Cross-border co-opetition through market co-creation

Andreas Panagopoulos
University of Crete, Department of Economics
Gallos Campus 74100 Rethymno
Tel: +30 28310 77395, Email: panagopoulos@uoc.gr

Christos N. Pitelis[1]
University of Bath, School of Management
Claverton Down, Bath BA2 7AY, UK
Tel: +44 (0)1225 383680, Email: c.pitelis@bath.ac.uk

Panos Desyllas
University of Bath, School of Management
Claverton Down, Bath BA2 7AY, UK
Tel: +44 (0)1225 384949, Email: p.desyllas@bath.ac.uk

JUNE 2016

WORKING PAPER

Abstract

We study the impact of the new intellectual property (IP) regime, as shaped by international agreements such as the Trade Related Aspects of IP Rights (TRIPS), on the competitive position of emerging country pharmaceutical firms. Our study explores how emerging country firms can utilize cooperative agreements with advanced country firms to adjust to the new environment, and uncovers the conditions under which cooperation becomes preferable to competitive rivalry for both parties. We show that, when IP agreements allow advanced country firms to take legal action against emerging country firms, whose products are perceived as infringing their IP, cooperation can prove preferable to both parties when the latter can leverage their strategic assets to extend and co-create market space. This co-opetitive outcome is fostered when the scope of IP rights is contestable. Important implications follow for managerial practice and public policy.

Keywords: cross-border co-opetition, market co-creation, complementary assets, intellectual property rights, MNEs, pharmaceuticals.

---

[1] Corresponding author

Introduction

In its August 8th 2015 leader, the Economist magazine questions the evidence for patent protection and proposes innovative alternative ways to foster innovation, including new forms of public sector regulation. Our aim is to suggest a market-based alternative and complement to regulation that leverages the joint benefits to companies that choose to cooperate and compete (co-opete), as opposed to the two extremes of direct competition, or collusion. We draw on the idea of market co-creation by companies in 'advanced' and emerging countries, using the pharmaceutical industry as our focus of examination.

Over the last two decades, emerging country pharmaceutical companies operate in an increasingly challenging competitive environment (Ghauri and Santangelo, 2012; Angeli, 2013). This new environment is, in part, the result of a series of international trade agreements that have strengthened the Intellectual Property (IP) regime worldwide. These agreements include the Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreement, the subsequent Anti-Counterfeiting Trade Agreement (ACTA), and the more recent Trans-Pacific Partnership (TPP) agreement. They are based on the view that global IP protection will foster trade opportunities across the world and also facilitate technology transfer from advanced to emerging countries (Blakeney, 2013; Yang, 2012).

This new IP regime is affecting competitive dynamics, particularly in the pharmaceutical industry where patents confer robust protection and are essential for the commercialization of innovations (James et al., 2013). In the past, emerging country pharmaceutical firms (EPFs) relied extensively on reverse engineering of patented compounds to produce "generic" versions of branded drugs at a fraction of the costs faced by the original innovators (McKinsey Report, 2013). However, the

result of TRIPS (and the subsequent agreements) has been to place restrictions on the space for the production of generic drugs (Shaffer and Brenner, 2009). Thus, EPFs had to fundamentally rethink their "closed" business models, which were oriented towards reverse engineering and low-cost manufacturing (Angeli, 2013).

Pharmaceutical firms in emerging countries, such as India, have adopted different strategies to adjust to the new environment. Some firms try to leverage their location advantages at home, such as relationships with hospital and doctors, but also frugal innovation-type strategies (Anand and Kale, 2006; Greenhalgh, 2013). Others attempt to upgrade their production and marketing capabilities to offer 'branded generics'. And others contest the IP rights of advanced country multinational companies. In 2005, for instance, several Indian generics producers successfully challenged Novartis' attempt to obtain patent protection for an updated version of its drug Gleevec (for chronic myeloid leukemia) in India (Shadlen and Guennif, 2011).

Direct competition, however, between EPFs and "advanced" country multinational enterprises (AMNEs) may not be the most desirable competitive outcome for either groups of firms. Instead, some form of cooperation can prove preferable to both parties when EPFs can leverage complementary assets and capabilities to extend and co-create market space. For instance, in 2009, Dr. Reddy's Labs established a partnership with GlaxoSmithKline plc to develop and market drugs in fast growing therapeutic segments (e.g. cardiovascular, diabetes, oncology, gastroenterology) across several emerging markets. Products were manufactured by Dr. Reddy's and were licensed and supplied to GlaxoSmithKline in various emerging markets, while revenues shared between the two partners. In other products and markets the two firms continued to compete.

The aim of this paper is to explore how EPFs can utilize cooperative agreements with AMNEs as a response to the emergence of the new IP environment, which was triggered by the implementation of TRIPS-type agreements. Specifically, we ask how EPFs can become valuable strategic partners for AMNEs so that cooperation becomes preferable to competitive rivalry for both parties. Drawing on ideas centred on co-opetition (Lado et al., 1997), market co-creation (Pitelis and Teece, 2010), and the role of specialised complementary assets (Teece, 1986, 2006), we propose that EPFs should aim to extend and co-create market space and we further uncover the conditions under which emerging and advanced country firms can profit by co-operating for value creation even if competing for value capture (i.e. co-opeting).

Method-wise, acknowledging the central role of strategic interdependence between EPFs and AMNEs, and in line with a fast expanding approach in management scholarship (e.g. Casadesus-Masanell and Zhu, 2013; MacDonald and Ryall, 2004), we adopt a cooperative game theoretic approach and model to derive formally the conditions under which co-opetition can ensue. The model frames the IP conflict between typical AMNEs and smaller EPFs over the capture of value in the pharmaceutical market, by considering a case where an AMNE introduces a new patent-protected drug. The EPF can either attempt to capture the value created by the AMNE by producing a generic version of this drug, or it can invest in complementary assets and capabilities that allow it to extend, create and/or co-create new markets, hence adding value. In turn, the AMNE can either cooperate with the EPF, or resort to a legal conflict that can be resolved by a court within the limits imposed by TRIPS.

Our analysis shows that the possibility to cooperate depends critically on the ability of EPFs to enhance the market value of the drug in question. The additional

value created can provide a bargaining space within which both parties can successfully try to find a cooperative solution. In addition, our model shows that the possibility of a cooperative outcome can be fostered when the bargaining power of the AMNE (afforded through TRIPS and related agreements) is counterbalanced by actions of the EPFs and host governments and courts. For instance, when the public authorities of an emerging country can credibly threaten to block an AMNE's attempt to adopt aggressive "strategic" patenting (e.g. by blocking the so called "ever-greening" patent practices) (see Hall et al., 2012).

This work has important implications. At a management practice level, we explore the way in which EPFs can switch from "closed" business models to more "open" business models which are designed to allow for market extension and co-creation with AMNEs (Chesbrough, 2006; Zott et al., 2011). We argue that this transition requires EPFs changing their focus from reverse engineering towards developing a broader set of capabilities which will allow them to extend the market available to AMNEs by reducing input costs and improving cost efficiency; contributing to the development of differentiated drugs; or by offering access to specialised complementary assets. At a policy level, the possibility of EPF-AMNE cooperative agreements under the new stronger IP regime can help realize the original objective of the TRIPS agreement (such as investment targeting poor county-specific diseases), which are believed to have failed to realize some of their originally intended objectives (Kyle and McGahan, 2009).

Our study contributes to the extant literature in two ways. First, it contributes to the international business literature (Cuervo-Cazurra, 2012; Mathews, 2006; Manning, 2008; Manning et al., 2008) by elucidating the mutually beneficial role of cooperative agreements between advanced and emerging country pharmaceutical

firms. EPFs can rely on such cooperative agreements to adjust to the new IP regime, provided that they first make the necessary market-enhancing investments. Second, our work extends the market co-creation perspective (Lado et al., 1997; Pitelis and Teece, 2010) to the multinational enterprise context but also challenges the conventional wisdom *vis a vis* the terms of engagement of emerging country firms and multinational enterprises in the very important global pharmaceutical sector.

The remainder of the paper is organised as follows. Section 2 provides an overview of the series of challenges of the IP regime in pharmaceuticals and sets out the concept of market extension and co-creation through cooperation between emerging and advanced country firms. Section 3 introduces a simple cooperative game theory model and explores alternative strategy scenarios and solutions. Section 4 provides concluding remarks and draws out implications for managerial practice and public policy.

Theoretical and contextual background

The emergence of a new IP regime

We begin by sketching a historical account of international IP treaties out and exploring their implications for the competitive dynamics among pharmaceutical companies. Up until the 1990s, most drug innovation and the global trade of pharmaceutical innovation was almost limited to advanced economies that provided IP protection. Emerging countries, which lacked IP protection, did not benefit from such innovation and trade. Considering that the cost of developing a new drug is now greater than $2.5 billion,[2] the danger of erosion of profits from imitation was

[2] This cost is estimated by J. DiMasi at the Tufts centre, see: http://csdd.tufts.edu/news/complete_story/pr_tufts_csdd_2014_cost_study

detrimental to innovation, or to the launching of new drugs. As Cockburn et al. (2014) illustrate, drug firms frequently opt not to build marketing and distribution infrastructure required to promote within-country adoption. They may also refrain from the necessary clinical trials that meet local requirements, from obtaining regulatory approval, and from educating healthcare providers. Consequently, when the launching costs are sufficiently large, a new drug may not find its way into a market.

