# WORKING PAPER

**International Jurdisdiction Over Standard-Essential Patents**

Henrik Horn

European University Institute
**Robert Schuman Centre for Advanced Studies**
Global Governance Programme

# International Jurdisdiction Over Standard-Essential Patents

Henrik Horn

**Robert Schuman Centre for Advanced Studies**

The Robert Schuman Centre for Advanced Studies, created in 1992 and currently directed by Professor Erik Jones, aims to develop inter-disciplinary and comparative research on the major issues facing the process of European integration, European societies and Europe's place in 21st century global politics.

The Centre is home to a large post-doctoral programme and hosts major research programmes, projects and data sets, in addition to a range of working groups and ad hoc initiatives. The research agenda is organised around a set of core themes and is continuously evolving, reflecting the changing agenda of European integration, the expanding membership of the European Union, developments in Europe's neighbourhood and the wider world.

For more information: http://eui.eu/rscas

**The Global Governance Programme**

The Global Governance Programme is one of the flagship programmes of the Robert Schuman Centre. It is a community of outstanding professors and scholars, that produces high quality research and engages with the world of practice through policy dialogue. Established and early-career scholars work on issues of global governance within and beyond academia, focusing on four broad and interdisciplinary areas: Global Economics, Europe in the World, Cultural Pluralism and Global Citizenship.

The Programme also aims to contribute to the fostering of present and future generations of policy and decision makers through its executive training programme: the Academy of Global Governance, where theory and 'real world' experience meet and where leading academics, top-level officials, heads of international organisations and senior executives discuss on topical issues relating to global governance.

For more information: http://globalgovernanceprogramme.eui.eu/

## Abstract

Countries are alleged to pursue commercial interests through their antitrust interventions regarding FRAND commitments for standard-essential patents (SEPs). This paper examines pros and cons of allocating jurisdiction according to fundamental principles in international law, assuming that countriesíregulations promote national objectives. It shows why the Territoriality Principle yields too lenient treatment of patent-issuing countriesíSEPs, and too strict of treatment of other countriesí SEPs, and why the Nationality Principle yields too lenient treatment generally. Non-discrimination obligations can, but need not, improve on outcomes. Hence, existing international law will typically not implement e¢ cient outcomes, suggesting that an international agreement is required.

## JEL classification

## Keywords

## Acknowledgements

# Contents

# 1   Introduction

Firms that participate in standard-setting or standard-developing organizations commit to make their patents available to future implementers of the standards on "fair, reasonable and non-discriminatory" (FRAND) terms, should their patents become essential to the use of the standards. These commitments are intended to limit the ability of holders of such standard-essential patents (SEPs) to exploit the market power that the essentiality of the patents yields. The more precise meaning of the FRAND commitments is typically not specified, however, so conflicts often arise between SEP holders and implementers regarding the practical interpretation of the concept. Since SEPs are very often implemented in international production chains, these conflicts often involve SEP holders and implementers from different countries.

While in some countries the regulatory enforcement of FRAND commitments primarily falls under private contract law, violations of FRAND commitments can fall under antitrust law in all major economies (as abuse of dominance, or similar). Antitrust interventions regarding SEPs have also laws occurred in, for instance, China, the EU, South Korea, Taiwan and the US. These antitrust interventions are causing increasing international tensions, however. China, Taiwan, and South Korea, in particular, have been criticized recently for using antitrust interventions against alleged violations of FRAND commitments as a form of industrial policy. For instance, the US White House National Security Council spokesman Patrick Ventrell recently stated:

> The United States government is concerned that China is using ... anti-monopoly law, to lower the value of foreign-owned patents and benefit Chinese firms employing foreign technology.[1]

Similar concerns have been addressed by a number of legal scholars and practitioners.[2]

These tensions are not surprising from an economic perspective. Countries that are involved in international production chains will often have diverging commercial interests regarding the appropriate regulation of the associated FRAND commitments, depending on the nationality of the SEP holders, whether the countries are exporting or importing products that draw on the SEPs, whether the countries more generally are primarily sources or implementers of SEPs, etc. Consequently, these commercial interests affect antitrust interventions, as is alleged, and as also seems plausible from an political economy perspective, countries will seek to implement different regulations of these commitments. This would be less of a problem if there existed a multilateral

---

[1] Reuters, Dec 16, 2014. www.reuters.com/article/us-qualcomm-china-antitrust-idUSKBN0JU0AK20141216.

[2] For example, based on patent application data from the EU, Japan and the US, Webster, Jensen and Palangkaraya (2014) establish a higher propensity to accept applications from domestic than foreign applicants; Wong-Ervin, Wright, Kobayashi and Ginsburg (2016) argue that some competition authorities appear to enforce FRAND commitments so as to benefit their local implementers or national champions; de Rassenfosse, Jensen, Julius and Webster (2019) identify a bias against foreign firms using patent data from five major economies that jointly account for approximately 80% of global patenting; and de Rassenfosse and Raiteri (2022) find strong evidence for such protectionism by the Chinese patent office with regard to what they define as strategic patents (albeit not for other patents).

agreement on the international allocation of jurisdiction regarding the implementation of FRAND commitments. However, no such agreement exists.

**The purpose of this paper**  The starting point of this paper is the observation that in the absence of international agreements on jurisdiction, all countries are *legally bound to respect the default rules for international jurisdiction* in customary international law. These rules, which have emerged as a result of systematic state practice, are of fundamental importance to international relations generally.[3] The purpose of the paper is to examine economic implications of relying on the two main bases in the default rules for allocating jurisdiction—the *Territoriality* and the *Nationality Principles*—when countries' regulations of FRAND commitments are affected by commercial considerations. Do these rules allocate jurisdiction across countries in an economically efficient manner? If not, what are their pros and cons, and can anything be said about whether either rule performs better than the other? These questions are of direct policy relevance. If the default rules implement efficient outcomes, existing law is adequate from an economic perspective. The problem is then to ensure that countries comply with the law. On the other hand, if the rules cannot implement an efficient outcome, there is a need to look for alternative solutions, in the form of other jurisdictional principles, or more likely in the form of an international agreement.

**The framework to be employed**  A highly stylized economic framework will be employed, in which a product is produced in one country by a monopoly firm, and is exported to another country. The product builds on a standard that draws on two patents. The patents are essential in two respects: both patented technologies are required in order to manufacture and sell the product, and the two holders of the patents are bound by FRAND commitments to charge "reasonable" license fees. The firm negotiates separately the magnitude of per-unit license fees with the holders of the two SEPs. In each country a regulatory authority can intervene to enforce the country's views on how the FRAND commitments should be interpreted. This authority can limit the use of market power by SEP holders by imposing *ceilings* on permissible license fees, but cannot directly regulate the level of the fees.

The interaction takes place in three stages. The authorities first simultaneously lay down FRAND policies for patent(s) for which they have jurisdiction, in the form of maximally permitted license fees. This stage hence represents the long-term decisions on the design of the legal treatment of FRAND commitments. There are then simultaneous separate negotiations between the producer and each of the two SEP owners regarding the license fees. These negotiations are interrelated, since the surplus that can be divided between each of the SEP holders and the producer, will depend

---

[3] The importance of these rules is vividly illustrated by the international reactions to the 2008 extension of the EU Emissions Trading System to aviation. Despite non-discriminatory, and introduced to protect the climate, this measure created such adverse international reactions from governments representing some 3/4 of the global population, that the EU very soon completely withdrew the measure. At the core of these international reactions was the perception that the measure violated jurisdictional principles, by imposing extra-territorial taxation.

on the license fee that they expect to be agreed upon between the producer and the other SEP holder. Formally, the outcome is assumed to be a "Nash-in-Nash" equilibrium, similar to in Horn and Wolinsky (1988). In the final stage there is production and consumption in standard fashion.

Each country interprets a license fee to be "reasonable" if it does not exceed the country's preferred level. The importing country is concerned with the implications of the negotiated fees for domestic consumer welfare and for the welfare of its SEP holder(s) if any, while the exporting country is concerned with the implications of the fees for its exporting firm, and for its SEP holder(s), if any. The countries can put an intrinsic value on license revenue for domestic SEP holders, as a short-hand for their desire to provide local incentives for innovation.

Simple as this economic structure is, it seems to capture basic aspects of how the interests of countries with regard to the enforcement of FRAND commitments depend on their roles in international production chains.[4]

**Findings**   In this framework, each country wants to minimize the license fee(s) for foreign-owned SEP(s). For the patent-issuing country, this will enhance consumer welfare by reducing the equilibrium product price. For the exporting country, minimizing the license fee for SEP(s) held by the patent-issuing country will enhance the profit of its producer. Also, since the bargaining processes for the SEP licenses are interrelated, both countries prefer a minimal license fee for the respective foreign SEP, to increase the surplus that is available for its domestic SEP holder(s), if any, to divide with the producer. Hence, absent observance of jurisdictional principles, the outcome implies inefficiently stringent regulation of the FRAND commitments compared what would be jointly optimal.

Having thus set the stage, the paper then considers the impact of allocating jurisdiction over the enforcement of FRAND commitments based on the Territoriality Principle and/or the Nationality Principle. The paper establishes that neither jurisdictional base will implement full efficiency:

- The Territoriality Principle implies that the patent-issuing country will be too lenient in its enforcement of the FRAND commitment for its domestically owned SEP, and too strict in the enforcement of the commitment for the foreign-owned SEP.

- With the Nationality Principle both countries will too leniently enforce the FRAND commitment for its domestic SEP.

- The Territoriality Principle performs better than the Nationality Principle when license revenue has a low intrinsic value, and the Nationality Principle dominates when this value is sufficiently large.

---

[4]There are obvoiusly many important legal issues regarding FRAND commitments that the paper disregards or assumes away. Just to mention a couple of such issues, the paper does not capture conditions for the use of injunctions, nor the treatment of patent portfolios involving patents in different countries.

3

The inefficiency of the default rules partly stems from the fact that they allow countries to *discriminate* in different ways in their enforcement of FRAND commitments. This raises the question of whether a prohibition of discriminatory regulation could improve the efficiency of the outcome. Such regulation might already be in place through the World Trade Organization (WTO) Agreement, as will be argued below. The paper shows that:

- The Territoriality Principle coupled with a National Treatment obligation cannot implement a jointly efficient outcome.

