

THE RELATIONSHIP BETWEEN INTELLECTUAL PROPERTY RIGHTS AND FOREIGN DIRECT INVESTMENT

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I. INTRODUCTION

Since the mid-1980s, policymakers in developed and developing countries have directed increasing attention to intellectual property rights (IPRs).¹ The globalization of economic activities and the expansion of international transactions involving knowledge-intensive products have generated much friction around this topic.² This friction often reflects differences in national approaches toward the protection of IPRs.³ In turn, the various national approaches have fostered a movement toward higher standards of protection at a worldwide level. Many developing countries, for example, have begun to reform their IPR regimes in response to new international commitments,⁴ domestic economic reforms, and external pressures.

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1. See Carlos A. Primo Braga, *Trade-Related Intellectual Property Issues: The Uruguay Round Agreement and Its Economic Implications*, in THE URUGUAY ROUND AND THE DEVELOPING ECONOMIES 381, 381-82 (Will Martin & L. Alan Winters eds., 1995) (published as World Bank Discussion Paper No. 307) [hereinafter Primo Braga]; see also Carlos A. Primo Braga & Carsten Fink, *The Economic Justifications for the Grant of Intellectual Property Rights: Patterns of Convergence and Conflict*, in PUBLIC POLICY AND GLOBAL TECHNOLOGICAL INTEGRATION 99, 99 (Frederick M. Abbott & David J. Gerber eds., 1997) [hereinafter Braga & Fink].

2. See Braga & Fink, *supra* note 1; Primo Braga, *supra* note 1, at 381-88.

3. See Primo Braga, *supra* note 1, at 381-88.

4. See, e.g., Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C,

This Article reviews the potential implications of stronger IPRs on foreign direct investment (FDI) flows. Part II provides background on the contemporary debate surrounding the economics of IPRs. Part III discusses how IPRs may affect FDI decisions, and Part IV reviews some of the available empirical evidence. The Article concludes with a discussion of areas in which additional research is needed, focusing on the perspective of developing countries.

The reform of IPRs is a long-term process and there is reason to believe that IPRs will become increasingly important for FDI decisions. At the same time, the available empirical evidence does not conclusively establish the relationship between IPRs and FDI decisions.

II. THE ECONOMICS OF IPRS⁵

The conventional economic rationale for the protection of IPRs is often framed in terms of Kenneth Arrow's seminal work on the incomplete appropriability of knowledge.⁶ IPRs can be understood as second-best solutions to the problems created by the "quasi-public good" nature of knowledge.⁷ To the extent that IPRs enhance appropriability, they are expected to foster investment in research and development (R&D) and knowledge creation.⁸ However, IPRs create a static distortion,⁹ as they constrain the current consumption of knowledge by enhancing the market power, or monopolistic practices, of title holders.¹⁰ In short, IPRs involve a government-mediated

LEGAL INSTRUMENTS—RESULTS OF THE URUGUAY ROUND vol. 31; 33 I.L.M. 81 (1994) [hereinafter TRIPS Agreement].

5. Part II relies extensively on the two following works: Braga & Fink, *supra* note 1; Primo Braga, *supra* note 1.

6. See Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS 609, 617 (Richard R. Nelson ed., 1962) ("[In] an ideal socialist economy, the reward for invention would be completely separated from any charge to the users of the information. In a free enterprise economy, inventive activity is supported by using the invention to create property rights; precisely to the extent that it is successful, there is an underutilization of the information.").

7. See *id.* at 616-17 ("In the first place, any information obtained, say a new method of production, should, from the welfare point of view, be available free of charge (apart from the cost of transmitting information). This insures optimal utilization of the information but of course provides no incentive for investment in research.").

8. See *id.* at 618.

9. "Distortions" are factors causing an economy to depart from Pareto-optimality. See JOHN BLACK, A DICTIONARY OF ECONOMICS 131 (1997). The concept of Pareto-optimality is explained in note 66, *infra*.