Operating in such a weak IP regime, EPFs had been primarily producers of generic drugs. Generic drugs contain the same active ingredients as the original drug and are normally introduced, normally when the statutory period of patent protection expires. However, a number of EPFs copied and rebranded medicines before patent expiration. Their dominant business models had been capitalizing on opportunities to reverse engineer patented compounds by AMNEs and produce them at lower cost by exploiting low input cost and through process innovation (Angeli, 2013).

This regulatory environment changed considerably with the introduction of the TRIPS agreement, which is administered by the World Trade Organization (WTO) and was negotiated in 1994. The agreement's main aim was to standardize IP regulation among signatory members, by specifying minimum standards for IP protection. The reason behind such an international harmonization was the belief that by lifting country restrictions on IP, all innovators would face similar standards of protection across countries. Under TRIPS, copying and rebranding products that are under patent protection is an illegal practice that constitutes infringement. This new IP regime would promote the trade of advanced technological products, encourage R&D investment, and allow emerging countries to benefit from advances made by

advanced economy firms (Dinopoulos and Segerstrom, 2010; Diwan and Rodrik, 1991).

After a ten-year transition period to enable IP law convergence, the TRIPS agreement came into force in India in 2005. With the exception of medical emergencies, where emerging country governments may circumvent IP rights for better access to essential medicines (see the Doha Declaration on the TRIPS Agreement and Public Health in 2001), a new stronger IP regime emerged in Indian. So far, however, the anticipated benefits from TRIPS have not always been materialized. While TRIPS might have benefited countries like China and Korea, who have witnessed an overwhelming increase in their IP production, the benefits of TRIPS for trade in various industries are seriously called into question. Kyle and McGahan, (2009) find that the introduction of patents in emerging countries has not been followed by an increase in R&D efforts on diseases that primarily affect the world's poor.

Even though several emerging countries have adopted TRIPS-compatible laws, the *de facto* drug-related IP protection varies as a result of serious domestic health concerns, business interests and pressure groups, such as local NGOs (Jandhyala, 2015). ACTA came as an addition in the arsenal against infringed and pirated products. Even though ACTA has met considerable opposition, and its implementation is currently at a halt, its relevant provisions are important because they are often reincarnated as parts of TRIPS-plus bilateral agreements. Of notable concern is ACTA's article 9.1 that focuses on damages. It requires courts to consider any legitimate measure of value the product's producer submits. This may include, *inter alia*, lost profits, the value of the infringed goods, or services measured by the market price, or the suggested retail price. Furthermore, ACTA's article 9.2 requires

that compensation should at a minimum reflect the profits derived from infringement. The view of ACTA is that the calculation of damages should be based upon the assumption that a single copyright infringement equates to a lost sale. The more recent Trans-Pacific Partnership (TPP) agreement - as leaked versions of preliminary drafts indicate - borrows heavily from ACTA.

The recent IP harmonization after TRIPS-type agreements has constituted a major institutional change for the Indian pharmaceutical sector (Scott, 1995; Battilana et al., 2009). The resultant new IP regime has important implications for the competitive dynamics between AMNEs and EPFs. AMNEs can now use their innovative drugs to penetrate the TRIPS-compliant Indian market and even relocate their high value-added activities, like R&D (Manning et al., 2008). Most importantly, the new IP regime undermined the viability of EPFs' predominantly "closed" business models, which were capitalizing on opportunities to copy patented compounds (Chesbrough, 2006; Zott et al., 2011). Simultaneously, however, the new IP regime creates potential for a cooperative solution based on market extension and co-creation, which generates new value and can benefit both parties. We focus on theoretical underpinnings of this solution below.

Co-opetition through market extension and co-creation

The inherent disadvantages of AMNEs when entering new foreign markets have been extensively studied by the international business scholarship (e.g. Petersen et al., 2008). Foreign entrants are affected by differences in national cultures, government policies, and political risks not only on the initial 'environment reading' during the market entry decision, but also on the strategy formulation and implementation processes post-market entry (Brouthers et al., 2009; Meschi, 2005; Sethi and

Guisinger, 2002). AMNEs adopt various strategies to overcome the, so-called, "liability of foreignness" (Hymer, 1976), most notably "insiderisation" strategies (Zaheer, 1995; Ohmae, 1985). These strategies include the hiring of personnel from the host country, regional adaptation of product and services, and/or establishing strategic partnerships with key collaborators in the host country.

Partnerships with host country firms, in particular, allow foreign entrants to benefit from complementarities between their own core competencies and the strategic assets of their partners (Hamel 1991). Through partnerships, AMNEs can tap into an additional pool of strategic resources and complementary assets, such as low-cost or distinctive manufacturing capabilities, distribution networks, and after-sales services (Anand and Kale, 2006; Teece, 1986, 2006). Many of these resources and capabilities are specialised, in the sense that they are not readily available in competitive supply in the marketplace, but they need to be developed through a stream of investment over time (Dierickx and Cool, 1989). Given institutional, political and cultural differences across national markets, these specialised complementary assets may well be location-specific (Cantwell, 1995). Evidence from the international business literature suggests that partnerships with host country firms are becoming more important for AMNEs as it has become increasingly difficult to find science and engineering talent in advanced countries, on the one hand, and after the rise of new science and engineering clusters providing such talent in emerging economies, on the other one (Manning 2008; Manning et al., 2008). Thus, AMNEs are increasingly exploring opportunities to cooperate with emerging country firms for higher value added functions, such as new product development, engineering and technical services.

Turning our attention to emerging country firms, these firms operate in an environment, which influences their behaviour, growth and internationalization patterns (Cuervo-Cazurra, 2012). For instance, Mathews (2006), studying internationalization patterns of emerging country firms, argues that they internationalize using linkages (acquiring advantages externally), leverage (connecting to partners to obtain resources), and learning (upgrading via repetition and improvement). The actual competitive behaviour of emerging country firms depends on the broader institutional environment, including the IP regime and contractual protection. These firms internalize transactions differently from AMNEs because they have a higher tolerance for the level of transaction costs they can manage and a lower trust in the ability of external mechanisms, such as the judicial system, to protect contracts (Cuervo-Cazurra, 2012). The emergence of a new IP regime with the introduction of the TRIPS/ACTA-type agreements has impacted the behaviour of emerging country firms, as well as the attractiveness of emerging markets for AMNEs (Li and Xie, 2011).

In the case of the global pharmaceutical sector in particular, we have witnessed numerous cooperative agreements between AMNEs and EPFs. Focusing on Indian pharmaceutical firms (representing the group of EPFs) and using data from Thomson's SDC database of strategic alliances (as one form of cooperation), we find that there have been three waves of strategic alliances since the mid-1990s: the first one commencing in the late 1990s, the second one in the mid-2000s and the last one in the early 2010s.[3] As it can be seen from Figure 1, the three peaks in alliance activity by Indian pharmaceutical firms can be explained, to a large extent, by the

[3] Thomson SDC Platinum provides information on strategic alliances using SEC filings and their international counterparts, trade publications, wires and news sources. The information collected is thus bound to be biased in favour of larger and international deals that have attracted more extensive business press coverage.

sharp rises in alliances involving foreign partners. Specifically, we identify a total of 317 deals during the period 1995-2012, of which 275 deals (87%) involve at least one foreign partner. Foreign partners involve blue chip AMNEs, such as, Pfizer Inc, GlaxoSmithKline PLC, Bayer AG, Merck & Co Inc, Boots Healthcare International, Novartis AG, and Bristol-Myers Squibb Co. Cross-border alliances cover primarily manufacturing (40%) and marketing (34%) agreements, but they also involve joint R&D (28%) or licensing agreements (9%) (See Figure 2). Consistent with findings from the international business literature (Manning, 2008; Manning et al., 2008), most of the Indian partners in our sample are headquartered in the major pharmaceutical clusters of India: Ahmedabad (8% of all partners in our sample deals), Bangalore (10%), Hyderabad (12%) and Mumbai (25%). It is also interesting to note that the bulk of this alliance activity by Indian pharmaceutical companies is concentrated on a handful of large and publicly traded companies, with firm size ranging from 2,800 to 16,617 employees. The list of the seven companies with the highest alliance activity (more than 10 alliances during the period 1995-2012) is presented in Table 1. These seven companies account for 111 (or 35%) of the 317 alliances in our sample.

[Insert Figures 1 and 2 and Table 1 about here]

Given the frequency of alliances between EPFs and AMNEs, it is important to identify the conditions that allow firms to favour a cooperative agreement over direct competition. In particular, we propose that such agreements will be sustainable when they lead to market extension and new market co-creation that arise from complementarities (Pitelis and Teece, 2010). In this sense, cooperation enhances the competitive position of both firms by enabling partners to build and leverage idiosyncratic, rent-yielding organizational competencies and simultaneously reduce the costs and risks associated with the mobilization of such competencies (Lado et al.,

1997). When successfully implemented, the syncretism between competition and cooperation fosters greater market growth than either competition or cooperation alone.