- A non-discrimination obligation similar to the "consistency requirement" in WTO law that prevents differential treatment of FRAND commitments in different industries, can implement the jointly efficient outcome if countries are symmetric.

- A National Treatment obligation can have beneficial effects also when allowing both countries to regulate based on an extreme version of a third jurisdictional base in the default rules, the Effects Principle.

The broader conclusion that emerges from the analysis is that *existing principles for jurisdiction in international law typically will not implement efficient outcomes,* and that non-discrimination obligations can, but need not, improve on outcomes. These findings point to the need for some form of international agreement. But the analysis also points to reasons why it will not be easy to identify an implementable agreement with desirable properties.

**Relation to the literature** To the best of our knowledge, this is the first paper to examine the economic efficiency of the fundamental jurisdictional rules for any application. But there are obviously several related fields of literature. For instance, there is a very large economic literature on competition policy in international markets. A basic theme in this literature is that competition authorities in open economies tend to promote not only consumer welfare in the traditional sense, but also other objectives; see e.g. the discussion by Mariniello, Neven and Padilla (2015).[5] Indeed, national authorities might be legally required to treat foreign interests differently than national interests; for instance, the US Sherman Act does not apply to export cartels that have no effect in the US market. Authorities might also be under domestic political pressure to favor domestic firms, or may be lobbied to do so by private parties. Following this approach it will be assume that when designing their FRAND policies, countries take account of producer surpluses and the incomes of SEP owners.

---

[5] A recent example is the proposed EU taxation of digital firms, which has been alleged to be motivated by the fact that it would primarily hit US firms. The notion that competition law is used to promote national objectives is not uncontested, however. For instance, Auer and Manne (2019) argue that it is in practice almost impossible to determine whether the EU's drive to tax digital firms is a reflection of protectionism, or a non-discriminatory application of competition law. And Bradford, Jackson Jr. and Zytnick (2017) find no evidence to suggest that the Commission has challenged non-EU mergers decisions to a larger extent than intra-EU mergers during 1990-2014.

There is a considerable law and economics literature on SEPs. A main issue in this literature is how to define or determine the "reasonable" part of the FRAND concept, and the circumstances under which SEP holders should be granted injunctions against implementers for not agreeing to the requested terms for using the patented technologies.[6] There is also a significant literature that discusses the appropriate role of antitrust for the enforcement of FRAND commitments.[7] This literature does not analyze jurisdictional issues to the best of our knowledge, however.

Yet another related literature examines the role of SEPs for innovation in closed economy settings. For instance, Spulber (2019) develops a dynamic model of SEPs, with endogenously determined research and development, inventor-producer bilateral bargaining, and subsequent Bertrand product market competition. The present paper uses a much simpler economic setting to study the implications of the default rules for jurisdiction, in the belief that the issues that arise here would appear also in settings with endogenous innovation.

Finally, the literature does occasionally address problems stemming from multiple jurisdictions for FRAND enforcement. For instance, Wong-Ervin, Wright, Kobayashi and Ginsburg (2016) emphasize the transaction costs that arise from differences in legal regimes, and Erixon and Bauer (2017) discuss the possibilities for SEP holders to select courts that are prone to grant injunctions (forum shopping). But these papers do not examine jurisdictional issues that arise in international markets. More directly related to this paper is the discussion by Contreras (2021) of jurisdictional conflicts that have arisen from anti-suit and anti-anti-suit injunctions in 16 FRAND cases during 2012-2021. But Contreras (2021) does not formally analyze the nature of these conflicts, nor the implications of relying on different jurisdictional principles for the assignment of jurisdiction.

**The structure of the paper**   The next section gives a brief description of the default rules for international jurisdiction. Section 3 lays out the simple economic market structure, including the negotiations over the license fees. Section 4 derives and compares the outcomes with the Territoriality and Nationality Principles. Section 5 extends the analysis to include non-discrimination obligations. Section 6 concludes.

---

[6]See e.g. Contreras (2019) for a survey of the literature on standard-setting organizations. Formal analyses of the FRAND notion are undertaken by e.g. Froeb, Ganglmeir and Werden (2012), Langus, Lipatov and Neven (2013, 2021), Choi (2014), and Lerner and Tirole (2015). Layne-Farrar (2017) surveys the economic literature on SEPs.

[7]See e.g. Hovenkamp (2020) for a recent legal analysis of the role for antitrust for the enforcement of FRAND commitments. Padilla, Ginsburg and Wong-Erwin (2018) provide a comprehensive overview of antitrust enforcement regarding intellectual property and standards in the EU, the US, Japan, China, India and South Korea. Geradin (2020) discusses the EU stand on SEP licensing and its relationship with EU competition law. Nikolic (2022) summarizes EU use of antitrust for FRAND enforcement.

# 2  The default rules for jurisdiction

All countries are bound by the default rules for the allocation of jurisdiction in customary international law.[8] These rules have emerged as custom from many years of interaction between states in a large number of different areas.[9] As part of customary international law, the rules are not laid down in multilateral treaties. But a widely accepted interpretation of these rules is provided in the series of *Restatements of Foreign Relations Law of the United States* by the American Law Institute (ALI).[10] In what follows, we will draw on the ALI (1987) and ALI (2018) Restatements to describe main features of these rules.[11]

There are three forms of jurisdiction. Jurisdiction to *prescribe* gives a state authority to issue laws that apply to actors, acts or objects. Jurisdiction to *adjudicate* allows a state to litigate disputes in its domestic courts. Jurisdiction to *enforce* allows a state to intervene to induce compliance with laws. In order for a state to have jurisdiction to prescribe there must be a "genuine connection" between the subject of the regulation and the state seeking to regulate. Such a connection might stem from one or several bases. The oldest, most frequently used, and least controversial, base is the location of actors, acts and objects within a state's geographic territory—the Territoriality Principle. Another jurisdictional base with a long tradition is the nationality of these entities—the Active-Nationality Principle. A more controversial, but increasingly commonly used, base is substantial effects that arise (or are intended to arise) within a state's territory—the Effects Principle (or Effects Doctrine). This basis, which is often seen as a special case of the Territoriality Principle, is commonly relied on in antitrust to address issues outside the physical borders of the regulating countries.[12]

The default rules can simultaneously give jurisdiction to more than one party. For instance, in the case of SEPs, the territorial applicability of a patent, and the nationality of the holder of the patent, might point in different directions with regard to the allocation of jurisdiction. In the past there was a clear hierarchy in international law according to which the Territoriality Principle

---

[8]Customary international law is formed when states act in a consistent fashion out of a sense of obligation. It applies to international relations in instances where there are no international treaties governing the relationships. The exception is if a country has persistently objected to a custom. But this does not appear to be of practical relevance to SEPs.

[9]The basic rules concerning jurisdiction were spelled out in the classic "Lotus judgment" in 1927 by the Permanent Court of International Justice (the predecessor of the International Court of Justice).

[10]ALI Restatements are meant to clarify the state of the law for the benefit of US courts, and are often used by courts as authoritative interpretations of the law. The latter stems from the thorough process through which the ALI memberership, comprising some 3 000 leading US legal scholars and professionals, scrutinizes the development of the Restatements. It should noted however that the Restatements reflect mainly US perceptions of customary international law, and not necessarily the understanding of the International Court of Justice.

[11]See also Lundstedt (2016) for a comprehensive description and analysis of jurisdictional principles, in particular as they apply to intellectual property law.

[12]Yet another controversial but increasingly common justification for regulating conduct outside a state's territory is to protect domestic nationals against harm—the Passive-Nationality Principle. ALI (2018) also points to the Protective Principle, which is concerned with national security, and Universal Jurisdiction, which concerns interventions in the case of crimes against humanity etc. These are omitted here since they seem less rrelevant to the issues at stake in the paper.

dominated both the Nationality and the Effects Principle; see the ALI (1987) Restatement. But the recent ALI (2018) Restatement unequivocally states that there no such hierarchy exists among the bases in international law, even if some bases are more controversial than others.

A possible solution in case of conflicting jurisdiction is comity, that is, that countries with jurisdiction defer to other countries to exercise jurisdiction, if the latter have stronger legitimate interests at stake.[13] There is no requirement in customary international law for states to do so. But countries nevertheless occasionally do this unilaterally through domestic laws and regulations that constrain the exercise of prescriptive jurisdiction. There are also some international comity agreements, such as the 1998 EU-US positive comity agreement, under which each side may request the other side to remedy anti-competitive behavior that originates in the other side's jurisdiction but affects the requesting party. However, since comity is predicated on subjective assessment of the relative importance of regulation to the countries involved, it can be difficult to rely on in practice.

In what follows we will focus on the principles regarding territoriality and active nationality ("nationality" for short below) since these seem most relevant to SEPs. We will also touch upon implications of the Effects Principle, but more briefly so for reasons explained below. We will assume when a country has jurisdiction, it covers prescription, adjudication and enforcement, since the distinction between these legally separate aspects does not seem to be of prime economic interest for the issues to be examined here. Finally, we will argue in favor of a certain allocation of jurisdiction based on the default rules. But is should be emphasized that other interpretations might be possible.

# 3 The outcome absent adherence to jurisdictional rules

A product is imported by country A from country B, where it is produced by a monopoly firm. The product is based on a standard that draws on two essential patents, denoted 1 and 2, with separate holders.[14] The firm negotiates the respective license fees $r_1$ and $r_2$ per unit sold separately and simultaneously with each SEP holder.[15] The patents are essential in two respects. First, the product cannot be produced without the use of both patents, and second, the standard has been developed with (FRAND) commitments by the patent holders to charge "reasonable" license fees.

Each country can enforce the FRAND commitments for the SEP(s) for which it has jurisdiction. There are three stages in the interaction for any given allocation of jurisdiction over the SEPs:

1. Each country lays down a FRAND regulation that sets ceilings for license fees for which it has jurisdiction;

---

[13]See Drahozal (2012), and Wong-Ervin and Heimert (2021), for analyses of comity.

[14]Some of the issues to be discussed could arise also with one patent. But two (or more) patents are required to examine strategic aspects of the design of FRAND enforcement policies, and in particular discriminatory treatment of foreign patents.

[15]The monopoly assumption is inessential. What matters is that production creates a surplus that is divided between the producer(s) and the SEP holders through negotiations.