10. See Arrow, *supra* note 6, at 619-22.

bargain between the producers of knowledge and society.¹¹

The economics of patent and copyright laws is typically explained in terms of Arrow's rationale.¹² By contrast, the basis for protection of trademarks and industrial designs is more often framed in terms of incentives for investments in reputation (quality) rather than for innovation per se.¹³ Trade secrets, in turn, are rationalized as a necessary supplement to the patent system by protecting innovations that do not comply with the strict requirements for patentability of products and processes.¹⁴

In developed economies, the long-term trend underlying IPR protection reflects a course toward the strengthening of IPRs.¹⁵ As Sidney Winter noted, however, there is no clear theoretical presumption that a movement toward stronger protection standards will categorically enhance welfare.¹⁶ In fact, patent claims that are too broad may restrict future R&D and other innovations, and patent races may lead to over-investment in R&D.¹⁷ In addition, private returns may exceed social returns as IPR protection increases and inventors begin to appropriate additional gains in assets that are complementary to the innovation.¹⁸ Finally, the increase in static distortions in the consumption of knowledge due to monopolistic practices may overcome the dynamic benefits of additional R&D.¹⁹

Despite these considerations, there is broad recognition that IPR

11. See *id.* at 623-25; see also Braga & Fink, *supra* note 1, at 100; Primo Braga, *supra* note 1, at 397. For an early discussion of the terms of this "bargain," see the "monopoly profit incentive" and the "exchange for secrets" theses as presented in Subcomm. on Patents, Trademarks, and Copyrights of the Senate Comm. on the Judiciary, 85th Cong., 2d Sess., *An Economic Review of the Patent System*, Study No. 15, at 20-25 (Comm. Print 1958) (Fritz Machlup).

12. See generally Arrow, *supra* note 6, at 616-22.

13. See, e.g., Gene M. Grossman & Carl Shapiro, *Counterfeit-Product Trade*, 78 AM. ECON. REV. 59, 60 (1988); see also Braga & Fink, *supra* note 1, at 100; Primo Braga, *supra* note 1, at 397.

14. See Braga & Fink, *supra* note 1, at 100; Primo Braga, *supra* note 1, at 398.

15. See Braga & Fink, *supra* note 1, at 100; Primo Braga, *supra* note 1, at 398.

16. See, e.g., Sidney Winter, *Patents in Complex Contexts: Incentives and Effectiveness*, in OWNING SCIENTIFIC AND TECHNICAL INFORMATION 41, 41 (Vivian Weil & John W. Snapper eds., 1989).

17. See Braga & Fink, *supra* note 1, at 101; Primo Braga, *supra* note 1, at 398.

18. See Braga & Fink, *supra* note 1, at 101; Primo Braga, *supra* note 1, at 398; see also Carlos A. Primo Braga, *Guidance from Economic Theory*, in STRENGTHENING PROTECTION OF INTELLECTUAL PROPERTY IN DEVELOPING COUNTRIES: A SURVEY OF THE LITERATURE 17, 22-23 (Wolfgang E. Siebeck ed., 1990) [hereinafter Primo Braga, *Guidance*].

19. See Braga & Fink, *supra* note 1, at 101; Primo Braga, *supra* note 1, at 398; see also Primo Braga, *Guidance*, *supra* note 18.

systems play an important role in the promotion of technological progress. It is true that other institutional arrangements can foster the generation of knowledge. The government's direct production of knowledge, as well as the private sector's reliance on subsidies and/or government procurement to foster R&D activities, illustrate available alternatives.²⁰ However, historical hindsight suggests that market-driven incentives (as exemplified by the proprietary approach) provide the most effective way to organize economic activities, including the creation of knowledge through R&D.²¹

Many questions concerning the normative implications of IPR regimes remain unanswered. For example, is the international trend toward higher standards of IPR protection improving welfare? What are the implications of stronger IPRs for trade and FDI flows? Can developing countries enhance their locational advantages in the beauty contest for FDI by strengthening their IPR regimes? The following sections review some of the theoretical aspects of the debate arising out of these issues.

