6505	-1.7315	-3.8653*	-1.7842	-3.9087*	0.4051	-3.3587	-2.3354	-3.0615
	(3.7938)	(2.5628)	(5.4469)	(2.5262)	(3.3909)	(1.9079)	(3.4061)	(1.9303)	(3.6512)	(1.9695)	(3.7222)	(1.8504)
sor_pat_exp	0.7649***	0.2379	1.1096***	0.3557*	1.3223***	0.3091*	1.3154***	0.3023*	1.2666***	0.1872	1.2112***	0.2939*
	(0.2237)	(0.1487)	(0.3265)	(0.1481)	(0.2944)	(0.1374)	(0.2969)	(0.1421)	(0.3319)	(0.1480)	(0.3185)	(0.1400)
sor_herf	6.8580*	0.1800	-7.6245	0.0673	-7.7464	-0.1301	-7.7361	-0.1253	-11.1198*	-0.0497	-9.8085*	-0.2936
	(2.9292)	(1.9341)	(4.6285)	(1.7863)	(4.0820)	(1.6194)	(4.0964)	(1.6233)	(5.4965)	(1.9793)	(4.6980)	(1.6973)
sor_backwd_mean	-0.4656	0.2432**	-0.6415*	0.1712**	-0.3777	0.1057*	-0.3768	0.1067*	-0.3026	0.1854**	-0.4128	0.1020
	(0.2424)	(0.0790)	(0.2774)	(0.0641)	(0.2225)	(0.0531)	(0.2227)	(0.0536)	(0.2313)	(0.0699)	(0.2211)	(0.0521)
sor_generality	0.8584	1.2655	4.1575	0.0520	0.1584	-0.3623	0.2439	-0.2717	0.5268	0.3522	2.3958	-0.5259
	(4.0351)	(2.1732)	(4.6218)	(1.8058)	(2.8719)	(1.7189)	(2.9058)	(1.7838)	(3.0357)	(1.9299)	(3.6807)	(1.6896)
_cons	-23.1155***	-4.2587	-10.1168	-2.9008	-15.3742***	-0.8344	-15.3171***	-0.7871	-12.5929*	-2.7350	-13.2891**	-0.8878
	(5.8584)	(2.5169)	(5.7411)	(2.3398)	(4.4463)	(2.1585)	(4.4602)	(2.1807)	(6.3260)	(2.2700)	(4.5500)	(2.0989)
N	227	227	227	227	227	227	227	227	227	227	227	227
ll	-72.5489	-72.5489	-67.0657	-67.0657	-71.8439	-71.8439	-71.8259	-71.8259	-64.6237	-64.6237	-68.5499	-68.5499

Standard errors in parentheses
="* p<0.05

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8	
	Royalty		Royalty		Royalty		Royalty		Royalty		Royalty		Royalty		Royalty	
	Lump sum	Two-tariff	Lump sum	Two-tariff	Lump sum	Two-tariff	Lump sum	Two-tariff	Lump sum	Two-tariff	Lump sum	Two-tariff	Lump sum	Two-tariff	Lump sum	Two-tariff
jaffe_rev			-0.2696	-2.9388	-0.3772	-2.8347	-0.7265	-2.8874	-4.1333	-3.3654	-0.6223	-2.5586	0.5503	-2.4442	0.6186	-2.3965
			(0.9182)	(0.2228)	(0.8874)	(0.2440)	(0.7865)	(0.2359)	(0.2033)	(0.2675)	(3.1157)	(2.8766)	(2.7581)	(2.4921)	(2.8407)	(2.5697)
ip_indm					-2.7479	12.4903	-20.4949	14.9990	-5.0107	12.1495	-5.2502	12.0206				
					(0.9992)	(0.9942)	(0.9993)	(0.9996)	(0.9981)	(0.9931)	(6300.2524)	(1612.4552)				
prod_indm													-2.2286	0.2179	-2.1917	0.3078
													(1.3096)	(1.1960)	(1.3297)	(1.2182)
indm_bundle																
ins_see							18.0706	-2.2950							13.3699	13.8169