2. License fees are negotiated, respecting any FRAND regulations; and

3. Production and consumption take place.

This sequence of events is intended to capture countries' long-run legislative decisions regarding their enforcement of FRAND commitments. The outcome is solved for by backward induction in standard fashion.

## 3.1 The product market

Let $D(p) \equiv \arg\max_c \tilde{U}(c) - pc$ be consumer demand in market A, where $\tilde{U}(c)$ is gross consumer welfare, $p$ is the product price, and $c$ is the level of consumption. For given license fees, the producer maximizes its profit in standard fashion by setting the price[16]

$$P(\mathbf{r}) \equiv \arg\max_p \ (p - \sum r_i)D(p),$$

where $\mathbf{r}$ denotes the vector $(r_1, r_2)$.[17] The firm's optimal price is assumed to increase less than proportionally in each of the fees; using subscripts attached to function operators to denote partial derivatives,[18]

$$0 < P_i(\mathbf{r}) < 1. \tag{1}$$

The maximized profit and net consumer welfare are

$$
\begin{aligned}
\Pi(\mathbf{r}) &\equiv [P(\mathbf{r}) - \sum r_i]D(P(\mathbf{r})), \\
U(\mathbf{r}) &\equiv \tilde{U}(D(P(\mathbf{r}))) - P(\mathbf{r})D(P(\mathbf{r})),
\end{aligned}
$$

both of which declining in the magnitudes of the license fees: $\Pi_i = -D < 0$ and $U_i = -DP_i < 0$.

## 3.2 License fee negotiations

License fees are negotiated in the intermediate stage of the interaction. This section first derives the negotiated license fees absent regulatory constraints, and then turn to the impact of these constraints on the negotiated outcomes.

---

[16] The indices $i$ and $j$ refer to either of the SEPs, with $i \neq j$.

[17] We assume throughout that second-order condictions are fulfilled for the optimization problems we consider. These conditions can be verified to hold in a fully parametric example with gross consumer welfare

$$\tilde{U}(c) \equiv c - \frac{1}{2}c^2 + y < 1,$$

where $0 < c < 1$ is consumption of the product of interest, and $y$ that of an outside product.

[18] A sufficient but not necessary condition for (1) to hold is that $D_{pp} \leq 0$:

$$P_i = \frac{D_p}{2D_p + (p - \sum r_i)D_{pp}}.$$

### 3.2.1 Negotiated license fees absent regulation

The firm negotiates the license terms simultaneously with the two SEP holders. Let $L^i(\mathbf{r}) \equiv r_i D(P(r_i, r_j))$ denote the license revenue received by the holder of SEP $i$. The outcome of the two bargaining problems is assumed to form a "Nash-in-Nash" equilibrium (as in Horn and Wolinsky, 1988), with the modification that the negotiations can be constrained by the SEP regulations. The status quo point is taken to be $(0,0)$ since each patent is essential. Hence, when unconstrained by enforcement of FRAND commitments, the outcome of the negotiation over license fee $r_i$ maximizes $\Pi(r)L^i(\mathbf{r})$, with the fee $r_j$ evaluated at its equilibrium value. Let the solution to this bargaining problem for $r_i$ be given by the function

$$N^i(r_j) \equiv \arg\max_{r_i} \Pi(\mathbf{r})L^i(\mathbf{r}),$$

defined by the first-order condition

$$-Dr_i + (p - \sum r_i)(D + r_i D_p P_i) = 0, \tag{2}$$

where $P_i$ and $D$ are functions of $\mathbf{r}$.

Four natural assumptions are made regarding the negotiations.[19] First, the fee that is negotiated between one of the SEP holders and the firm, is lower the higher is the fee for the other SEP:

$$N_j^i < 0. \tag{3}$$

This is natural since a smaller $r_j$ will give more surplus to be divided between the producer and SEP $i$ holder, and part of this additional surplus will accrue to the holder of SEP $i$ in the form of a higher $r_i$.

Second, we assume that there is a unique equilibrium $r_1^0 = r_2^0 \equiv r^0$, given by

$$r^0 = N^i(r^0) \tag{4}$$

for the unconstrained negotiations.

Third, similar to what is assumed in the context of many other applications with interrelated decision making, to have intuitively reasonable comparative statics properties, we assume that the interaction between the two bargaining processes is "stable." In the "unstable" case a deviation in $r_i$ from the equilibrium $\mathbf{r}^0$ would trigger a deviation in $r_j$ that in turn would yield an incentive for a further deviation in $r_i$, etc.[20] To remove this formally feasible, but economically counter-intuitive,

---

[19] These assumptions are fulfilled e.g. in the fully parametric example specified in footnote 17.

[20] Put differently, in the unstable case an exogenous change that increases the negotiated $r_i$ for given $r_j$, will induce an increase in the negotiated $r_j$ causes the new equilibrium $r_i$ to be *lower* than it was before the exogenous change occurred.

possibility we assume that

$$N^j(N^i(r_j)) > r_j \text{ iff } r_j < r^0. \tag{5}$$

Finally, the *set of feasible fees* is the convex hull of fees $r_i \geq 0$ for which $r_i \leq N^i(r_j)$. It is illustrated in Figure 1 by the area given by the thicker portions of the axes and of the negotiation functions $N^i(r_j)$. It follows that for any $r_1$, the negotiation over $r_2$ will yield $N^2(r_1)$ if unconstrained, and possibly a lower fee if constrained, and symmetrically for the fee for SEP 2. But the equilibrium fees cannot be outside this set.

### 3.2.2 Negotiated license fees when constrained by regulation

Patent holders have incentives to use their market power to maximize the revenue from their patents. Countries are constrained in two respects when seeking to remedy exploitation of this market power. First, countries can only intervene with regard to SEPs for which they have *jurisdiction*. Second, countries can only impose *upper limits on permitted license fees*, countries cannot implement higher fees than those negotiated between the producer and the respective patent holder. This is intended to capture the nature of most antitrust interventions, which typically only impose limits on the exploitation of market power. Importantly, in case both countries impose restrictions on a license fee, the SEP holder is assumed to comply with both regulations *by respecting the more stringent regulation*.

Formally, let $m_i^A$ and $m_i^B$ be the maximal fees allowed by the respective country for SEP $i$. The maximal permitted fee for SEP $i$ will then be $m_i \equiv \min(m_i^A, m_i^B)$. Let $\mathbf{m} \equiv (m_1, m_2)$ be the pair of most binding regulations.[21] Four types of situations may arise as a result of the regulatory interventions.

**(i) $\mathbf{m} \geq \mathbf{r}^0$**  Neither regulation constrains the outcome, so the equilibrium fees are $\mathbf{r} = \mathbf{r}^0$.

**(ii) $m_i < r^0 < m_j$ and $m_j > N^j(m_i)$**  The negotiation regarding $r_j$ will be unconstrained if $r_i = m_i$, and will thus yield $r_j = N^j(m_i)$. Given this level of $r_j$ the constraint $r_i \leq m_i$ will bind, so the outcome will be $(r_i, r_j) = (m_i, N^j(m_i))$. This type of equilibrium is illustrated in Figure 1 with $r_j = r_1$ and $r_i = r_2$.

**(iii) $m_i < r^0 < m_j$ and $m_j \leq N^j(m_i)$**  This is another asymmetric case, but with a more stringent regulation of $r_j$ compared to the previous case. Here both negotiations will be constrained by the regulations, so $\mathbf{r} = (m_i, m_j)$ will be the equilibrium.

---

[21] If neither country intervenes with regard to patent $i$ we can set $m_i^A \geq N^i(0)$ and $m_i^B \geq N^i(0)$, since this is formally equivalent to a non-binding regulation.
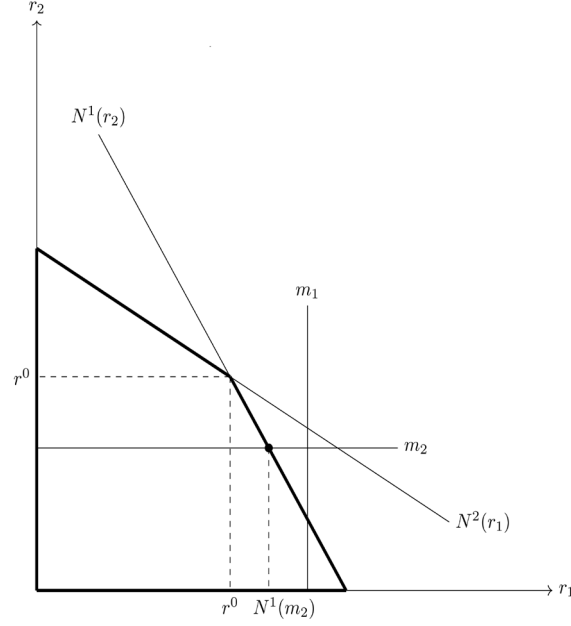
Figure 1: Implementable fees with $m_1 > N^1(m_2) > r^0$

**(iv) $\mathbf{m} < \mathbf{r}^0$** Both fees are regulated to levels below what would result without regulation, so both interventions will bind: $\mathbf{r} = \mathbf{m}$.

In sum:

**Lemma 1** *The pair of negotiated fees as functions of the SEP regulations, $\mathbf{r} = \mathbf{R}(\mathbf{m})$, are:*

$$
\mathbf{R}(\mathbf{m}) \equiv
\begin{cases}
\mathbf{r}^0 & \textit{if} \quad \mathbf{m} > \mathbf{r}^0 \\
(m_i, N^j(m_i)) & \textit{if} \quad m_i < r^0 < m_j \textit{ and } m_j > N^j(m_i) \\
\mathbf{m} & \textit{if} \quad m_i < r^0 < m_j \textit{ and } m_j \leq N^j(m_i) \\
\mathbf{m} & \textit{if} \quad \mathbf{m} < \mathbf{r}^0 .
\end{cases}
\tag{6}
$$

### 3.3 Regulation

We now turn to the first stage interaction between the countries absent jurisdiction rules, in which the countries lay down their regulations.

#### 3.3.1 The integrated economy benchmark

Assume temporarily that all agents reside in the same economy. This integrated economy maximizes an objective function that increases in consumer welfare, license revenues for SEP holders, and the profit of the producer:

$$
\begin{aligned}
W(\mathbf{r}) &\equiv U(\mathbf{r}) + \alpha \sum L^i(\mathbf{r}) + \Pi(\mathbf{r}) \\
&= \tilde{U}(D(P(\mathbf{r}))) + (\alpha - 1) \sum L^i(\mathbf{r})
\end{aligned}
$$

11

where the parameter $\alpha$ is the weight put on license revenues.