A. The International Dimension

IPRs are territorial in nature. Nations must reach mutual accommodation as their residents seek protection for their works in international markets. The negotiations of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) in the context of the Uruguay Round constitute the most recent chapter in a long history of attempts to negotiate the issue of extra-territoriality as related to IPRs.²² Emerging from these negotiations was the acceptance of minimum standards of protection (not only in terms of coverage of subject matter and scope of protection, but also with respect to enforcement) and the universal coverage of the agreement (with special and differential treatment for developing countries limited to generous transition periods).²³ TRIPS will promote greater harmonization of IPR protection than the international community believed to be feasible a few years ago.²⁴

20. For a discussion of these issues, see Partha Dasgupta & Paul Stoneman, *Introduction*, in *ECONOMIC POLICY AND TECHNOLOGICAL PERFORMANCE* 1, 3 (Partha Dasgupta & Paul Stoneman eds., 1987).

21. See Braga & Fink, *supra* note 1, at 101.

22. See Primo Braga, *supra* note 1, at 381 (explaining that the debate "on trade-related aspects of intellectual property rights in the GATT can be traced back to the Tokyo Round (1973-79) of multilateral trade negotiations").

23. See Braga & Fink, *supra* note 1, at 101-02; Primo Braga, *supra* note 1, at 388, 394-95.

24. See Braga & Fink, *supra* note 1, at 102; Primo Braga, *supra* note 1, at 405. The TRIPS

The caveats that apply to the desirability of increasing protection for IPRs at the national level gain an additional dimension when the analysis moves to the international domain. If the existing or potential title-holders are predominantly foreigners, strengthened IPR protection raises the possibility of an international rent transfer.²⁵ The net welfare impact of the reform for the host country will depend on how local consumers and producers are affected, as well as on the implications of greater IPR protection for world R&D levels and composition.²⁶

Various scenarios capture the potential effects of higher standards of IPR protection.²⁷ In a small country with limited production and innovation capabilities whose IPR regime does not affect world R&D, higher standards of protection likely will improve welfare as long as they permit access to products that would otherwise not be available.²⁸ However, if the country has greater production capabilities (a proxy for its capacity to imitate), but limited innovative capacity (as measured by its R&D basis, for example), higher standards of protection will likely displace local producers, raise prices, and transfer rent from local consumers and producers to foreign title-holders, resulting in a negative welfare impact. Over time, however, improved access to technology and knowledge-intensive products

Agreement leaves its signatories with some flexibility in designing national IPR regimes (for example, in determining the criteria for patentability, the use of compulsory licenses, or the regulations regarding parallel imports). Moreover, the TRIPS standards of protection are less stringent than the standards of protection currently prevailing in developed countries such as the United States.

25. See Braga & Fink, *supra* note 1, at 102; Primo Braga, *supra* note 1, at 405. For example, in 1995, of the approximately 35,400 patents granted in developing countries (excluding the countries of Central and Eastern Europe and the Commonwealth of Independent States), more than 28,000 (or 82.5%) were awarded to foreign residents. For further information, see *World Intellectual Property Organization* (visited Nov. 11, 1998) <<http://www.wipo.org>>.