In order to better appreciate the importance of co-opetition and the factors that foster a cooperative solution, one has to first compare this to the strategies that firms are currently pursuing. The pharmaceutical market arena is dominated by firms with highly asymmetrical abilities. In particular, advanced economies are home to established AMNEs that have the funds and the experience to vigorously protect their markets (e.g. Kafouros et al., 2008). In most cases, AMNEs possess formally protected drugs primarily developed for their home markets. Emerging countries tend to be dominated by relatively smaller firms that have limited research and development (R&D), technological and legal capabilities (see Lanjouw and Schankerman, 2004). In such an arena, one typically observes AMNEs, which use their competences in order to capture value from consumers in emerging markets, without any apparent incentive to cooperate with host country firms.

However, EPFs may be able to extend the current market or open up new opportunities for AMNEs in three main ways. First, EPFs can exploit their comparative cost advantages to reduce input and labour costs and improve cost efficiency (Porter, 1980, 1985). For instance, they can exploit their low-cost manufacturing, carry out standardised R&D activities (such as clinical trials), or leverage frugal innovation in order to reach 'bottom of the pyramid'-based consumers. Second, they can direct their R&D efforts to differentiate AMNEs' existing drugs to tailor them to local needs. For example, an EPF can differentiate existing drugs in a way that renders them more efficacious for indigenous patients or help cure local diseases. Alternatively, EPFs can direct their R&D to make drugs

resistant to local climate conditions. This is particularly important as several drugs are inappropriate for emerging country climates, as they lose their potency if left out of the refrigerator (this is frequently the case in many emerging country pharmacies).

Third, EPFs can offer AMNEs access to various specialised complementary assets, i.e. assets which are not readily available in the marketplace and which are needed for the successful commercialization of drugs (Manning et al., 2008; Teece 1986, 2006). This type of synergy through inter-firm asset combination is becoming more important as AMNEs seek to source increasingly high-end value chain activities externally (Manning et al., 2008). Thus, EPFs can entice AMNEs by developing and leveraging their strategic assets, such as their scientific human capital, control over local distribution systems, deeper market knowledge, relationships with local hospital and doctors, and, more generally, their key ecosystem partners (see Nalebuff and Brandenburger, 1996; Pitelis and Teece, 2010). For instance, in many emerging countries, such as China, there is evidence that advanced country pharmaceutical companies struggle to gain market share due to slow registrations, difficulty in winning highly competitive provincial tenders, and demanding hospital listing requirements (McKinsey Report, 2013). Similarly, in India access to the state-owned General Insurance Company is important, as this is the main health insurance provider (MarketLine, 2014).

Thus, by switching from "closed" business models, which are centred on reverse engineering, towards more "open" business models supported by a broader set of core competencies, EPFs can become attractive partners for AMNEs. Such cooperation can lead to higher value creation and capture for the two parties than in the case of direct competition, both in the short and in the long run. Below we

develop a simple game theoretic model that shows under which conditions cooperation can be selected over conflict, by leveraging the aforementioned ideas.

The model

We adopt a cooperative game theoretic model in order to derive formally the conditions under which coopetition can ensue. Two reasons guid our research approach. First, we follow a long tradition in the strategy and industrial organization literatures which acknowledges the central role of strategic interdependence between industry rivals (Nalebuff and Brandenburger, 1996, Tirole, 1988). Indeed, our approach is in line with a fast expanding approach in management scholarship (Adner and Zemsky, 2006; Branderburger and Stuart, 1996; Camerer, 1991; Casadesus-Masanell and Zhu, 2013; MacDonald and Ryall, 2004). Second, our game theoretic approach positions us well to study the impact of a major institutional change on firm-level activities and the resultant responses by firms. The need for abstraction in our theoretical model is dictated by the fact that organizational changes triggered by institutional shocks tend to be complex processes, requiring divergent changes, and involving different types of forces and agents (Scott, 1995; Battilana et al., 2009). Because these changes break the status quo and tend to be met by organizational inertia, they can be slow evolutionary processes. This is particularly true in the case of pharmaceutical industry, where there have been several sequential changes in the IP regime since 1994, the implications of which have not been fully factored in competitive dynamics (considering that it might take up to 49 years from initial drug discovery to making the drug available to patients). Thus, one cannot easily track empirically the impact of IP regime change on EPFs strategies (like when measuring the causal effect of a discrete treatment). Our approach allows us to overcome the

unavoidable empirical restrictions imposed by data unavailability and poor data quality when weak proxies are used.

The companies' dilemma

We develop a game to study the strategic interaction between an innovating and an imitating pharmaceutical firm that are headquartered in different countries. By studying the equilibrium outcomes of the game, we try to identify the conditions under which the two firms will choose to compete against each other or to cooperate. We focus on two types of firms, an AMNE (for example Bayer), which is the original drug developer, and an EPF (e.g. Cipla), which is assumed to be an imitator. The AMNE holds a patent protected drug (e.g. Nexavar), which is initially marketed and sold in its domestic market, and wants to start selling its drug to EPF's host country market. However, the EPF has started offering its own drug version to its home market. In this context, we explore conditions under which the two players may be inclined to choose cooperation over conflict.

We first sketch our thesis within a "prisoner's dilemma" type matrix that models the prospective benefits from cooperation *vis a vis* conflict. Even though this matrix offers a static version of the conflict that we have described in the previous sections, it helps clarify the main idea and allows for comparisons, paving the way for the more dynamic analysis that we undertake later.

In Figure 3, the AMNE faces two strategies. It can (a) litigate in order to try and claim back what it considers as its IP. For example, the legal battles fought by Bayer for ownership of Nexavar respectively fall in this type of strategy. Alternatively, the AMNE can (b) adopt some form of cooperation with the EPF. The EPF is also faced with two strategies. It can either (a) copy the drug, infringing on the

AMNE's IP rights (Cipla's generic version of Nexavar is a case example); or (b) invest to enhance the perceived characteristics of the drug and tailor it to local needs or expand the market size. As we explained earlier, EPFs can extend the market available to AMNE entrants by reducing input and labour costs and improving cost efficiency (e.g. by exploiting cost-advantages in carrying out clinical trials), contributing to the development of differentiated drugs (e.g. by tailoring drugs to indigenous patients or help cure local diseases), or by offering access to specialised complementary assets (e.g. through established relationships with local health authorities, hospitals and doctors).

Up to now the narrative has been broadly framed in terms of both parties following their first strategy, leading to infringement and litigation (i.e. conflict). Their second strategy is included in the matrix as a counterfactual that, as we will show, has the capacity to pave the way for a solution to the conflict.

[Insert Figure 3 about here]

In more detail, the matrix is divided into four cells, three of which depict various manifestations of non-cooperation akin to the current apparent status quo. Starting with cell D, the EPF copies the branded drug and the AMNE responds by filing an infringement suit. Cell C differs from cell D inasmuch as the EPF invests in enhancing the drug's market value. However, the AMNE considers that the "new drug" does not significantly differ from the original drug and in turn it files an infringement suit. Cell B, on the other hand, represents a situation where infringement can lead to an amicable solution if the AMNE agrees to forego some of its profits, which are correspondingly captured by the EPF. Such an erosion of profits can lead to lower R&D incentives and/or delays in the launching of new drugs. Contrasting cells B, C and D that capture a conflict or jointly suboptimal outcomes,

cell A represents a situation where the EPF invests resources to enhance the market value of the drug and in this context the AMNE finds cooperation profitable. We try to understand whether cell A is viable, and if so what are the conditions that will allow the two parties to jointly select to be in cell A, rather than to cells B, C and D.

While cell A provides a necessary condition for cooperation between the two parties which can try to share the additional market value, it is not a sufficient one. We need to explore the incentives that can forge such cooperation. For example, why should the AMNE decide to position itself in cell A instead of cell C so as to try and appropriate via litigation the fruits from the extended market? In such an occasion, firm 'opportunism' (possibly aided by lack of appreciation of the EPF's efforts) could lead to a conflict. If so, and by the same token, why should the EPF try to extend the market in the first place when faced with the prospects of litigation?

A possible solution to this classic case of 'market failure' could be provided by the courts of the EPF country that can identify and reward value adding EPFs by restricting the potential payoffs from litigation of the AMNE, while not doing the same for mere copycats. In this case, the EPF can invest in enhancing the drug's market value because it knows that the original developer will find itself in a difficult situation in court. By contrast, a mere copycat EPF will not anticipate similar protection, the presence of which might reduce the incentive to add value in the first place, eventually, leading in a situation where the AMNEs reduce their R&D and/or delay the launching of a new drug.

The ability of the courts to identify and rewards value adders can of course be compromised when misinformed, biased, or politicised local courts fail to separate between value adders and mere copycats. However, when countries have signed the TRIPS agreement they have agreed to harmonise their legal standards. Consequently,

the legal tests employed by courts and their interpretation of legal terms and treaties is becoming homogenised across countries. Therefore, even though legal norms can vary from country to country, there is a bounded space for overtly biased decisions and courts must employ the standards set out by TRIPS in adjudicating such cases. For example, even though both Bayer lost its case at the Indian High Court, it did not complained about Indian legal standards. In a nutshell, the possibility of bias is bounded by international standards.