To capture the notion that SEP license income can bring welfare benefits beyond being a source of income for SEP holders, it will be assumed that $\alpha \geq 1$. With $\alpha = 1$ these payments only constitute transfers from one pocket to another, and thus from a social welfare perspective "wash out." But with $\alpha > 1$ welfare in the integrated economy increases from a redistribution of payments from the producer to the license holders, all else given. We will denote this as license revenues having an "intrinsic" social value. This does not mean that it would be desirable from a welfare point of view to have maximal fees, since higher fees induce the producer to increase its price and thereby reduce consumer welfare.

It is needless to say a considerable analytical short-cut to let the value of positive license revenues as stimulants for innovation be captured in this fashion. The assumption is made for a combination of two reasons. First, it would require a dynamic model of endogenous innovation to capture the incentive effects of expected patent income on innovation, and this would complicate the analysis considerably. Secondly, the driving factor in the analysis to follow will be that countries' interests diverge depending on whether they are concerned about the implications of the license revenues for consumers, for producers and/or for license holders. We believe that similar jurisdictional issues to those discussed here will arise also in settings where the investment incentive effects are given richer modeling.

**Joint welfare maximization**  What matters for joint efficiency in the present setting is the aggregate license fee, that is, the sum of the two license fees. This stems from the assumption that the marginal social value of license income is the same for both patents. Hence, from the point of view of joint efficiency, it is immaterial how a particular level of the aggregate fee is decomposed into $r_1$ and $r_2$. But it simplifies the presentation to consider the identical license fees $\mathbf{r}^I = (r^I, r^I)$ that maximize the welfare of the integrated economy, as the benchmark for measuring the efficiency of the outcome with national regulation.[22]  The jointly optimal fee for SEP $i$ balances the positive effect on the revenue for the holder of SEP $i$, against the adverse effects of the fees on consumer surplus, on the holder of SEP $j$, and on the producer surplus. It is given by

$$
\begin{aligned}
W_i(\mathbf{r}^I) &= pD_pP_i + (\alpha - 1)[D + 2r^ID_pP_i] \\
&= 0.
\end{aligned}
\tag{7}
$$

The focus will be on situations where the unconstrained jointly efficient regulation restricts the negotiated outcome, but still allows for strictly positive fees for the SEPs, that is, where[23]

$$
\mathbf{0} < \mathbf{r}^I < \mathbf{r}^0.
\tag{8}
$$

---

[22] As noted above, this is not the first best outcome due to the market power that exists in both the product and the patent markets.

[23] Vector notation $\mathbf{r} < \mathbf{r}'$ denotes $r_i < r'_i$, $i = 1, 2$, etc.

This excludes corner solutions where the jointly efficient fees do not yield any revenue for SEP holders ($\mathbf{r}^I = 0$), or where it is jointly efficient to leave the market unregulated ($\mathbf{r}^I \geq \mathbf{r}^0$). It follows from (7) that there will be a range of $\alpha \geq 1$ for which the jointly optimal fees will be zero, and that the fees will be strictly positive for sufficiently large $\alpha$. That is, the marginal benefit of license revenue must exceed the marginal cost in terms of reduced consumer welfare. This will be assumed to hold in what follows, unless otherwise stated.

### 3.3.2 National regulation absent jurisdictional rules

Now divide the integrated economy described above into two countries such that consumption occurs only in country A and production only in country B. We will mostly focus on the case where the two owners of the SEPs reside in different countries, since this seems to capture the most interesting setting, and to some extent also incorporates the effects from asymmetric ownership patterns (other ownership patterns are briefly examined in the Appendix). To this end, let the holder of SEP 1 be a country A national, and the holder of SEP 2 a national of country B. Countries seek to design their FRAND regulations in order to maximize their respective national welfare:

$$V^A(\mathbf{r}) \equiv U(\mathbf{r}) + \alpha L^1(\mathbf{r}) \text{ and } V^B(\mathbf{r}) \equiv \Pi(\mathbf{r}) + \alpha L^2(\mathbf{r}). \tag{9}$$

Observe that the objectives of the two countries add up to the objective of the integrated economy: $V^A(\mathbf{r}) + V^B(\mathbf{r}) = W(\mathbf{r})$. Hence, any deviation in the regulation from what is efficient in the integrated economy, will reflect *international externalities from the national decision making regarding the FRAND commitments.*[24]

The international dimension drives a wedge between the interests of the countries, since each country prefers the license revenue of the non-national SEP holder to be as small as possible. For country A this increases consumer welfare, and the license income of the holder of SEP 1, and for country B this increases producer's profits, and the license income of the holder of SEP 2:

$$V_2^A = -D P_2 + \alpha r_1 D_p P_2 < 0 \text{ and } V_1^B = -D + \alpha r_2 D_p P_1 < 0. \tag{10}$$

Without adherence to rules that restrict jurisdiction, the outcome will thus be $\mathbf{r} = \mathbf{0}$. This will be too restrictive from a joint welfare perspective, since the optimal regulation in the integrated economy implies strictly positive license fees ($\mathbf{r}^I > \mathbf{0}$).

**Proposition 1** *Absent rules that restrict jurisdiction, national regulations of the FRAND commitments will yield too stringent regulation, with each country imposing a zero license fee restriction on the SEP of the other country.*

---

[24]More precisely, the "efficient" outcome in the integrated economy should be denoted as "constrained efficient" since it features market power both with regard to the SEPs and the product market.

This leads to the question of whether adherence to the default rules for international jurisdictional will improve upon the outcome.

# 4 Imposing the two basic jurisdictional principles

Jurisdiction can be exercised with respect to *acts, actors* and *objects*. Jurisdiction over each of these entities can potentially derive from one or more of the three jurisdictional principles discussed above. It is in practice often a delicate task to determine the implications of these principles for the allocation of jurisdiction. First, the identification of the relevant acts, actors and objects can be difficult. Second, whether a particular jurisdictional principle is applicable to a particular act, actor or object, is also often unclear. Third, the application of a principle can point in different directions when applied to acts, actors and objects. Furthermore, the rules might prescribe overlapping jurisdiction. The appropriate allocation of jurisdiction under the default rules will therefore often be a source of conflict, and will typically depend on the specific situation at hand.

In the present context it seems reasonable, however, to interpret the relevant acts as the demands by the SEP holders regarding license fees, the actors as the SEP holders, and the objects as the SEPs. The appropriate application of the Territoriality and Nationality Principles to these entities will be considered separately.

## 4.1 The Territoriality Principle

The main territorial dimension of acts is normally the geographic location where they take place. But in our setting it seems to be less relevant whether the act of negotiating the SEP license fees physically take place in one country or the other, if at all possible to determine. Also, it is hard to see how the identity of the actors could have any territorial significance beyond their nationality (which falls under the Nationality Principle). The objects at issue, the SEPs, have clear territorial features however, since the patents apply to the territory of country A and only to this territory. We will therefore assume that *an application of the Territoriality Principle would give the patent issuing country jurisdiction over both SEPs*.

The outcome with jurisdiction allocated according to the Territoriality Principle will then be given by the solution to

$$\max_{m_1, m_2} V^A(\mathbf{R}(\mathbf{m})),$$

with $\mathbf{R}(m)$ defined in (6). Country A's interest with respect to the license fee for the foreign-owned SEP 2 is clear: it will prefer $r_2$ to be as low as possible, since this will minimize the domestic consumer price, and maximize the revenue available for its SEP holder 1 to share with the foreign producer, as clear from (10). Since country A can implement $r_2 = 0$ without reducing its choice set with regard to $r_1$, it will do so by setting $m_2 = 0$.

Country A will have conflicting interests with regard to the license fee for SEP 1:

$$V_1^A = -DP_1 + \alpha[D + r_1 D_p P_1] \gtreqless 0. \tag{11}$$

An increase in $r_1$ drives up the product price and thereby reduces consumer welfare. The resulting lower demand tends to reduce the license revenue. But a higher $r_1$ has the direct effect of increasing the revenue for SEP 1. To reduce the number of cases to consider, we assume that country A prefers a higher license fee for its domestically owned SEP, the lower is the license fee for the foreign owned SEP, that is, that the license fees are strategic substitutes for country A:[25]

$$V_{12}^A < 0. \tag{12}$$

This implies that country A's most preferred fee for SEP 1 is strictly positive when $r_2$ is regulated to 0:

$$V_1^A(0,0) > V_1^A(r^I,0) > V_1^A(r^I,r^I) = -V_1^B(r^I,r^I) > 0.$$

where the first inequality follows from $r^I > 0$ and $V_{11} < 0$, the second inequality from $r^I > 0$ and $V_{12}^A < 0$, and the equality from the definition of $r^I$.

One possibility is that country A prefers a fee $r_1' < N^1(0)$, given by

$$V_1^A(r_1',0) = 0, \tag{13}$$

which it can implement by setting $m_1 = r_1'$. The other possibility is that country A prefers a license fee $r_1' > N^1(0)$. There is in this case no point for country A to intervene regarding $r_1$, since the holder of SEP 1 will then negotiate the fee $N^1(0)$, which is the maximal that can be achieved through the negotiation over $r_1$. Whether $r_1' \gtreqless N^1(0)$ will depend on the intrinsic value that country A attaches to license revenues relative to consumer welfare. Let $\alpha'$ be the weight for which country A's most preferred license fee is what would come out of an unconstrained negotiation:

$$V_1^A(N^1(0),0;\alpha') \equiv 0. \tag{14}$$

Drawing on (11) and (2) we can then characterize the outcome with the Territoriality Principle as follows:

**Lemma 2** *When SEP holder 1 is a country A national, SEP holder 2 is a country B national, and country A is awarded jurisdiction over both SEPs based on the Territoriality Principle, the resulting regulation of the FRAND commitments will be:*
*(i)* $\mathbf{r} = (r_1',0)$ *with $r_1'$ given by (11) for $\alpha < \alpha'$, and*
*(ii)* $\mathbf{r} = (N^1(0),0)$ *for $\alpha \geq \alpha'$,*

---

[25] This condition holds e.g. in the fully parametric version of the model specified in footnote 17.