26. See Braga & Fink, *supra* note 1, at 102; Primo Braga, *supra* note 1, at 398.

27. For formal models, see M.K. Berkowitz & Y. Kotowitz, *Patent Policy in an Open Economy*, 15 CANADIAN J. ECON. 1, 1-17 (1982); Judith C. Chin & Gene M. Grossman, *Intellectual Property Rights and North-South Trade*, in THE POLITICAL ECONOMY OF INTERNATIONAL TRADE: ESSAYS IN HONOR OF ROBERT E. BALDWIN 90, 92-107 (Ronald W. Jones & Anne O. Krueger eds., 1990); Ishac Diwan & Dani Rodrik, *Patents, Appropriate Technology, and North-South Trade*, 30 J. INT'L ECON. 27, 27-47 (1991); Alan V. Deardorff, *Welfare Effects of Global Patent Protection*, 59 ECONOMICA 35, 35-51 (1992). For a discussion of the optimal level of protection in the South, see Claudio R. Frischtak, *Harmonization Versus Differentiation*, in *Intellectual Property Right Regimes*, in GLOBAL DIMENSIONS OF INTELLECTUAL PROPERTY RIGHTS IN SCIENCE AND TECHNOLOGY 89, 103-05 (Mitchel B. Wallerstein et al. eds., 1993).

28. See Berkowitz & Kotowitz, *supra* note 27; see also Chin & Grossman, *supra* note 27, at 96-99; Deardorff, *supra* note 27.

should counterbalance this initial adverse impact. Finally, if the small country has both well-developed production and innovative capabilities (as in the case of the East Asian newly industrialized economies), the result will be indeterminate, depending on the elasticity of supply of domestic innovations with respect to IPR protection.²⁹

Alternatively, in a developing country large enough to affect innovation in the North (i.e., developed economic regions), strengthened IPR protection could cause an increase or reorganization of R&D investments on a global scale. In this case, higher levels of protection in the South (i.e., in the developing world) may reflect a better solution for the world as a whole even if the immediate losses in the South are greater than the initial benefits for innovators in the North.³⁰

This brief review underscores the limitations of normative recommendations concerning changes in the rules for IPRs at the world level. Strengthened IPR protection will have different welfare implications depending on the characteristics of each country. Generalizations can only be made if strong assumptions are adopted. For example, if one assumes that the supply of innovations in the South is inelastic and that IPR regimes have limited influence on trade, foreign direct investment, and technology transfer, then it follows that TRIPS is essentially an exercise in rent transfer.³¹ Opposite assumptions lead to a more optimistic view of the welfare implications of strengthened IPR regimes for developing countries.³²

B. The IPRs-Trade Link

IPRs can influence trade flows. For example, discrepancies among national IPR regimes generate effects similar to non-tariff barriers.³³ Compared to North-North trade, Northern exporters have

29. See Braga & Fink, *supra* note 1, at 102; Primo Braga, *supra* note 1, at 398.

30. See Diwan & Rodrik, *supra* note 27.

31. See Arvind Subramanian, *TRIPs and the Paradigm of the GATT: A Tropical, Temperate View*, 13 *WORLD ECON.* 509, 516 (1990).

32. See Robert M. Sherwood, *Why a Uniform Intellectual Property System Makes Sense for the World*, in *GLOBAL DIMENSIONS OF INTELLECTUAL PROPERTY RIGHTS IN SCIENCE AND TECHNOLOGY* 68, 68-88 (Mitchel B. Wallerstein et al. eds., 1993) (explaining that "ideological arguments against strong intellectual property protection will fade, permitting a fresh examination of its positive role in development").

33. See Richard Stern, *Intellectual Property*, in *THE URUGUAY ROUND: A HANDBOOK ON THE MULTILATERAL TRADE NEGOTIATIONS* 198, 202-05 (J. Michael Finger & Andrezej Olechowski eds., 1987).

additional costs when exporting to the South if they have to engage in activities designed to inhibit local imitation. Moreover, the international harmonization of IPR regimes diminishes the transaction costs of operating in different regulatory environments.

The net impact on trade flows of strengthening protection of IPRs in the South remains ambiguous. As Keith E. Maskus and Mohan Penubarti revealed, a higher protection level fosters two conflicting effects.³⁴ First, greater protection will enhance the market-power of the title holder, reducing the elasticity of demand for his or her products.³⁵ Second, greater protection will expand the net demand for the protected products as imitators are displaced.³⁶ The net trade result will depend on which effect dominates. If the market-power effect is more substantial than the market-expansion effect, trade flows may decrease in the aftermath of the reform. If the opposite occurs, strengthened IPR protection will lead to trade expansion. In other words, the net trade effect of TRIPS will prove to be an empirical question.³⁷

Several studies estimate the effects of IPRs in econometric models.³⁸ Although the estimation results are specific to the models applied, mounting evidence indicates "that IPRs are indeed trade-related."³⁹ For example, Maskus and Penubarti suggest that the implementation of TRIPS will create an increase in trade flows.⁴⁰ Although no precise welfare predictions can yet be derived, market-expansion appears to dominate market-power effects.