With an eye to assisting verbal exposition, below we focus on identifying the requisite conditions for cooperation to prevail, in the context of a simple cooperative game theoretic model. Considering that the matrix of Figure 3 offers a static version of what is effectively a sequential game, and the fact that the underlying analysis does not capture the role of courts, we extend this simple matrix so as to capture more realistically the form of court interventions (see Appendix for details on the full dynamic game). We set up a cooperative game (e.g. see Branderburger and Stuart, 1996; MacDonald and Ryall, 2004) in order to compare and contrast the playoffs for the two parties under each of the main scenarios that we identified in the matrix of Figure 3. The focal point of the model is to understand the actions (market extension/co-creation initiatives or threats related to IP) that both parties must take in order to cooperate and not compete. Effectively, our analysis tries to identify parameter values that make the payoffs of cell A preferable compared to the payoffs from the other cells.

Analysis

Working sequentially, the initiative rests with the EPF that must decide if it wants to merely copy AMNE's patented drug, or add some value to it. If no value is added then

pure infringement leaves little choice to the AMNE but to pursue litigation, where litigation takes place in the EPF's home country, which is a TRIPS signatory. If some value is added by the EPF, then the AMNE must decide on collaborating with the EPF or to pursue litigation. In order to find which outcome will prevail, we need to compare the payoffs from each combination of strategies (see Figure A1 for the game tree of the sequential game).

The payoff from a conflict depends critically on two parameters. The first one is the probability that the AMNE prevails in court, and the second one is the damages that the AMNE is entitled to if it wins the case. Considering that the conflict takes place within TRIPS the probability that the AMNE will prevail must depend on the international legal standards set out by TRIPS. This means that the probability of winning the case is effectively semi-exogenous, and that neither the EPF nor its host country can change the rules of the game. The second parameter, however, is not exogenous. What constitutes damages awards under TRIPS relies on domestic norms. For example, if India does not permit "ever-greening" patent practices[4], or has restrictive views as to what can be claimed as a patentable invention, then the foregone AMNE's profits on which these damages must be based on are relatively small. Subsequently, damages are an endogenous parameter that can be shaped by the EPF's host country policies and/or the EPF's willingness to take action against AMNEs.

The payoff from cooperation on the other hand must depend on the investment the EPF is willing to make in enhancing the drug's market value, and on how the two parties divide the additional market value that this investment has created. We assume

[4] AMNEs with patents over drugs that are about to expire try to retain their monopoly position by taking out new patents over small modifications of old drugs (e.g. over associated delivery systems or new pharmaceutical mixtures) for longer periods of time than would normally be permissible under the law (Hall et al., 2012).

that the AMNE and the EPF will try to split the additional value through bargaining. In modelling bargaining, we assume that firms bargain in a Nash-bargaining fashion, which constitutes the standard way of modelling bargaining problems of this nature. For a detailed analysis of this cooperative technique that allows two parties to split up a pie on which they hold mutual interests, see Binmore (1992).

This general setting is formally modelled in the Appendix, where each strategy and its payoffs are cast in mathematical terms. Yet, from the above discussion it is evident that the parameters that will shape the conditions that can lead to an amicable solution are: (a) the investment that the EPF must make to increase a drug's market value (and subsequently the additional drug market value created); and (b) the estimated damages awarded to the AMNE. The results from the mathematical analysis verify this prediction and suggest that cooperation becomes more beneficial for both parties as the investment made by the EPF to increase the drug's market value increases relative to the expected damages that courts can award to the AMNE.

Consequently, if the EPF hopes for a non-competitive solution, it must first invest in increasing the drug's market value and, at the same time, try to diminish the expected damages awarded to the AMNE in the case of successful litigation, or equivalently restrict the scope of the AMNE's patent-based monopoly (e.g. by questioning the validity of broad patent claims or blocking patent continuation when there is no significant inventive step). If the EPF chooses not to invest in enhancing the drug's market value, the two firms have nothing to amicably settle on, and the only solution is that of a conflict. As we display in the Appendix, such a conflict offers a lower payoff compared to a non-competitive solution. Hence, it is in the EPF's interest to invest in increasing the drug's market value, instead of simply pursuing litigation against the AMNE.

In simple terms, we argue that value co-creation through market extension provides the necessary condition for a cooperative solution because it has the capacity to create the additional bargaining space on which a cooperative solution can be found via bargaining. Furthermore, the sufficient condition for such a solution is the ability to contest the scope of the AMNE's IP rights and/or payoff from litigation. When these two conditions are met cooperation is the strategy that offers both parties the best payoff, making it irrational to opt for a conflict. This leads to a situation where both parties are incentivised to choose market extension and co-creation through cooperation.

The analytical model included in the Appendix does not discriminate as to the role of each party. For example, the situation can be reversed and the EPF may face competition from an AMNE that lobbies local authorities to restrict the scope of the EPFs patent and the corresponding damages awards. There are two recent instances of such a reversal of roles. Two Indian generic producers, Ranbaxy[5] and Dr. Reddy[6] tried to introduce enhanced versions of existing drugs in the US market only to be blocked by the US authorities after having sunk considerable costs in developing their local market infrastructure. In this context the standards homogenization provided by TRIPS could well help induce cooperative outcomes by restricting the scope for opportunistic litigation and/or courts decisions.

Our results can be summed up through the following proposition:

Proposition: *Cooperation and market extension/co-creation by an EPF and an AMNE will be the equilibrium outcome when EPF's investment to enhance the drug's*

[5] In 2014 the FDA prohibited Ranbaxy from manufacturing and distributing pharmaceutical products from its Toansa facility in India and from its Ohm Laboratories facility in New Jersey.

[6] Dr Reddy's tried to market its AmVaz, a near-equivalent version of Pfizer's patent protected Norvasc, in the US market in 2004. Simultaneously, Dr Reddy's invested 6-8% of its revenues in its drug and a further $200 million to set up a marketing infrastructure in the US for AmVaz. Unfortunately for Dr Reddy's, the US Court of Appeals of the Federal Circuit ruled that the patent extension covering Pfizer's Norvasc was applicable to Dr Reddy's AmVaz.

market value is relatively large and the estimated damages awarded by courts to the AMNE due to foregone profits from the sale of the infringing product is relatively small.

Corollary: *Direct competition and legal conflict between the EPF and the AMNE will be the equilibrium outcome otherwise.*

The bargaining space leading to cooperation or conflict for different values of EPF's investment and of damages awarded to AMNE for infringement are depicted graphically in Figure 4. The figure also maps out the four strategic outcomes which were identified in the matrix of Figure 3, with respect to the two parameters of interest. The point of intersection between the vertical axis and the upward sloping demarcating line reflects the fact that when the EPF makes no value creating investment, a conflict will emerge only when the damages awarded are big enough to make conflict beneficial for the AMNE.

[Insert Figure 4 about here]

An example of a company that has actively tried to employ the principles captured by the above proposition is Ranbaxy, a firm that openly states that its goal is to invest in developing generic drugs at a fifth of the original cost. In 1999, Ranbaxy managed to enhance the capacity of an antibiotic developed by Bayer (ciprofloxacin), reducing the two daily doses down to one. Instead of a conflict, this led Bayer to pay Ranbaxy $65 million so as to use this improvement globally. In this case, both the necessary and the sufficient conditions were satisfied. The necessary condition was satisfied because Ranbaxy had made a considerable improvement on ciprofloxacin, while the sufficient condition was satisfied because it would be hard for Bayer to contest the evidently value adding character of the improvement in a court of law. By contrast, the inability of Dr. Reddy's Labs to persuade the US Court of Appeals that its hypertension and angina drug (called AmVaz) constituted a significant improvement

over Pfizer's patent protected Norvasc offers an example where, even though the necessary condition was satisfied, the sufficient condition turned out not to (Business Standard, 2004).

As always, firms will have to take decisions on the basis of informed but ultimately uncertain anticipations. The TRIPs provisions can help reduce, albeit not eliminate, such uncertainties. This also shows the limits of formal solutions such as ours, which nonetheless help highlight the important issues that need to be considered and complement harder to generalise verbal analysis.

Discussion and implications

In this paper we explored the competitive dynamics between advanced and emerging country firms in the emerging IP regime. Drawing on the ideas of market extension/co-creation (Lado et al., 1997; Pitelis and Teece, 2010) and specialized complementary assets (Teece, 1986, 2006), and using cooperative game theory with some plausible assumptions, we showed that there can be ways out of a conflict between EPFs and AMNEs with benefits for both parties involved.