*with $\alpha'$ given by (14).*

When deciding on its regulations, country A disregards the interests of country B. Since $r^I > 0$, country A will be too restrictive vis-à-vis the holder of SEP 2 from a joint welfare perspective. But it will be too lenient regarding the FRAND commitment by the holder of SEP 1. This is clearly the case if $m_1 = N^1(0)$, since $N^1(0) > r^I$. The same holds when $m_1 = r'_1$ as given by (11):

$$
\begin{aligned}
W_1(r'_1, r^I) &= V_1^A(r'_1, r^I) + V_1^B(r'_1, r^I) \\
&< V_1^A(r'_1, 0) + V_1^B(r'_1, r^I) \\
&= V_1^B(r'_1, r^I) < 0,
\end{aligned}
$$

again using $V_{12}^A < 0$. Hence, $r'_1 > r^I$ by $W_1(r'_1, r^I) < 0$. In sum:

**Proposition 2** *The Territoriality Principle implies that the patent-issuing country will be too lenient in its enforcement of the FRAND commitment for its domestically owned SEP, and too strict in the enforcement of the commitment for the foreign-owned SEP.*

## 4.2 The Nationality Principle

Consider next the implications of the Nationality Principle. Acts do not seem to have nationality in any meaningful way, at least not in this context, and will thus not serve as a basis for allocating jurisdiction. But actors obviously have nationality. The Nationality Principle would thus allocate jurisdiction for the FRAND enforcement for each of the SEPs to the respective home country of the SEP holders. The objects in question, the patents, could be argued to have nationality in that they are issued by country A. But we will focus on the case where the nationality of the actors is interpreted to dominate from point of view of the Nationality Principle, implying that each country has jurisdiction over its national SEP holder.

When each country regulates only the FRAND commitment of its domestic SEP, the equilibrium regulation $(m'_1, m'_2)$ will be given by

$$
\begin{aligned}
m'_1 &= \arg\max_{m_1} V^A(m_1, m'_2) \leq N^1(m'_2) \\
m'_2 &= \arg\max_{m_2} V^B(m'_1, m_2) \leq N^2(m'_1).
\end{aligned}
$$

The Nationality Principle hence differs in a fundamental way from the Territoriality Principle, in that the nationally pursued regulations will in certain situations *interact* to determine the outcome. Several types of equilibria are possible:[26]

---

[26] One potential symmetric Nash equilibrium would be that both countries set their respective fees to the minimum levels, $m_1^A = m_2^B = 0$, so $\mathbf{r} = (0, 0)$. This requires that $\alpha$ is sufficiently small that $V_1^A(0, 0) < 0$ and $V_2^B(0, 0) < 0$. But this outcome is not compatible with the assumption that the jointly optimal outcome is strictly positive, $\mathbf{r}^J > 0$.

**(i) Neither fee is regulated** When neither fee is subject to binding regulation, the outcome is $\mathbf{r} = \mathbf{r}^0$. Setting $\mathbf{m} \geq \mathbf{r}^0$ will be individually rational for the countries if

$$V_1^A(\mathbf{r}^0) \geq 0 \text{ and } V_2^B(\mathbf{r}^0) \geq 0.$$

Such a situation can arise if $\alpha$ is large enough that both countries prefer higher licenses fees for their respective nationally held SEPs than can be achieved through the negotiations between the producer and the SEP holders. This type of equilibrium is compatible with the assumption $0 < \mathbf{r}^I < \mathbf{r}^0$ since

$$\begin{aligned} W_1(\mathbf{r}^0) &= V_1^A(\mathbf{r}^0) + V_1^B(\mathbf{r}^0) < V_1^A(\mathbf{r}^0) \\ W_2(\mathbf{r}^0) &= V_2^A(\mathbf{r}^0) + V_2^B(\mathbf{r}^0) < V_2^B(\mathbf{r}^0). \end{aligned}$$

In this case the countries will allow for *higher* license fees than is jointly desirable.

**(ii) Both fees are regulated** Both fees will be regulated if the countries choose $\mathbf{m}'$ with the property that $m_i' < N^i(m_j')$. In this case the fees will be given by

$$V_1^A(\mathbf{R}(\mathbf{m}')) = -P_1 D + \alpha[D + r_1 D_p P_1] = 0 \tag{15}$$

$$V_2^B(\mathbf{R}(\mathbf{m}')) = -D + \alpha[D + r_2 D_p P_2] = 0 \tag{16}$$

This interior solution requires that $\alpha$ is large enough to make both countries prefer strictly positive fees, but not higher than that the fees can be implemented through the parallel negotiations. Again, both fees would be *higher* than in the integrated economy:

$$\begin{aligned} W_1(\mathbf{R}(\mathbf{m}')) &= V_1^B < 0 \\ W_2(\mathbf{R}(\mathbf{m}')) &= V_2^A < 0. \end{aligned}$$

This type of equilibrium can have the feature that even though both FRAND regulations are binding, the regulation by the importing country allows for a larger license fee than would come about absent regulation: $m_2 < r^0 < m_1$. The reason is that when $m_2 < r^0$, there will be more surplus for the parties to divide in the negotiation over SEP 1 than when $r_2 = r^0$.

Note that the two countries are affected symmetrically by a marginal increase in the respective domestically-owned SEP, as it concerns the effect on license income—the terms in brackets (15) and (16) are identical and positive. Country A is also affected by the resulting loss of consumer welfare, and country B in the loss of producer surplus. Since the producer will absorb some of license fee increase by not increasing the price by same amount as the increase in the fee, $0 < P_i < 1$, the consuming country A will be less adversely affected by the fee increase compared to the exporting country, and will therefore be the country that imposes the more lenient regulation.

**Observation 1** *When the countries regulate their respective domestically held SEP, the importing country has an incentive to impose a more lenient fee than the exporting country, since this is a way for the importing country to capture some surplus from the producer.*

**(iii) $r_2$ is regulated but not $r_1$**   If country A does not impose a binding regulation, but country B does, the outcome will be $r_2 = m_2 < r^0 < r_1 = N^1(m_2) < m_1$. The optimal regulation for country B then solves

$$\arg \max_{m_2 \leq r^0} V^A(N^1(m_2), m_2).$$

The interior solution $m_2'$ to this problem is given by the first-order condition

$$V_1^B(N^1(m_2'), m_2'))N_2^1(m_2') + V_2^B(N^1(m_2'), m_2') = 0. \tag{17}$$

For $(N^1(m_2'), m_2')$ to be an equilibrium, it must not be optimal for country A to set $m_1 < N^1(m_2')$, that is, it is required that

$$V_1^A(N^1(m_2'), m_2')) \geq 0. \tag{18}$$

In sum:

**Lemma 3** *When the Nationality Principle awards countries jurisdiction over their respective domestically held SEP, the resulting regulation of the FRAND commitments will be either of:*
*(i)   No binding regulation.*
*(ii)  $\mathbf{m}'$ as defined by (15) and (16).*
*(iii) $(N^1(m_2'), m_2')$, where $m_2'$ is the solution to (17).*

The equilibrium where $r_2$ is regulated but not $r_1$ has a novel feature in that country B now effectively determines *both* license fees: $r_1 = N^1(m_2)$ and $r_2 = m_2$. This stems from the combination of the fact that country A here effectively does not regulate since it prefers a higher fee for its SEP holder than the negotiation can yield, and the interrelationship of the two bargaining problems. Since country B prefers a low $r_1$, this consideration will tend to lead to *more lenient* regulation of the license fee for SEP 2.

**Observation 2** *When each country regulates the FRAND commitment for its domestically held SEP only, the exporting country can in certain situations use lenient enforcement of its domestic FRAND commitment as a strategic device to reduce the negotiated fee for the foreign-owned SEP.*

Turning to the efficiency of the FRAND regulations, it is clear that if there is no binding regulation in equilibrium, so that $\mathbf{r} = \mathbf{r}^0$, the fees will be higher than what is jointly desirable, as long as $\mathbf{r}^0 > \mathbf{r}^I$. If the outcome is given by (15) and (16), both fees will again be too high, since

18

these conditions do not take into account the adverse international externalities from the domestic fees. Finally, if $(N^1(m'_2), m'_2)$ with $m'_2$ given by the solution to (17), $r_1$ is yet again too high, since $r_1 > r^0 > r^I$. A reduction in $r_2$ would increase welfare, when evaluated at $(N^1(m'_2), m'_2)$:

$$W_2(N^1(m'_2), m'_2) = V_2^A(N^1(m'_2), m'_2) + V_2^B(N^1(m'_2), m'_2) < 0$$

where $V_2^A < 0$, and where $V_2^B < 0$ by (17) since $V_1^B < 0$ and $N_2^1 < 0$. Hence, a reduction in $r_2$ from $m'_2$ would increase welfare. Hence:

**Proposition 3** *With the Nationality Principle each country will enforce the FRAND commitment of its domestic SEP holder too leniently.*

### 4.3 The pros and cons of the two principles

As we have seen, when the Territoriality Principle gives exclusive jurisdiction over the SEPs to the patent-issuing country, there will be too lenient regulation of this country's domestically owned SEP, and too strict regulation of the foreign-owned SEP. The Nationality Principle, when allocating jurisdiction based on the SEP holders' nationality, will tend to result in too lenient regulation of both SEPs. So regardless of whether jurisdiction is allocated according to the Territoriality or Nationality Principle, regulating countries will impose *too lenient enforcement of the domestically owned SEPs, and too stringent regulation of the foreign-owned SEPs.* But which principle will perform better from a joint welfare perspective?

**(i) License income has no intrinsic social value** Consider first the case where $\alpha = 1$, so that no extra value is put on license holders' income relative to consumer welfare in country A, and relative to producer welfare in country B. The jointly optimal license will then be zero. If the Territoriality Principle is applied, country A will impose the maximally stringent regulation $m_2 = 0$ on the foreign SEP. However, country A will still set $m_1 > 0$, despite the lack of special value attached to license revenue, with $m_1$ given by

$$V_1^A(m_1, 0) = (1 - P_1)D + m_1 D_p P_1 = 0.$$

The reason is, as noted above, that while a positive $r_1$ hurts consumers in country A by increasing the price of the product, the producer will absorb some of the cost increase by not increasing the price to fully offset its cost increase. It will therefore be optimal for the importing country to allow for positive license revenue for SEP 1 as a means of indirectly taxing the monopolist.