							(0.9993)	(0.9999)							(2842.2512)	(2842.2510)
ins_sor									-5.9386**	-0.8869						
									(0.0012)	(0.5470)						
ins_both											6.9601***	6.1585**				
											(2.0354)	(1.9284)				
see_pat_exp	-0.1488	-0.0966	0.2666	0.3960*	0.2535	0.3946*	0.3103	0.3956*	-0.0066	0.3547	-0.1349	0.0260	0.0792	0.3833	0.0699	0.3922
	(0.1993)	(0.1645)	(0.1914)	(0.0274)	(0.2135)	(0.0279)	(0.1378)	(0.0283)	(0.9771)	(0.0619)	(0.3454)	(0.3273)	(0.2416)	(0.2007)	(0.2483)	(0.2016)
see_herf	-13.0689***	-7.6059**	-19.1772***	-13.6860**	-18.9293***	-13.6215**	-19.3995***	-13.6490**	-17.4294***	-15.0359**	-13.3954*	-9.3157	-18.4954***	-13.4069**	-18.3587***	-13.3836**
	(0.0000)	(0.0060)	(0.0000)	(0.0016)	(0.0000)	(0.0016)	(0.0000)	(0.0016)	(0.0010)	(0.0025)	(6.7324)	(6.5594)	(4.6883)	(4.3844)	(4.6646)	(4.3462)
see_backwd_mean	-0.0597**	-0.0706**	-0.0459**	-0.0600*	-0.0460**	-0.0584*	-0.0425*	-0.0583*	-0.0483*	-0.0906*	-0.0820*	-0.0838*	-0.0543**	-0.0760*	-0.0535**	-0.0743*
	(0.0014)	(0.0054)	(0.0050)	(0.0231)	(0.0051)	(0.0259)	(0.0104)	(0.0282)	(0.0265)	(0.0122)	(0.0326)	(0.0349)	(0.0193)	(0.0313)	(0.0199)	(0.0312)
see_generality	0.2611	-4.3567***	5.4627	0.7534	5.2199	0.9171	5.2897	1.0405	2.3409	-0.2754	4.4548	1.7792	6.6260*	-0.3315	6.6793	-0.1954
	(0.8994)	(0.0002)	(0.0609)	(0.7784)	(0.0750)	(0.7313)	(0.0698)	(0.6927)	(0.4898)	(0.9303)	(4.4977)	(4.3446)	(3.3621)	(2.9037)	(3.4134)	(2.8885)
sor_pat_exp	-0.4586***	-0.1847*	-0.8748***	-0.5666**	-0.8749***	-0.5550**	-0.8255***	-0.5569**	-0.7811***	-0.5433**	-0.9098***	-0.6425**	-0.9765***	-0.5545**	-0.9695***	-0.5310**
	(0.0006)	(0.0220)	(0.0000)	(0.0011)	(0.0000)	(0.0015)	(0.0001)	(0.0016)	(0.0003)	(0.0015)	(0.2659)	(0.2432)	(0.2304)	(0.1914)	(0.2389)	(0.1972)
sor_herf	3.2329	1.3172	-5.8454*	-5.9356**	-5.8545*	-6.0364**	-5.9548*	-6.0814**	-5.3481	-6.5147**	5.2048	4.7789	-6.2420*	-5.8140*	-6.4750*	-6.0125*
	(0.0799)	(0.2226)	(0.0325)	(0.0072)	(0.0324)	(0.0062)	(0.0305)	(0.0057)	(0.0719)	(0.0044)	(4.7453)	(4.4960)	(2.9114)	(2.4511)	(2.9480)	(2.4935)
sor_backwd_mean	-0.0972*	-0.0447**	0.6018**	0.6945**	0.6094**	0.6946**	0.6171**	0.7000**	0.4815*	0.6662**	0.6241**	0.7085**	0.4663*	0.6555**	0.4639*	0.6525**
	(0.0438)	(0.0076)	(0.0077)	(0.0015)	(0.0065)	(0.0014)	(0.0059)	(0.0013)	(0.0332)	(0.0017)	(0.2258)	(0.2213)	(0.2307)	(0.2156)	(0.2274)	(0.2124)