Specifically, our theoretical model and analysis showed that EPFs, in the face of competitive challenges, need to devise and adopt strategies that help make cooperation between firms in the two sets of countries the most preferred strategic outcome. Thus, EPFs, which had been oriented towards reverse engineering of patented compounds by AMNEs, need to invest in developing a new set of capabilities and assets by leveraging their location- and firm-specific advantages (Cantwell, 1995; Barney, 1991, 1995). These capabilities should enable EPFs extend the market available to AMNEs by reducing input and labour costs and improving cost efficiency, contributing to the development of differentiated drugs, and by

offering access to specialised complementary assets at various value chain stages. In our framework, AMNEs can choose to share the now enhanced drug's market value, allowing EPFs to 'infringe' rather than lose in a court of law. The resulting division of labour helps extend and co-create new markets. If the EPFs producing generics fail to increase the drug's market value, it is hard to avoid the problem of dynamic inefficiency, as the AMNE and the EPF enter into a conflict that is more likely to be resolved via litigation.

The main suggestion stemming from our analysis is that, for as long as firms have something to bargain on, there can be a settlement between the two firms that can foster trade. Thus, as long as EPFs have the capacity to enhance the actual or perceived characteristics of the product (e.g. through R&D or marketing investments) or expand the market size (e.g. through established relationships with local health authorities, hospitals and doctors), the two parties can resort to cooperation, rather than direct competition, hence bypassing the problem of dynamic inefficiency and helping foster trade. But, such a settlement further depends on the way that host country courts estimate damages as a function of the foregone profits from the sale of the infringing good. When damages are relatively small, the settlement likelihood tends to prevail. The homogenization of court practices engendered by TRIPS-type agreements helps mitigate opportunistic decisions and reward genuine vale adders.

Concerning managerial practice, our study suggests that EPFs should invest in developing strategic assets and capabilities for market extension which are complementary to those possessed by AMNEs. This might require, for instance, a rethinking and re-orientating R&D budgets and recruitment of scientific talent. But it might extend to include more fundamental changes in their business models, switching from a "closed" design suited for incremental process innovation and fast

imitation towards a more "open" business model, designed to generate differentiated drugs which better serve the needs of targeted patients and which can be produced and marketed more efficiently. In relation to EPFs IP strategy, our analysis highlights the need for EPFs to make themselves aware of their international competitors' IP strengths and weaknesses (e.g. through carrying out patent landscape analysis) so that they can raise possible concerns about aggressive strategic patenting by AMNEs with IP authorities. On the other hand AMNEs should be cognizant of the possibility for and advantages of co-opetition and refrain from pursuing, even if in good faith, practices that turn out to be restrictive and counter-productive such as aggressive strategic patenting. Both parties should refrain from opportunistic litigation. Co-opetition between firms through market co-creation can also serve as an alternative to stricter public sector regulation.

Concerning public policy, governments could assist with market co-creation, by encouraging firms to acquire and leverage knowledge, complementary assets and capabilities, as well as by seeking to support the creation of a space that fosters the identification of cooperative solutions that reward value adders and challenge copy cats or attempts by some AMNEs to capture value by adopting aggressive strategic patenting practices (e.g. overly extending the scope and duration of otherwise legitimate IP rights).

There is a wealth of evidence showing that (contrary to initial expectations) the increase in IP protection that followed the implementation of TRIPS does not seem to have led to the additional investments needed to fight the largely neglected emerging country diseases (Kyle and McGahan, 2009; Lanjouw, 2005). Our findings imply that, even though IP protection will not on its own lead to additional investments by AMNEs, it may nevertheless aid negotiations between local producers

and AMNEs for the creation of new products that are best suited for local needs or emerging country-specific diseases (such as malaria) and the extension and co-creation of markets. These emerging forms of cross-border co-opetition help moving closer to the original objectives of TRIPS-compliant regulation.

Our findings contribute to the extant literature in two ways. First, our study contributes to the international business literature (Cuervo-Cazurra, 2012; Mathews, 2006; Manning, 2008; Manning et al., 2008) by elucidating the mutually beneficial role of cooperative agreements between advanced and emerging country pharmaceutical firms. Our study shows that EPFs can rely on such cooperative agreements to adjust to the new IP regime, provided that they first make the necessary market-enhancing investments. Furthermore, our game theoretic approach allows us to overcome the unavoidable empirical issues imposed by the slow regulatory evolution through a series of international trade agreements, making a systematic assessment of the role of partnerships as a means to respond to instructional change hard to implement empirically. Second, our work extends the market co-creation perspective (Lado et al., 1997; Pitelis and Teece, 2010) to the multinational enterprise context but also challenges the conventional wisdom *vis a vis* the terms of engagement of emerging country firms and multinational enterprises in the very important global pharmaceutical sector.

Limitations and future work

Like all research, our study is subject to limitations that should be acknowledged. Our model was originally built around the IP regime and competitive dynamics in the pharmaceutical sector of the economy, which might limit the generalizability of our findings. However, we believe that the theoretical predictions of our model can apply

(at different degrees) to other industries where formal IP protection is seen as an effective mechanism for appropriating value from innovation by preventing direct imitation, such as in the chemical, electronics and machinery industries (James et al., 2013).

We further highlight three limitations which are related to the necessary simplifying assumptions of our game theoretic model. First, although damages that are awarded to AMNEs - in the case of IP infringement - are treated as an endogenous parameter shaped by the EPF's host country policies (and the EPF's willingness to take action against AMNEs IP rights), the legal IP framework is considered exogenous. However, recent advances in institutional theory suggest that actors may act as institutional entrepreneurs and transform existing institutions themselves (Battilana et al., 2009). Second, our analysis as to how EPFs can become attractive partners for AMNEs highlights the need for the latter to develop new sets of capabilities or even reconfigure their business models. Nevertheless, the requisite capabilities to implement change will not be identical across all EPFs and such organizational changes may be hampered by inertia, sunk costs, lack of legitimacy etc. (Hannan and Freeman, 1977; Leonard-Barton, 1992; Teece, 2009). Finally, despite our plausible assumptions (e.g. about rational decision makers operating in profit-maximizing firms), one cannot rule out the existence of alternative contingencies, once market inefficiencies and information asymmetries become a possibility. Future research is needed to examine systematically how all these alternative scenarios and courses of action can contribute to the survival and growth of emerging and advanced country firms in the new IP regime.

References [needs updating]

Adner, R. & Zemsky, P. (2006). A Demand-Based Perspective on Sustainable Competitive Advantage. *Strategic Management Journal*, 27: 215-239.

Anand, J. and Kale, P. (2006). Effects of market liberalization on joint venture contributions and control: an empirical study of international JVs in India. In Cooper, A., Alvarez, S., Carrera, A., Mesquita, L. and Vassolo, R. (Eds.), Entrepreneurship and Innovation in Emerging Economies, Wiley-Blackwell.

Binmore, K., (1992). Fun and games. Toronto: D.C. Heath and Company.

Blakeney, M. (2013). Covert International Intellectual Property Legislation: The Ignoble Origins of the Anti-Counterfeiting Trade Agreement (ACTA). *Michigan State International Law Review*, 21: 87-114.

Branderburger, A. M., and Stuart, H. W. (1996). Value-based Business Strategy. *Journal of Economics and Management Strategy*, 5: 5–24.

Brouthers, L.E., Mukhopadhyay, S., Wilkinson, T.J., & Brouthers, K.D. (2009). International market selection and subsidiary performance: A neural network approach. *Journal of World Business*, 44: 262–273.

Business Standard. 2004. US court smashes Dr Reddy's $200m amlodipine dream. [ONLINE] Available at: http://www.business-standard.com/article/companies/us-court-smashes-dr-reddy-s-200m-amlodipine-dream-104030101021_1.html. [Accessed 04 June 15].

Camerer, C. F. (1991). Does strategy research need game theory? *Strategic Management Journal*, 12:137-152.

Cantwell, J. A. (1995). The globalisation of technology: what remains of the product cycle model. *Cambridge Journal of Economics*, 19: 155-174.

Casadesus-Masanell, R., & Zhu, F. (2013). Business Model Innovation and Competitive Imitation: The Case of Sponsor-Based Business Models. *Strategic Management Journal*, 34: 464-482.

Cockburn, I., Lanjouw, J., & Schankerman, M. (2014), Patents and the global diffusion of new drugs, *NBER Working Paper No*. 20492.

Cuervo-Cazurra, A. (2012). Extending theory by analysing developing country multinational companies: Solving the goldilocks debate. *Global Strategy Journal*, 2: 153-167.

Dierickx, I., & Cool, K. (1989). Asset stock accumulation and sustainability of competitive advantage. *Management Science*, 35(1): 1504-1511.

Dinopoulos, E., & Segerstrom, P. (2010). Intellectual Property Rights, Multinational Firms and Economic Growth, *Journal of Development Economics*, 92: 13-27.

Diwan, I., & Rodrik, D. (1991). Patents, Appropriate Technology, and North-South Trade. *Journal of International Economics*, 30: 27-47.

Dussauge, P. & Garrette, B. (1999). Cooperative Strategy: Competing Successfully Through Strategic Alliances, New York: John Wiley and Sons.

Ghauri, P. N., & Santangelo, G. D. (2012). Multinationals and the Changing Rules of Competition. *Management International Review*, 52(2): 145-154.

Greenhalgh, C. (2013). Science, Technology, Innovation and IP in India – New Directions and Prospects, Oxford Department of Economics Discussion Paper Series, No. 660.

Hall, B. H., Helmers, C., Rogers, M. & Sena, V. (2012). The choice between formal and informal intellectual property: A review. *NBER Working Paper*, No. 17983.