If instead the Nationality Principle is applied, and $\alpha = 1$,

$$V_2^B(r_1, 0) = r_2 D_p P_2 \le 0.$$

Country B will thus find it optimal to set $m_2 = 0$ not to destroy any producer surplus. Country A will therefore effectively be in the same situation as with the Territoriality Principle, so the two principles will yield the *same* outcome. It will be inefficient since there will be a too lax regulation of the license fee owned by the importing country.

**(ii) License income has some intrinsic social value** Assume next that country A's most preferred $r_1$ is strictly larger than $N^1(0)$ when $r_2 = 0$. In this case a small increase in $\alpha$ from 1 will not have any implication when the Territoriality Principle is applied, since there is a corner solution for $r_1$. Nor will $r_2 = 0$ be affected. With the Nationality Principle $r_2 = 0$ with $\alpha = 1$, but $r_2$ will be strictly positive for slightly larger $\alpha$. This will not have any impact on $r_1$ however, as long as the increase in $\alpha$ is small, since $r_2$ is at a corner solution. Consequently, since the two principles yielded the same outcome with $\alpha = 1$, since it is still jointly optimal with zero fees with $\alpha$ slightly larger than unity, and since only the Nationality Principle increases the aggregate fees with such an increase, it follows that the Territoriality Principle will be better for $\alpha$ marginally larger than unity. Intuitively, the Territoriality Principle tends to hold down the aggregate license fees for a similar reason that a monopoly produces less then a duopoly. This is desirable when the countries have a common interest in maintaining low license fees for both SEPs, as is the case when $\alpha$ is close to 1.

**(iii) License income has large intrinsic social value** Assume finally that $\alpha$ is sufficiently large that it will be jointly optimal with no restriction on the license fee negotiations, $\mathbf{r}^I = \mathbf{r}^0$. This will also be outcome if the Nationality Principle is applied, since it will tend to yield higher license fees than what is jointly optimal. However, with the Territoriality Principle, country A has an even stronger incentive to restrict $m_2$ to 0 with a large $\alpha$, since it will now put even stronger emphasis on the revenue accruing to the owner of SEP 1. It follows from the symmetry of the license negotiations that the aggregate license fee with the Territoriality Principle, $r_1 + r_2 = N^1(0)$, is smaller than the aggregate fee with the Nationality Principle, $2r^0$, which in turn equals the jointly most preferred outcome, $2r^I$. Hence, the Territoriality Principle will in this case lead to too stringent regulation of the foreign-owned SEP from a joint welfare perspective.

In sum:

**Proposition 4** *When the ownership of the SEPs is split between the countries:*
*(i) If license income has no intrinsic social value, the two jurisdictional principles yield the same outcome, with too lenient regulation of both license fees.*
*(ii) For an intermediate range of social valuations of license revenue, the Territoriality Principle yields higher joint welfare than the Nationality Principle.*
*(iii) If license income has a sufficiently large intrinsic social value, the Nationality Principle yields an efficient outcome, and the Territoriality Principle an inefficient outcome due to a too restrictive regulation of the fee for the foreign-owned SEP.*

## 4.4 Simultaneous application of both jurisdictional principles

In the past there used to be a hierarchy in international law, whereby the Territoriality Principle dominated the Nationality Principle whenever the two principles prescribed different allocations of jurisdiction. However, according to the recent ALI Restatement (2018), there is no such hierarchy. With this interpretation, it is possible for several countries to simultaneously have jurisdiction over acts, persons or objects, with reference to different principles. Overlapping jurisdictions have also become more likely with the increased emphasis on the Effects Principle (see below). We will therefore briefly examine implications of the simultaneous application of the Territoriality and Nationality Principles, for the three allocations of SEP ownership that can arise in this setting.

When both the Territoriality and the Nationality Principles are applicable, country A can claim jurisdiction over the FRAND commitments for both SEPs based on the Territoriality Principle as applied to the objects at issue—the patents—and country B can argue it has jurisdiction over the FRAND commitment by the nationality of the holder of SEP 2, based on the Nationality Principle as applied to the actors. There will then be overlapping jurisdiction for SEP 2, and the more stringent regulation, which will be imposed country A, will prevail. So the outcome will be $m_2 = 0$, and $m_1$ will be given by (13). The outcome will thus be the same as when only the Territoriality Principle is applicable.[27] So the Nationality Principles becomes superfluous:

**Proposition 5** *The simultaneous application of the Territoriality and Nationality Principles yields the same outcome as if only the Territoriality Principle is applied.*

Hence, the dominating position that earlier customary international law gave to the Territoriality Principle, arises endogenously here due to the assumption that regulated entities will adapt to the more stringent among regulations.

The gist of Proposition 5 is more general than the present setting might suggest. For instance, safety standards are often expressed in terms of maxima or minima, such as the maximal amount of toxic substances that foodstuffs are allowed to contain, or the minimum time a product should be able to withstand fire. When such regulations differ across countries, producers can choose to respect all of them by abiding the most stringent regulation. In these settings, as long as the importing country sets the more stringent regulation, the Nationality Principle will have no bite.

There are also circumstances where the exporting country will prefer more stringent regulation. A natural case is where production gives rise to local emissions in the exporting country. If the importing country is not affected by the emissions, it will prefer to leave them unregulated, to keep the import price of the product as low as possible. But both principles would in this case give the

---

[27]This holds also for other patterns of ownership of the SEPs. If both SEP holders are country A nationals both the Territoriality and the Nationality Principles allocate full jurisdiction to country A, so the same outcome will be the same with both principles. If both SEP holders are country B nationals, the Territoriality Principle still gives country A jurisdiction based on the territorial application of the objects, the patents. Country A will then impose maximally stringent regulation of both FRAND commitments, $m_1 = m_2 = 0$. Hence, the Nationality Principle is again irrelevant to the outcome.

exporting country jurisdiction, so the Nationality Principle would again have no bite beyond the Territoriality Principle.

## 5 Non-discrimination obligations

Several of the equilibria that were derived above feature some form of differential enforcement of the FRAND commitments for the SEP holders. With the Territoriality Principle, the regulating country explicitly discriminates by treating SEP holders differently based on nationality. Discrimination is more subtle with the Nationality Principle, but the outcome can imply different regulatory treatment depending on SEP holders' territorial location. Such discrimination is not inefficient as such, as long as only the aggregate license fee is what matters for efficiency. But the possibility to treat the SEPs differently can affect the magnitude of the aggregate fee. This raises the question of whether the outcome would be better if some form of non-discrimination requirement were imposed. This question is not only of conceptual interest, it is also of practical relevance for several reasons.

First, discriminatory enforcement of FRAND commitments might violate international agreements. Most countries are bound by the *Paris Convention for the Protection of Industrial Property*, which covers patents. It includes in Art. 2 a *National Treatment* (NT) provision:

> Nationals of any country of the Union shall, as regards the protection of industrial property, enjoy in all the other countries of the Union the advantages that their respective laws now grant, or may hereafter grant, to nationals... they shall have the same protection...and the same legal remedy against any infringement of their rights....

It seems plausible that more stringent treatment of a foreign-owned than of an otherwise completely symmetric domestically-owned SEP could violate this stipulation.

Second, most countries are also members of the World Trade Organization (WTO). They are therefore legally bound to respect the *Agreement on Trade-Related Aspects of Intellectual Property Rights* (TRIPS Agreement), which includes provisions that appear to potentially make discriminatory treatment of FRAND commitments illegal. The applicability of the TRIPS Agreement to the enforcement of SEP commitments has not been tested yet in case law. However, in February 2022 the agreement was invoked for the first time in a dispute regarding FRAND-related issues. In this dispute, the EU alleges that China violates the TRIPS Agreement through its enforcement of FRAND commitments for EU patent holders in China.[28,29]

Third, the impact of non-discrimination on FRAND enforcement is also of interest in its own right since any future international agreement in this area is likely to include such provisions.

---

[28] According to the EU's Request for Consultation, China "...prohibits patent holders from asserting their rights in other jurisdiction by commencing, continuing and enforcing the results of legal proceedings before a non-Chinese court" (www.wto.org, WT/DS611/1).

[29] There is also an NT provision in Art. 3 TRIPS, but it is not clear that it is applicable to FRAND enforcement. NT provisions regarding intellectual property rights are also almost invariably included in other major trade agreements.

There are several non-discrimination principles in trade law that could be applied to FRAND enforcement. We will examine whether two basic concepts in the WTO Agreement could improve the performance of the Territoriality and Nationality Principles, and also of an extreme form of the Effects Principle. In trade disputes, a core issue is to determine when treatment is "less favorable." It is rare that countries pursue policies that explicitly discriminate on the basis of nationality. Instead, in the typical non-discrimination dispute, the same rules apply regardless of nationality, but for some reason the rules treat foreign interests less favorably.[30] This will be an issue

## 5.1 The Territoriality Principle with a National Treatment obligation

Assume that the ownership of the SEPs is split between the countries, and that jurisdiction is allocated to country A by virtue of the Territoriality Provision. Absent a non-discrimination obligation, it would set $m_2' = 0$. Assume that it would set a binding regulation for $r_1$, that is, that it would set $m_1 < N^1(0)$, with $m_1$ given by the solution to (13). There would hence be discriminatory treatment of SEP 2.

A strict NT rule that requests equal regulation of the two FRAND commitments, will only apply in instances where both commitments are regulated. It would therefore leave country A with two options.[31] One option would be to regulate both FRAND commitments in an identical fashion: $m_1 = m_2 = m''$. The other option would be to leave the commitment for SEP 2 unregulated. This would allow country A to set a higher $r_1$ without violating the NT rule. In the present setting, the former option is better for country A.

To see why, note that for the second option to be of interest to country A, its most preferred fee for SEP 1, $r\prime_1$, must be smaller than $r^0$, since any regulation $m_1' > r^0$ would result in $r_1 = r_2 = r^0$ when $r_2$ is left unregulated. If it holds that $r_1' < r^0$, implementation of this level through $m_1' = r_1'$ would yield $r_2' = N^2(m_1') > r^0$. It would then be feasible for country A to switch to a non-discriminatory regulation $m'' > m_1'$ with the property that $2m'' = m_1' + N^2(m_1')$. Since the aggregate license fee would remain unchanged, there would not be any consequences for the level of consumption or demand for the SEP 1 license. But with $m_1' < m'' < N^2(m_1)$, it would yield a higher $r_1$ and lower $r_2$, both changes benefitting country A. Hence, the option of imposing the same regulation on both SEPs is better for country A than leaving $r_2$ unregulated.