sor_generality	1.1731	-0.2146	3.6419	2.6815	3.8221	2.4647	3.4483	2.6042	1.6466	-0.3356	-1.9668	-3.1061	1.9029	1.7372	1.8809	1.5383
	(0.5862)	(0.8786)	(0.2223)	(0.3275)	(0.2221)	(0.3882)	(0.2707)	(0.3552)	(0.6688)	(0.9251)	(4.4722)	(4.2313)	(3.3947)	(3.1052)	(3.5261)	(3.2110)
count_inter			-0.0139***	-0.0115***	-0.0140***	-0.0115***	-0.0144**	-0.0116***	-0.0114*	-0.0109***	-0.0130**	-0.0092***	-0.0150**	-0.0114***	-0.0149**	-0.0115***
			(0.0009)	(0.0000)	(0.0009)	(0.0000)	(0.0010)	(0.0000)	(0.0164)	(0.0000)	(0.0046)	(0.0027)	(0.0050)	(0.0025)	(0.0049)	(0.0025)
_cons	12.4825***	13.2882***	14.3155***	14.2530***	14.3892***	14.1027***	14.1636***	13.9759***	22.7352***	19.7132***	11.1796*	10.5685*	18.1121***	15.5208***	18.0692***	15.2674***
	(0.0007)	(0.0000)	(0.0004)	(0.0001)	(0.0003)	(0.0001)	(0.0004)	(0.0001)	(0.0000)	(0.0002)	(4.4668)	(4.1754)	(4.8884)	(4.4389)	(4.9422)	(4.4474)
N	227	227	227	227	227	227	227	227	227	227	227	227	227	227	227	227
ll	-143.4631	-143.4631	-83.9198	-83.9198	-83.2093	-83.2093	-82.0812	-82.0812	-71.5019	-71.5019	-71.5495	-71.5495	-78.9094	-78.9094	-78.7579	-78.7579

p-values in parentheses
="* p<0.05 ** p<0.01 *** p<0.001"

	Model 9		Model 10		Model 11		Model 12		Model 13		Model 14	
	Royalty		**Royalty**		**Royalty**		**Royalty**		**Royalty**		**Royalty**	
	Lump sum	**Two-tariff**	**Lump sum**	**Two-tariff**	**Lump sum**	**Two-tariff**	**Lump sum**	**Two-tariff**	**Lump sum**	**Two-tariff**	**Lump sum**	**Two-tariff**
jaffe_rev	-2.6881	-3.7712	2.5443	0.3085	-0.3755	-3.0242	-0.3859	-3.0248	0.0097	-1.0632	-0.1658	-2.4846
	(3.2783)	(3.0013)	(3.7162)	(3.5305)	(2.5445)	(2.3527)	(2.5447)	(2.3530)	(3.0641)	(2.8399)	(3.1037)	(2.8929)
ip_indm												
prod_indm	-0.6282	0.9000	-0.2458	2.0727								
	(1.5061)	(1.2993)	(1.9478)	(1.8188)								
indm_bundle					7.4140***	6.3025***	7.4112***	6.3016***	8.0693***	7.5086***	5.5297**	4.5820*
					(1.7700)	(1.6092)	(1.7729)	(1.6124)	(2.2800)	(2.0390)	(2.0032)	(1.8583)
ins_see							8.7365	8.4859				
							(1392.6040)	(1392.6036)				
ins_sor	-5.4440**	-1.5306							-0.6336	3.2029		
	(1.9884)	(1.5540)							(2.9000)	(2.8520)		
ins_both			8.6190***	7.5555***							4.0113*	3.4903
			(2.1758)	(2.0428)							(1.9800)	(1.8540)
see_pat_exp	0.0253	0.3980	-0.3131	-0.0464	-0.0502	0.0815	-0.0437	0.0812	-0.1049	0.1741	-0.2082	-0.0578
	(0.2475)	(0.2058)	(0.3165)	(0.2885)	(0.2054)	(0.1823)	(0.2083)	(0.1826)	(0.2284)	(0.2023)	(0.2925)	(0.2733)