Hamel, G. (1991). Competition for competence and interpartner learning within international strategic alliances. *Strategic Management Journal*, 12: 83–103.

Hennart, J. F. (1988). A transaction costs theory of equity joint ventures. Strategic Management Journal, 9: 361-374.

Hymer, S. H. (1976). *The international operations of national firms: A study of direct investment*. Cambridge, MA: MIT Press.

James, S.D., Leiblein, M.J. & Lu, S. (2013) How firms capture value from their innovations. *Journal of Management*, 39: 1123-1155.

Jandhyala, S. 2015. International and domestic dynamics of intellectual property protection. *Journal of World Business*, 50: 284-293.

Kafouros, M.I, Buckley, P.J, Sharp, J.A & Wang, C. (2008). The role of internationalization in explaining innovation performance, *Technovation*, 28: 63–74.

Kyle, M., & McGahan, A. (2009). Investments in Pharmaceuticals Before and After TRIPS, *NBER Working Paper*, No. 15468.

Lado, A., Boyd, N., & Hanlon, S. (1997). Competition, cooperation, and the search for economic rents: A syncretic model. *Academy of Management Review*, 22: 110-141.

Lanjouw, J. (2005). Patents, Price Controls and Access to New Drugs: How Policy Affects Global Market Entry. *NBER Working Paper*, No. 11321.

Lanjouw, J., & Schankerman, M. (2004). Protecting Intellectual Property Rights: Are Small Firms Handicapped? *The Journal of Law and Economics*, 47: 45-74.

Li, J. & Xie, Z. (2011). Global R&D Strategies in an Emerging Economy: The Development and Protection of Technological Competencies, *European Management Review*, 8: 153–164.

MacDonald, G., & Ryall, M. D. (2004). How do value creation and competition determine whether a firm appropriates value? *Management Science*, 50: 1319-1333.

MarketLine. (2014). *OTC Pharmaceuticals in India*, London.

Mathews, J. A. (2006). Dragon multinationals: New players in the 21st century globalization. *Asia Pacific Journal of Management*, 23: 5-27.

McKinsey and Company (2013). *Generating value in generics: finding the next five years of growth*. Report on Insights into Pharmaceuticals and Medical Products.

Meschi, P. (2005) Environmental Uncertainty and Survival of International Joint Ventures: The Case of Political and Economic Risk in Emerging Countries. *European Management Review*, 2:143-152.

Ohmae, K. (1985). *Triad Power: The Coming Shape of Global Competition*, New York: The Free Press.

Petersen, B., Pedersen, T., & Lyles, M. (2008). Closing Knowledge Gaps in Foreign Markets. *Journal of International Business Studies*, 39(7): 1097-1113.

Pitelis, C.N., & Teece, D.J. (2010). Cross-border Market Co-creation, Dynamic Capabilities and the Entrepreneurial Theory of the Multinational Enterprise. *Industrial and Corporate Change*, 19: 1247-1270.

Sethi, D. & Guisinger, S. (2002). Liability of foreignness to competitive advantage: How multinational enterprises cope with the international business environment. *Journal of International Management*, 8: 223-240.

Shadlen, K. C. & Guennif, S. (2011). *Intellectual Property, Pharmaceuticals and Public Health: Access to Drugs in Developing Countries.* Cheltenham: Edward Elgar Publishing.

Shaffer, E.R. & Brenner, J. E. (2009). A Trade Agreement's Impact On Access To Generic Drugs. *Health Affairs*, 28: 957-968.

STRATFOR (2010). U.S., Brazil: A Temporary Respite in Trade Tensions. April 6, 2010.

Teece, D. (1986). Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy. *Research Policy,* 15(6): 285-306.

Teece, D. J. (2006). Reflections on 'Profiting from Innovation'. *Research Policy*, 35(8): 1131-1146.

Yadav, P. (2010). Differential Pricing for Pharmaceuticals: Review of Current Knowledge, New Findings and Ideas for Action. *A study conducted for the UK Department for International Development*.

Yang, D. (2012). Arm's length and captive transactions: Patent-based view of control in internationalization. *International Business Review*, 21(4): 575-587.

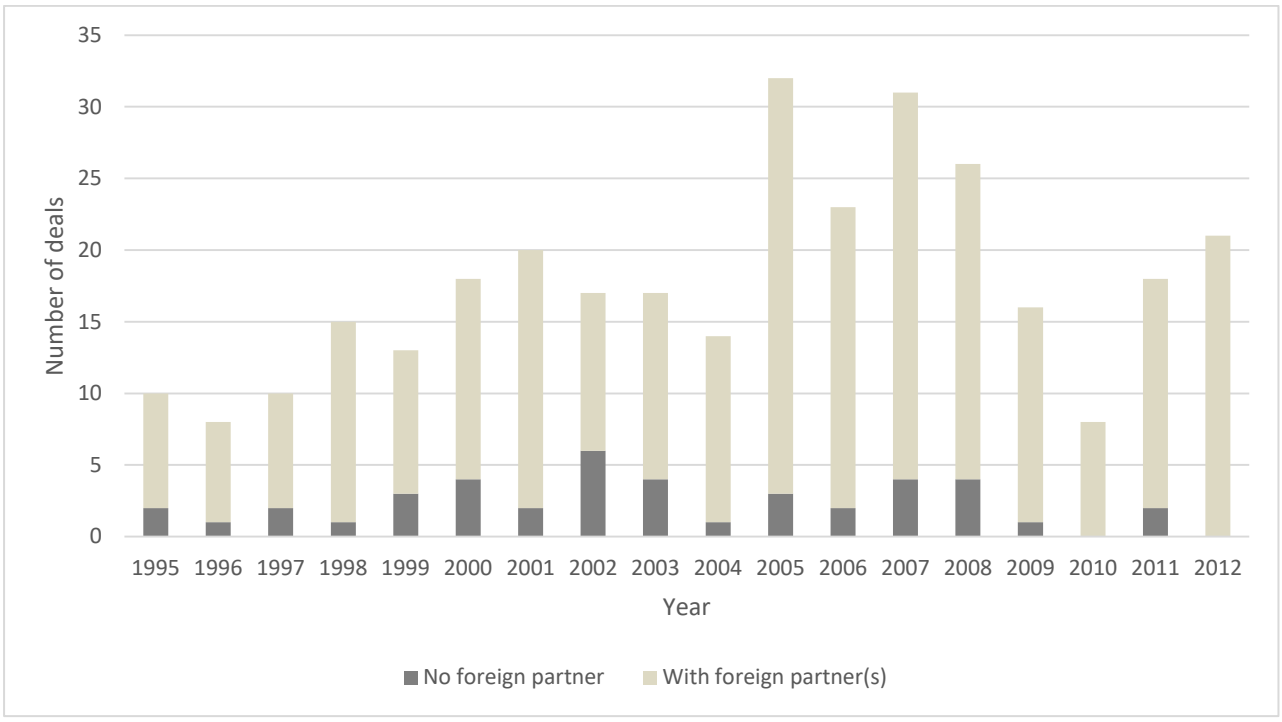
Zaheer, S. (1995). Overcoming the Liability of Foreignness. *Academy of Management Journal*, 38(2): 341-363.

Table 1
Strategic alliances by most alliance-active Indian pharmaceutical companies, 1995-2012