With regard to the joint welfare effects of the National Treatment rule, note first that it would be jointly desirable if country A were to reduce marginally the gap $m_1 - m_2$ that it would impose if unconstrained by such a rule. To abide by a requirement to do so, country A could either reduce $m_1$, increase $m_2$, or use some combination of the two. A marginal reduction in $m_1$ would not have any first-order effect at $(m_1', 0)$ since $V_1^A(m_1', 0) = 0$. But increasing $m_2$ would have a negative first-

---

[30] See Grossman, Horn and Mavroidis (2012) for a comprehensive analysis of the WTO case law on National Treatment.

[31] We disregard the fact that National Treatment provisions normally are expressed as weak inequalities, such as "treatment no less favorable than...".

order effect for country A equal to $(-D + \alpha r' D_p)P_2 < 0$. Hence, country A's optimal adjustment to a slightly binding NT rule would be to mainly reduce $m_1$. This will be desirable from a joint efficiency perspective:

$$W_1 = V_1^B < 0.$$

The imposition of a strict NT rule will have non-marginal effects, however. While it is clear that country A will lose and country B will benefit, the implications for joint welfare are generally ambiguous.[32] What is clear though, is that it strict NT cannot implement a fully efficient outcome. With $m''$ given by the first-order condition

$$V_1^A(m'', m'') + V_2^A(m'', m'') = -2DP_i + \alpha[D + 2m''D_pP_i] \qquad (19)$$
$$= 0,$$

it will hold that

$$\frac{d}{dm}W(m'', m'') = V_1^B(m'', m'') + V_2^B(m'', m'')$$
$$= -2(1 - P_i)D < 0$$

Hence, the Territoriality Principle coupled with a strict NT rule will lead to too lenient enforcement of the FRAND commitments.

**Proposition 6** *If the SEP holders have different nationality, and jurisdiction is determined according to the Territoriality Principle:*
*(i) a marginally binding NT provision will improve joint welfare; but*
*(ii) a strictly binding NT obligation cannot implement full efficiency.*

## 5.2 The Nationality Principle with a consistency obligation

In trade disputes, a core issue is to determine when treatment is "less favorable." It is rare that countries pursue policies that explicitly discriminate on the basis of nationality. Instead, in the typical non-discrimination dispute, the same rules apply regardless of nationality, but for some reason the rules treat foreign interests less favorably.[33] The Nationality Principle gives countries jurisdiction only over the enforcement of the FRAND commitments by their domestic SEPs. Therefore it cannot result in less favorable treatment of foreign SEPs in the setting we have considered. However, if the setting is extended to include more than one industry, a rationale for differential treatment arises also with the Nationality Principle.

---

[32]Similar observations are made in the very small economic literature on the role of NT in trade agreement; see Horn (2006), Saggi and Sara (2008), and Horn, Maggi and Staiger (2011).

[33]See Grossman, Horn and Mavroidis (2012) for a comprehensive analysis of the WTO case law on National Treatment.

To illustrate, assume that there are two industries, an industry X that is identical to the one examined above, and an industry Y that is a mirror image of X with the roles of the countries reversed. Hence, each country is the producer of one product and the consumer of another product. The two industries are economically separate. Production in industry X draws on two SEPs, the country A-owned X1 and the country B-owned X2, and production in industry Y uses the country A-owned Y1 and the country B-owned Y2.

In the benchmark integrated economy, all FRAND commitments would be treated identically due the complete symmetry of the setting. But when the integrated economy is split into two mirror images, countries will typically want to treat their national SEP holders differently, *depending on whether the SEPs are used in their export or import industries.* There would thus again be differential treatment of SEP holders that stem from the international dimension, and the policy could potentially be considered as discriminating against foreign SEP holders if countries adopt more stringent interpretation of FRAND commitments in their import industries than in their export industries. .

The WTO Agreement includes in one of its special agreements a requirement to treat regulatory risks in a *consistent manner* across different situations:

> ...each Members shall avoid arbitrary or unjustifiable distinctions in the levels [of risk] it considers to be appropriate in different situations, if such distinctions result in discrimination or a disguised protection of international trade...[34]

The idea is hence that trade interests should not be allowed to affect the regulatory regime.

Applied to the present setting, consider an obligation for the countries to enforce FRAND commitments in the same manner regardless of the sector where SEPs are used. Country A will then impose a regulation $m_{X1}^A = m_{Y1}^A = m^A$ that for $m_{X2}^B = m_{Y2}^B = m^B$—the corresponding regulatory stance taken by country B—solves

$$\max_{m^A} U^X(m^A, m^B) + \alpha L^{X1}(m^A, m^B) + \alpha L^{1Y}(m^A, m^B) + \Pi^Y(m^A, m^B).$$

The first two terms is the welfare derived from the X industry, and the second two terms the welfare derived from the other industry. Country B would solve the corresponding problem. Note that due to the assumed full symmetry of the setting, the countries would now effectively maximize joint welfare, and the outcome would then be *fully efficient,* as in the integrated economy.

Intuitively, absent the consistency requirement, the two industries are economically separate, implying that for each country, the decision problem regarding one industry is fully separate from that for the other industry. But the consistency obligation bundles the two decision problems. Of course, each country still disregards the impact of its decision on the other country. But with the consistency obligation, each country will take into account the effects of its decision both with

---

[34] Art. 5.5 of *The Agreement on the Application of Sanitary and Phytosanitary Measures.*

regard to the industry where it is an importer and where it is an exporter. When the countries are mirror images, each country will effectively maximize welfare with respect to the instrument it controls for an economy that is a replica of the other country. Full efficiency requires of course that the countries are perfect mirror images. But the mechanism will be at play also in more asymmetric settings, although full efficiency will then not be achieved.

**Proposition 7** *A Nationality Principle, supported by a consistency requirement that prevents differential treatment of FRAND commitments in different industries, can implement the jointly efficient outcome if countries are symmetric.*

## 5.3   The Effects Principle with a National Treatment obligation

The Territoriality and Nationality Principles are the two classic bases for jurisdiction. Another base that is increasingly referred to, in particular in antitrust, is the Effects Principle. It gives countries jurisdiction to regulate when they are exposed to effects from abroad. The Effects Principle is often qualified to apply only in cases where the effects involved are "substantial," to account for the fact that almost any policy decision a country takes will affect all other countries, even if the effects are often very small and hard to measure. While a natural qualification, it raises the difficult question of what should be meant with "substantial."

In the present setting however, both countries could reasonably be said to be exposed to substantial effects from the regulation of the respective foreign-owned SEP. Country A could argue that the objective of the regulation of FRAND commitments, in particular if undertaken through antitrust, is consumer protection, that the fees have significant impact on consumer prices, and that it consequently should have jurisdiction. Country B could point to the importance of the SEPs for its export industry, and claim that FRAND enforcement is an antitrust concern also as inputs for its export industry; indeed, countries such as China, South Korea and Taiwan appear to have argued along the latter line in actual cases. It therefore seems plausible that both countries in our setting can claim jurisdiction based on the Effects Doctrine; it is due to this somewhat trivial outcome that we have refrained from making the Effects Doctrine part of the main analysis. However, assuming that the Effects Principle does give both countries jurisdiction over the enforcement of FRAND commitments for both still helps illuminate a subtle implication of the National Treatment obligations that will likely be at play also with more sophisticated interpretations of the Effects Principle.

Assume that the ownership of the SEPs is split between the countries. When both countries can exercise jurisdiction over both FRAND commitments, each country will set the license fee for the foreign-owned SEP to its minimal level—each country will hence discriminate. But since the more stringent of the regulations will bind when they are overlapping, the implemented outcome will be non-discriminatory: $\mathbf{r} = (m_1^B, m_2^A) = (0, 0)$.

**Observation 3** *When the Effects Principle yields overlapping jurisdictions, both regulations will be discriminatory, but the equilibrium treatment will be the same for the SEP holders.*

Consider now the imposition of a strict NT obligation that requires each country to impose the same regulation on both SEPs; the countries hence set $(m^A, m^A)$ and $(m^B, m^B)$. The lower of $m^A$ and $m^B$ will be the binding regulation for both SEPs, provided that it is low enough to be implementable through the license fee negotiations. Country A's optimal regulation is given by an identical expression to (19). Evaluating such an expression at country A's optimal regulation absent the NT obligation, $m'_1$:

$$\frac{d}{dm}V^A = V_1^A(m'_1, m'_1) + V_2^A(m'_1, m'_1)$$
$$< V_1^A(m'_1, 0) + V_2^A(m'_1, m'_1)$$
$$= V_2^A(m'_1, m'_1) < 0,$$

where the inequality follows from the assumption $V_{12}^A < 0$. The NT obligation will hence induce country A to choose a more stringent FRAND enforcement for its domestically owned SEP, and less stringent regulation of the SEP with a country B holder. The same considerations apply to country B.

To see the implications of this NT obligation for aggregate welfare, assume that it is country A that prefers the more stringent regulation, $m^A < m^B$. It must then be that

$$\frac{d}{dm}W(m^A, m^A) = \frac{d}{dm}[V^A(m, m) + V^B(m, m)]$$
$$= \frac{d}{dm}V^B(m^A, m^A) > 0,$$

where the inequality sign follows from the assumption that $m^A < m^B$, and that $m^B$ is optimal for country A. The same reasoning applies in case $m^A > m^B$.

That is:

**Proposition 8** *If the Effects Principle awards both countries jurisdiction over both FRAND commitments:*
*(i)  License fees will be regulated to minimal levels absent a National Treatment obligation.*
*(ii)  With a National Treatment obligation regulations will be more lenient, joint welfare will be higher, but regulations will still be too restrictive.*

# 6   Concluding discussion

This paper has been based on two premises: First, countries have different interests with regard to FRAND commitments for SEPs when they are engaged in different parts of global production chains,

and this affect their preferred regulations. Second, international law requires countries to respect the default rules for jurisdiction in customary international law, absent international agreements regulating jurisdiction. These rules are crucial in almost every area of international interaction, including in the economic sphere. But the rules have still been subject to little (if any) systematic economic analysis, to the best of our knowledge.