see_herf	-18.3513***	-15.7304**	-12.8330*	-9.0618	-14.2860**	-9.4649*	-14.3408**	-9.4610*	-10.1570*	-7.3947	-12.2917*	-8.0275
	(5.5003)	(5.1654)	(6.3605)	(6.1218)	(4.6577)	(4.3971)	(4.6655)	(4.3971)	(4.7539)	(4.3336)	(5.1776)	(4.9040)
see_backwd_mean	-0.0460*	-0.0844*	-0.1075**	-0.1063*	-0.1048***	-0.1028**	-0.1043**	-0.1028**	-0.1060***	-0.1273**	-0.1070**	-0.1032**
	(0.0217)	(0.0363)	(0.0371)	(0.0420)	(0.0316)	(0.0330)	(0.0318)	(0.0332)	(0.0320)	(0.0445)	(0.0370)	(0.0372)
see_generality	5.0367	0.0996	8.2642	3.6137	1.7315	-2.1338	1.7842	-2.1245	-0.4051	-3.7638	2.3354	-0.7260
	(3.7938)	(3.3141)	(5.4469)	(4.9712)	(3.3909)	(3.0429)	(3.4061)	(3.0499)	(3.6512)	(3.3339)	(3.7222)	(3.3671)
sor_pat_exp	-0.7649***	-0.5271**	-1.1096***	-0.7539*	-1.3223***	-1.0133***	-1.3154***	-1.0130***	-1.2666***	-1.0793***	-1.2112***	-0.9173**
	(0.2237)	(0.1792)	(0.3265)	(0.2944)	(0.2944)	(0.2671)	(0.2969)	(0.2683)	(0.3319)	(0.2981)	(0.3185)	(0.2942)
sor_herf	-6.8580*	-6.6780**	7.6245	7.6918	7.7464	7.6363	7.7361	7.6108	11.1198*	11.0701*	9.8085*	9.5148*
	(2.9292)	(2.3888)	(4.6285)	(4.4682)	(4.0820)	(3.9069)	(4.0964)	(3.9212)	(5.4965)	(5.2388)	(4.6980)	(4.5173)
sor_backwd_mean	0.4656	0.7088**	0.6415*	0.8127**	0.3777	0.4833*	0.3768	0.4836*	0.3026	0.4880*	0.4128	0.5148*
	(0.2424)	(0.2239)	(0.2774)	(0.2710)	(0.2225)	(0.2161)	(0.2227)	(0.2161)	(0.2313)	(0.2228)	(0.2211)	(0.2160)
sor_generality	-0.8584	0.4071	-4.1575	-4.1055	-0.1584	-0.5207	-0.2439	-0.5156	-0.5268	-0.1746	-2.3958	-2.9217
	(4.0351)	(3.5500)	(4.6218)	(4.3798)	(2.8719)	(2.5543)	(2.9058)	(2.5546)	(3.0357)	(2.5437)	(3.6807)	(3.4340)
count_inter	-0.0137**	-0.0113***	-0.0167**	-0.0113**	-0.0129**	-0.0074**	-0.0130**	-0.0074**	-0.0129*	-0.0093**	-0.0124**	-0.0070**
	(0.0049)	(0.0026)	(0.0057)	(0.0037)	(0.0048)	(0.0024)	(0.0049)	(0.0024)	(0.0053)	(0.0034)	(0.0048)	(0.0025)
_cons	23.1155***	18.8568***	10.1168	7.2161	15.3742***	14.5398***	15.3171***	14.5300***	12.5929*	9.8579	13.2891**	12.4013**
	(5.8584)	(5.3363)	(5.7411)	(5.3915)	(4.4463)	(4.0120)	(4.4602)	(4.0168)	(6.3260)	(5.9803)	(4.5500)	(4.1370)
N	227	227	227	227	227	227	227	227	227	227	227	227
ll	-72.5489	-72.5489	-67.0657	-67.0657	-71.8439	-71.8439	-71.8259	-71.8259	-64.6237	-64.6237	-68.5499	-68.5499

p-values in parentheses
=** p<0.05

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