Company name (city)	No. of Employees	No. of Alliances	Indian partners	Overseas partners
Ranbaxy Laboratories Ltd (Gurgaon)	14,600	23	Alembic Ltd, CD Pharma India Pvt Ltd, Cipla Ltd; Dr Reddy's Laboratories Ltd, Ethypharm India Pvt Ltd, Lupin Laboratories Ltd, Nicholas Piramal India Ltd, Orchid Chem & Pharm Ltd Sun, Wockhardt Ltd, Zenotech Laboratories Ltd, Zydrus Cadila	Bayer AG, City Asucom, Community Invest Hldgs(Pty)Ltd, Davidson Laboratories, DWC Auto 14th Sec Spv, GlaxoSmithKline PLC, Knoll AG(BASF AG), Merck & Co Inc, Microbia Inc, MMV, Nippon Chemiphar Co Ltd, SciGen Ltd, Tiger Brands Ltd
Nicholas Piramal India Ltd (Mumbai)	2,976	18	Alembic Ltd, Ambalal Sarabhai Entrp Ltd, Cadila Healthcare Ltd, Cipla Ltd, Dr Reddy's, Laboratories Ltd, Hoechst Marion Roussel Ltd, Lupin Laboratories Ltd, Ranbaxy Laboratories Ltd, Reckitt & Colman of India Ltd, RPG Life Sciences Ltd, Shree Dhootapapeshwar, Sun, Tribeni & Roy, Wockhardt Ltd, Zydrus Cadila	ACIC(Canada)Inc, Allergan Inc, ARKRAY Inc, Biogen Idec Inc, BioSyntech Inc, Boots Healthcare International, City Asucom, Cytran Ltd, DxTech LLC, IVAX Corp, Laporte PLC, Napo Pharmaceuticals Inc, Pierre Fabre, Reckitt & Colman PLC
Dr Reddy's Laboratories Ltd (Hyderabad)	16,617	16	Alembic Ltd, Cipla Ltd, Lupin Laboratories Ltd, Natco Pharma Ltd, Nicholas Piramal India Ltd, Ranbaxy Laboratories Ltd, Sun, Zydrus Cadila	7TM Pharma A/S, Argenta Discovery Ltd, Canada Rotam Enterprises Co, City Asucom, Clintec International Ltd, Foamix Ltd, Fujifilm Corp, GlaxoSmithKline PLC, Kunshan Double-Crane, Kushan Double-Crane Pharm, Merck Serono SA, Novartis AG, Oceana Therapeutics Inc, Revesco Ltd, Rheoscience A/S, SCOLR Pharma Inc
Cadila Healthcare Ltd (Ahmedabad)	15,025	15	Ambalal Sarabhai Entrp Ltd, Bayer Industries Ltd(Bayer AG), Bharat Serums & Vaccines Ltd, Boehringer Ingelheim India, Kopran Ltd, Nicholas Piramal India Ltd, RPG Life Sciences Ltd, Wockhardt Ltd	Bayer Healthcare AG, IVAX Corp, Korea Green Cross Corp, Mallinckrodt Inc, Mayne Pharma Pty Ltd, Microbix Biosystems Inc, Prosto strakhuvannia, Schering AG, TGL Enterprises LLC
Orchid Chem & Pharm Ltd (Chennai)	2,800	14	Elder Health Care Ltd, Ranbaxy Laboratories Ltd, RPG Life Sciences Ltd	Actavis Group hf, Alpharma Inc, Apotech USA Inc(Apotech Inc), BEXEL Biotechnology Inc, BEXEL Pharmaceuticals Ltd, Cambridge Chemicals, Forest Laboratories Inc, IBP SpA, Mayne Pharma PLC, North China Pharmaceutical Co, Par Pharmaceutical Inc, Stada Pharmaceuticals Inc
Wockhardt Ltd (Mumbai)	8,600	14	Cadila Healthcare Ltd, Nicholas Piramal India Ltd, Ranbaxy Laboratories Ltd	Al Mintakh, Bayer AG, Daiichi Pharmaceutical Co Ltd, Eisai Co Ltd, Ferring Pharmaceuticals, Hisamitsu Pharmaceutical, IVAX Corp, MAS, Pharma Dynamics, Rhein Biopharm, Rimsa Laboratorios, Sidmak Laboratories Inc, Sinclair Pharma PLC, Wallis Laboratories
Biocon Ltd (Bangalore)	7,310	11		Abraxis BioScience Inc, Amylin Pharmaceuticals Inc, Bentley Pharmaceuticals Inc, Bristol-Myers Squibb Co, Mylan Inc, NeoPharma AB, Nobex Corp, Pfizer Inc, Vaccinex Inc

Sources: Thomson SDC Platinum alliances; number of employees in 2012 by BvD OSIRIS

Figure 1
Strategic alliances by Indian pharmaceutical companies by year, 1995-2012



Source: Thomson SDC Platinum alliances

Figure 2
Area of strategic alliances by Indian pharmaceutical companies, 1995-2012

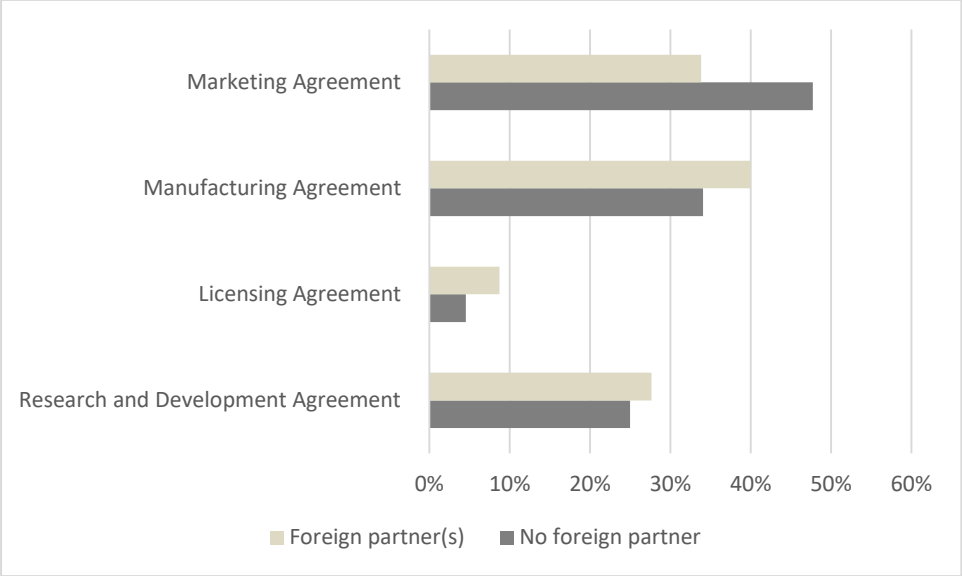
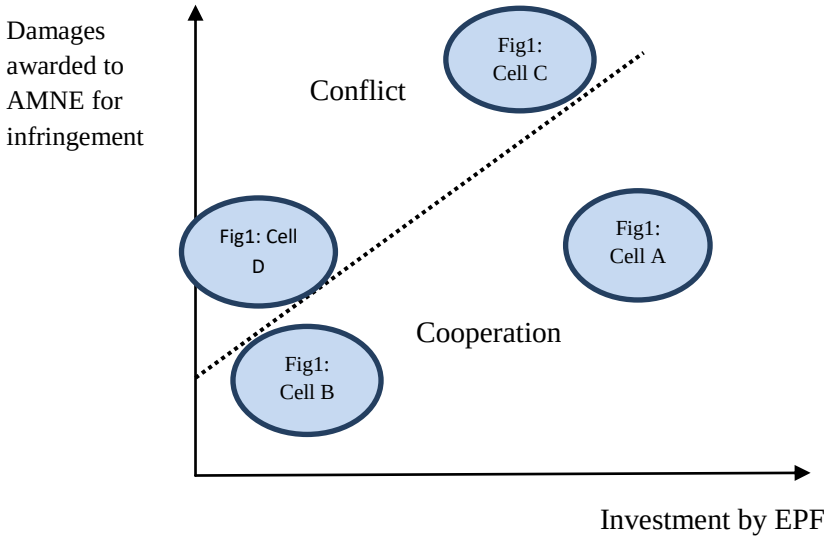


Figure 3
Strategy matrix: The game between EPFs and AMNEs

AMNE

EPF	Cooperate	Compete
Invest to extend/Co-create Market	**A**: The added value from market extension/co-creation is shared between the AMNE and EPF.	**C**: The AMNE tries to appropriate the added value from market extension/co-creation via litigation.
Copy/Distribute Value	**B**: The mere copying of the patented drug leads to a cooperative solution only if the AMNE is prepared to forego some of its market share.	**D**: The mere copying of the patented drug, leads to conflict via litigation.

Figure 4
Competitive outcomes by key model parameters



Appendix

The Players and their Strategies

We consider two pharmaceutical firms. Firm 1 is an AMNE that faces competition from Firm 2, which is an EPF. Firm 1 holds a patent protected drug that is marketed and sold in its domestic market and wants to start selling its drug to Firm 2's host country market. Firm 2 also aims to offer its own drug version to its home market. Firm 1 accuses Firm 2 that its drug infringes its patents rights.

Firm 2 can adopt two alternative strategies: a) compete with Firm 1 by copying Firm 1's patented drug formula (strategy IN – for INFRINGEMENT); or b) invest in adding value to its drug in order to better tailor it to the needs of the local market and make it superior relative to the original offering (strategy VA – for VALUE ADDED). In both cases, the creation of the drug by Firm 2 will lead to profits for Firm 2. However, as Firm 2 is perceived by Firm 1 to be selling Firm 1's patented drug formula, these profits represent foregone profits (i.e. losses) for Firm 1, which sees its share of the market being captured by Firm 2's product.

When Firm 2 chooses to copy Firm 1, Firm 1's losses are l_1 and Firm 2's gains are l_2. Copying implies that Firm 2's gains are Firm 1's loses ($l_1 = l_2$). Consequently, infringement results in a redistribution of the pie, with Firm 2 appropriating a share of Firm 1's anticipated market share in the emerging country. Under strategy VA, on the other hand, Firm 2 invests in order to foster value added, and by doing so the size of the pie effectively increases. In particular, we expect that Firm 2's gains must be greater than 1's losses; within the context of the model it is rudimentary to show that any other assumption cannot lead to a cooperative solution. To capture this, we assume that the inclusion of value added requires Firm 2 to invest i into its new product, in which case Firm 2 can garner gains that are greater than otherwise by a factor equal to il_1. Consequently, Firm 2's gains from strategy VA are $l_2 = l_1 + il_1$. To sum up, strategy VA increases the overall pie by $V = l_2 - l_1 = il_1$, while strategy IN does not increase the overall pie, and $V = 0$. In this context, investment *i* constitutes the carrot that takes the form of increases in the overall pie.