The purpose of this paper has been to initiate the study of the capacity of the two main jurisdictional principles to the address international externality problems that arise from unilateral enforcement of FRAND commitments. Broadly speaking, the findings suggest that the default rules should not be expected to fully address the inefficiencies that arise due to the unilateral regulation. These rules allocate jurisdiction, but they *do not address the source of the externality problems*: the unilateral decision making regarding enforcement of FRAND commitments. Another weakness of the rules is that they *allow countries to purse discriminatory regulation*, even though this is inefficient from a joint welfare perspective.

These findings suggest the need for some form of internationally negotiated solution. International comity agreements constitute steps toward more cooperative regulation. There are a few examples of such agreements in other areas of competition law. However, apart from the inherent problem of determining which party has the "greater interest," comity agreements have the drawback of allocating jurisdiction to the party with the larger *unilateral* interest, not to the party that will implement the jointly more efficient outcome. There are therefore limits to the extent to which such agreements can improve upon the outcome.

The findings also suggest that while an international agreement on non-discrimination might improve matters, it will not suffice to resolve the problems that stem from national enforcement of FRAND commitments in an economically efficient manner.

The only way of addressing the problem appears to be to negotiate an international agreement that not only allocates jurisdiction, but that also specifies what constitutes reasonable license fees, or how they are to be calculated. It seems unlikely that such an agreement can be formed anytime soon, however, given countries' widely different views on how to enforce these commitments, and given countries' different commercial interests. It thus looks like the world will be stuck with the current type of conflicts for the foreseeable future.

# A   Appendix: Other SEP ownership patterns

The framework above assumed that there is one SEP holder in each country. But the gist of the findings above continue to hold for settings where both SEP holders reside in the same country.

To see why, consider first the Territoriality Principle. When both SEP holders are nationals of country B, the objective of the country A is simply to maximize the consumer surplus: $V^A(\mathbf{r}) \equiv U(\mathbf{r})$. This is achieved by minimizing the license fees: $m_1 = m_2 = 0$. Since the jointly optimal levels are strictly positive, this regulation is too strict.

If instead both SEP holders are country A nationals, country A will take both SEP holders' license revenues into account. With a temporary change of notation, let

$$V^A(\mathbf{r}) \equiv U(\mathbf{r}) + \alpha \sum L^i(\mathbf{r}).$$

Assuming that country A prefers the license fees to be the same (since they enter fully symmetrically), it will prefer $\hat{\mathbf{r}} = (\hat{r}, \hat{r})$ given by $V_i^A(\hat{\mathbf{r}}) = 0$. It will thus impose the regulation $\mathbf{m} = \hat{\mathbf{r}}$, provided that $\hat{\mathbf{r}}$ can be implemented ($\hat{\mathbf{r}} \leq \mathbf{r}^0$). Since $r_2 > 0$, it follows from $V_{12}^A < 0$ that country A will impose a more stringent regulation on $r_1$ than when the holder of SEP 2 is a national of country B. It follows from the assumption that the jointly efficient fee $\mathbf{r}^I$ is interior ($0 < \mathbf{r}^I < \mathbf{r}^0$), and given by

$$W_i(\mathbf{r}^I) = V_i^A(\mathbf{r}^I) + \Pi_i(\mathbf{r}^I) = 0,$$

that $V_i^A(\mathbf{r}^I) > 0$. Since $V_i^A(\hat{\mathbf{r}}) = 0$, the optimal regulation for country A is in this case $\mathbf{r}^I < \mathbf{m} = \hat{\mathbf{r}} \leq \mathbf{r}^0$.

Consequently, Proposition 2 holds for these more extreme distributions of the ownership of the SEPs, when slightly reworded to reflect the number of SEP holders for the patent-issuing country.

Now turn to the Nationality Principle. When both SEP holders are nationals of country A, country A will have full jurisdiction. The outcome will be the same as with the Territoriality Principle, since country A maximizes the objective function $V^A(\mathbf{r})$ in both cases. This implies too lenient treatment of both FRAND commitments, since country A will disregard the implications for the profits of the producer. If instead both SEP holders are nationals of country B, country B has full jurisdiction according to the Nationality Principle. It will then be too lenient, since it does not take into account the negative effect of the fees on consumers in country A. Hence, Proposition 3 continue to hold, slightly reworded.

# References

ALI (1987). *Restatement (Third) Foreign Relations Law of the United States*. American Law Institute, Philadelphia, USA.

ALI (2018). *Restatement (Fourth) Foreign Relations Law of the United States*. American Law Institute, Philadelphia, USA.

Auer, Dirk and Geoffrey Manne (2019). Is European Competition Law Protectionist? A Quantitative Analysis of the Commission's Decisions. ICLE Antitrust & Consumer Protection Program Issue Brief 2019-03-25.

Bradford, Anu, Robert J. Jackson Jr., and Jonathon Zytnick (2017). Is EU merger control used for protectionism? An empirical analysis. *Journal for Empirical Legal Studies* 14(4), December.

Choi, Jay P. (2014). FRAND royalties and injunctions for standard essential patents. CESIfo Working Paper Series No. 5012.

Contreras, Jorge L. (2019). Technical standard, standards-setting organizations and intellectual property: a survey of the literature (with an emphasis on empirical approaches). In Menell, Peter S. and David Schwartz (eds), *Research Handbooks on the Economics of Intellectual Property Law, Vol 2 - Analytical Methods,* Edward Elgar. SSRN: https://ssrn.com/abstract=2900540

Contreras, Jorge L. (2021). Anti-Suit Injunctions and Jurisdictional Competition in Global FRAND Litigation: The Case for Judicial Restraint. *Journal of Intellectual Property and Entertainment Law* 11(2).

de Rassenfosse, Gaétan, Paul H. Jensen, T'Mir Julius and Elisabeth Webster (2019). Are foreigners treated equally under TRIPS? *The Journal of Law and Economics* 62(4), 663-685.

de Rassenfosse, Gaétan and Emilio Raiteri (2022). Technology protectionism and the patent system: Evidence from China. *The Journal of Industrial Economics* LXX(1), 1-43.

Drahozal, Christopher R. (2014). Some observations on the economics of comity. In Eger, Thomas and Stefan Voigt (eds) *The Economic Analysis of International Law,* Mohr Siebeck. Available at SSRN: https://ssrn.com/abstract=2101400.

Erixon, Fredrik and Matthias Bauer (2017). Standard essential patents and the quest for faster diffusion of technology. ECIPE Policy Brief No. 4.

Froeb, Luke M., Bernard Ganglmeir, and Gregory J. Werden (2012). Patent hold up and antitrust: how a well-intentioned rule could retard innovation. *Journal of Industrial Economics* 60(2), 249-273.

Geradin, Damien (2020). SEP Licensing After two Decades of Legal Wrangling: Some Issues Solved, Many Still to Address. TILEC Discussion Paper No. DP2020-040.

Grossman, Gene M., Henrik Horn and Petros C. Mavroidis (2012). Legal and Economic Principles of World Trade Law: National Treatment. In Horn, Henrik and Petros C. Mavroidis (eds), *Legal and Economic Principles of World Trade Law*, Cambridge University Press.

Horn, Henrik (2006). National Treatment in the GATT. *American Economic Review* 96(1), 394-404.

Horn, Henrik, Giovanni Maggi and Robert W. Staiger (2010). Trade agreements as endogenously incomplete contracts. *American Economic Review* 100(1), 394-419.

Horn, Henrik and Asher Wolinsky (1988). Bilateral monopolies and incentives for merger. *RAND Journal of Economics* 19, 408-419.

Hovenkamp, Herbert (2020). FRAND and antitrust. *Cornell Law Review* 105(6). https://ssrn.com/abstract=3420⁣

Langus, Gregor, Vilen Lipatov and Damien J. Neven (2013). Standard-essential patents: Who is really holding up (and when)? *Journal of Competition Law and Economics,* 253-284.

Langus, Gregor and Damien J. Neven (2021). Ex ante competition for patents reading on mobile standards. A dynamic perspective. Mimeo, May.

Layne-Farrar, Anne (2017). The economics of FRAND. In Blair, Roger D. and D. Daniel Sokol (eds), *The Cambridge Handbook of Antitrust, Intellectual Property, and High Tech,* Cambridge University Press, 58-78.

Lerner, Josh and Jean Tirole (2015). Standard-essential patents. *Journal of Political Economy* 123(3), 547-586.

Lundstedt, Lydia (2016). *Territoriality in Intellectual Property Law.* Department of Law, Stockholm University.

Mariniello, Mario, Damien Neven, and Jorge Padilla (2015). Antitrust, regulatory capture, and economic integration. E15Initiative. Geneva: International Centre for Trade and Sustainable Development and World Economic Forum.

Nicolic, Igor (2022). Comments on the Draft Policy Statement on Licensing Negotiations and Remedies for Standard-Essential Patents Subject to F/RAND Commitments. Manuscript, Feb. 3.

Padilla, Jorge, Douglas H. Ginsburg, and Koren W. Wong-Ervin (2018). Antitrust analysis involving intellectual property and standards: implications from economics. *George Mason Law Review* 26(2). https://www.ftc.gov/system/files/documents/public_comments/2018/08/ftc-2018-0055-d-0003-147694.pdf.

Saggi, Kamal and Nesa Sara (2008). National Treatment in the WTO: The roles of product and country heterogeneity. *International Economic Review* 49(4), 1365-1394.

Spulber, Daniel F. (2019). Licensing standard essential patents: bargaining and incentives to invent. Available at https://ssrn.com/abstract=3338997.

Webster, Elisabeth, Paul H. Jensen and Alfons Palangkaraya (2014). Patent examination outcomes and the Nationality Principle. *The Rand Journal of Economics* 45(2), 449-469.

Wong-Ervin, Koren and Andrew J. Heimert (2021). Extraterritoriality: Approaches around the world and model analysis. In Nicolas Charbit (ed), *Eleanor M. Fox Liber Amicorum*, Concurrence.

Wong-Ervin, Koren W., Joshua D. Wright, Bruce H. Kobayashi, and Douglas H. Ginsburg (2016). Extra-jurisdictional remedies involving patent licensing. *Competition Policy International* 12(2). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2870505.

# Authors

**Henrik Horn**

Professor of International Economics

Research Institute of Industrial Economics (IFN)

Stockholm

SWEDEN

henrik.horn@econ-law.se