Shifting our attention to Firm 1, upon recognising that Firm 2 has infringed, Firm 1 has three strategies that it can follow: a) it can choose a competitive solution by entering into a conflict (strategy C for COMPETE), b) it can choose to find an amicable solution (strategy A for ACCOMODATE), or lastly, c) it can choose to do nothing (strategy N for NO ACTION). Strategy N will not be modelled further because the game ends with Firm 1 conceding defeat. Nonetheless, in the course of the analysis it will prove helpful to use the payoffs stemming from this strategy as a benchmark that defines what would happen if Firm 1 just decides to turn a blind eye. With this in mind, we present the game tree in Figure A1, which lists the strategies that firms can follow and the payoffs that each strategy leads to. It should be noted that the depicted strategies are essentially similar to the ones of the matrix of Figure 1. The main difference in this setting is the sequential nature of the argument.

[Insert Figure A1 about here]

From Figure A1 it becomes apparent that, similar to the matrix of Figure 1, in order for the conflict to be avoided Firm 2 must first follow strategy VA, and then Firm 1 must also pursue strategy A. We envision that in such a case the disagreement is resolved through an out-of-court settlement. By contrast, if Firm 2 chooses strategy IN, or Firm 1 strategy C, the two parties proceed with the conflict. Starting with a settlement, we will model settlement as a bargaining agreement between the two parties. In this case, through bargaining, Firm 1 will: a) try to reclaim what is legally

its own property, and b) split the additional pie that Firm 2's investment led to. In modelling bargaining we will assume that firms bargain in a Nash bargaining fashion.

If the two parties choose a conflict, the conflict must ultimately result in some form of adjudication, where one party prevails. To simplify things we assume that this adjudication takes the form of litigation in an emerging country court (nonetheless, any type of arbitration that accords with international norms suits our purpose). Focusing on the emerging country legal system, we assume that the emerging country has signed TRIPS and there is IP legislature in place. Hence, the issue of infringement is considered as a legal issue that must be treated according to international regulations, and Firm 1 can win in court with probability μ. If Firm 2 is found to be infringing, it will have to return the appropriated profits and pay a fine/damages. The yardstick used by courts in estimating damages is foregone profits from the sale of the infringing good.[7] Accordingly, we model damages in terms of the losses l_1 that the plaintiff has suffered via infringement, framing damages as ζl_1, where ζ corresponds to domestic legal norms. Even though ζl_1 must be positive it can vary.

One way to vary ζl_1 is by changing the patent breadth/length of patented drugs. Specifically, a reduction in the drug's patent breadth/length must lower the drug's monopoly profits thereby diminishing l_1. Thereby, keeping l_1 steady, such a reduction is tantamount to a drop in ζ. As we have already explained, EPFs are actively trying to lessen the patent breadth/length of AMNEs patented drugs, effectively lowering ζ. Such moves have been met with disquiet by AMNEs who argue that they are detrimental to a solution. This need not be the case. To best argue against this case, we model ζ in the fashion intended by AMNEs, i.e. as the aforementioned stick that can force EPFs to stop their infringing practices. Consequently, the carrot affects the gains that Firm 2 can garner by a factor equal to il_1, while the stick affects the damages that it incurs by ζl_1. As we argue, it is possible to avoid a conflict by increasing *i* and decreasing ζ. Furthermore, as we explain, this pattern (of increasing *i* and decreasing ζ) is increasingly the *modus operandi* of EPFs and emerging country governments.

To summarize the above, if Firm 2 decides on copying, appropriating Firm 1's market share, there can clearly be no amicable solution as Firm 1 must retaliate, demanding damages ζ. By contrast, if Firm 2 decides to invest *i* then the two firms have something to split in case of a settlement. Consequently, this strategy has the potential to lead to a settlement i.e. a non-competitive solution. Thus, we envision that for certain values of ζ and *i* the two forces will re-enforce each other leading to a non-competitive solution.

The Payoffs from Each Strategy

We denote the profits of each firm prior to the emergence of a conflict as $\pi_{1,NC}$ and $\pi_{2,NC}$ (NC stands for NO CONFLICT) respectively. Equally, when the conflict emerges, and prior to any solution, the firms' profits are denoted as $\pi_{1,\mathrm{N}}$ and $\pi_{2,\mathrm{N}}$ respectively; these are the profits that the two firms garner if Firm 1 chooses to turn a blind eye to infringement.

[7] Sometimes courts derive damages through the accumulated royalties resulting from a hypothetical licensing agreement. In theory both methods should provide identical results.

If Firm 1 follows strategy A and the firms eventually settle, they need to reclaim lost profits and split up $V = il_1$ into two shares of ε_1 and ε_2 respectively, i.e. $V = \varepsilon_1 + \varepsilon_2$. This implies that the profits that the two firms derive by following strategy A should be equal to the profits that they would have respectively captured in the absence of a solution ($\pi_{1,N}$, $\pi_{2,N}$), plus their bargaining shares (ε_1, ε_2). Subsequently, the firms' profits from a settlement, respectively denoted as $\pi_{1,A}$ and $\pi_{2,A}$ are, $\pi_{1,A} = \pi_{1,N} + \varepsilon_1$ and $\pi_{2,A} = \pi_{2,N} + \varepsilon_2$.

Allowing the two firms to bargain in a cooperative fashion, before underlining the Nash product (which when maximized provides the bargaining share of each firm) we must establish the threat points that each firm faces. In other words, we need to find how the two firms split *V* when settlement fails and the case is decided by a court. In this case, if Firm 1 wins (with probability μ), it must get back the l_1 profits that Firm 2 appropriated, plus the ζl_1 damages that it is entitled to; if it loses Firm 2 captures the entire *V*. This reasoning implies that Firm 1's threat point is $\mu(1+\zeta)l_1$.

Focusing on Firm 2, if the case goes to court and Firm 2 wins, it can legally appropriate its full share of its contribution to *V*, which is l_2, making Firm 2's threat point equal to $(1-\mu)l_2$; if it loses it gets naught. Accordingly, the firms maximize the following Nash product, $max_{\varepsilon_1,\varepsilon_2}[(\varepsilon_1 - \mu(1+\zeta)l_1)(\varepsilon_2 - (1-\mu)l_2)]$ where $V = \varepsilon_1 + \varepsilon_2$. Bearing in mind that $l_2 = l_1 + il_1$, the FOC of this maximization problem is $\varepsilon_1 = \frac{1}{2}\big((2+i+\zeta)\mu - 1\big)l_1$, and $\varepsilon_2 = V - \varepsilon_1$. Note that both μ and ζ have a positive effect on the bargaining share of Firm 1 and a negative on Firm 2. Hence, increasing the damages awards, or the probability of prevailing in court, shifts the balance of power towards Firm 1.

On account of the above $\pi_{1,A} = \pi_{1,N} + \varepsilon_1$ and $\pi_{2,A} = \pi_{2,N} + \varepsilon_2$ become,

(1) $\pi_{1,A} = \pi_{1,N} + \frac{1}{2}\big((2+i+\zeta)\mu - 1\big)l_1,$

(2) $\pi_{2,A} = \pi_{2,N} + \frac{1}{2}\big((2+\zeta)\mu - 1 - i(2-\mu)\big)l_1.$

Shifting our attention to strategy C and litigation, if after filing the case Firm 1 wants to pursue litigation then the firms' profits from litigation are,

(3) $\pi_{1,C} = \mu\big(\pi_{1,N} + (1+\zeta)l_1\big) + (1-\mu)\pi_{1,N},$

(4) $\pi_{2,C} = \mu\big(\pi_{2,N} - (1+\zeta)l_1\big) + (1-\mu)\pi_{2,N},$

In (3), $\mu\big(\pi_{1,N} + (1+\zeta)l_1\big)$ denotes the profits that Firm 1 attains by winning the court case with probability μ. These should be equal to the $\pi_{1,N}$ profits that accrue to Firm 1 when infringement takes place, plus the l_1 profits that it foregoes due to infringement, to which one should add the ζl_1 damages that Firm 1 is entitled to. On the other hand, if Firm 1 loses its case, with probability $(1-\mu)$, then it can only get $\pi_{1,N}$. Equation (4) draws a similar picture for the infringer, who has to pay damages and return the profits it appropriated (i.e. $(1+\zeta)l_1$) if it loses the case, while if it wins it can legally get the profits from infringement, i.e. $\pi_{2,N}$.

Comparing the Profits from Each Strategy

Having obtained the payoffs for strategy A and C we can now compare the two. To simplify the results we will assume that both firms have an equal chance of winning the case. This assumption allows us to focus on how Firm 2 can employ the parameter values of i and ζ so as to achieve a more favourable outcome. As far as Firm 1 is concerned, the profits from strategy A are greater than those from strategy C if

$2 + \zeta < i$. For Firm 2 the profits from strategy VA are greater than those from IN if $\frac{1}{3}\zeta < i$. As the first inequality is always greater than the second we only focus on

(5) $\quad 2 + \zeta < i.$

which suggests that cooperation becomes more beneficial as ζ declines relative to i. Simply put, Firm 2 will tend to choose to cooperate with Firm 1 when ζ is small relative to i.

Figure A1

The strategic interaction game tree for EPFs and AMNEs