III. IPRS AND FIRMS' FOREIGN INVESTMENT DECISIONS

In determining the impact that weak or strong protection of IPRs has on decisions to invest abroad, it is useful to begin with a review of the economic incentives firms have for becoming transnational. The most widely accepted framework in this regard is the so-

34. See Keith E. Maskus & Mohan Penubarti, *How Trade-Related are Intellectual Property Rights?*, 39 J. INT'L ECON. 227, 229-30 (1995).

35. See *id.* at 230; see also Braga & Fink, *supra* note 1, at 106-07; Primo Braga, *supra* note 1, at 399.

36. See Maskus & Penubarti, *supra* note 34, at 230.

37. See Braga & Fink, *supra* note 1, at 106-07; Primo Braga, *supra* note 1, at 399.

38. See, e.g., Michael J. Ferrantino, *The Effect of Intellectual Property Rights on International Trade and Investment*, 129 REV. OF WORLD ECON. 300, 311-29 (1993); Primo Braga, *supra* note 1, at 381-411; Maskus & Penubarti, *supra* note 34, at 227-48.

39. Maskus & Penubarti, *supra* note 34, at 244.

40. See *id.* at 237-44.

called “ownership-location-internalization theory” (OLI).⁴¹ The OLI approach begins by stipulating that transnational corporations (TNCs) possess ownership advantages vis-à-vis local firms in the form of intangible assets.⁴² These assets usually take the form of new technologies, informal know-how shared among employees, specific organizational skills, reputation for quality, and so forth.⁴³ However, while ownership advantages are necessary, they are not sufficient for overseas investment.⁴⁴ In fact, many firms that possess intangible assets choose to serve foreign markets by arm’s-length trade relationships.⁴⁵

In order for firms to invest abroad, two further conditions must be met. First, the foreign country must offer location advantages that make it more profitable to locate business abroad.⁴⁶ Location advantages are usually associated with factors such as high transportation costs and tariffs, low input prices, access to distribution networks, and local regulatory environments.⁴⁷ Second, it must be more profitable for firms to internalize production rather than to sell or license their intellectual assets to independent local firms in the foreign country.⁴⁸ Internalization advantages take the form of avoiding transaction costs with potential licensees, controlling inputs, and protecting quality.⁴⁹

The OLI framework is useful in identifying the influence of IPR

41. See generally John H. Dunning, *Explaining Changing Patterns of International Production: In Defense of Eclectic Theory*, 41 OXFORD BULL. ECON. & STAT. 269, 275 (1979) [hereinafter Dunning, *Eclectic Theory*]; John H. Dunning, *Explaining the International Direct Investment Position of Countries: Towards a Dynamic or Developmental Approach*, 117 REV. WORLD ECON. 30, 30-33 (1981) [hereinafter Dunning, *Developmental Approach*].

42. See Dunning, *Eclectic Theory*, *supra* note 41; Dunning, *Developmental Approach*, *supra* note 41, at 30, 32.

43. See Dunning, *Eclectic Theory*, *supra* note 41, at 276; Dunning, *Developmental Approach*, *supra* note 41, at 33; James R. Markusen, *The Boundaries of Multinational Enterprises and the Theory of International Trade*, J. ECON. PERSP., Spring 1995, at 169, 174.

44. See Dunning, *Developmental Approach*, *supra* note 41, at 33.

45. See *id.* at 31. An example would be a U.S. telecommunications equipment manufacturer that produces mobile telephones (possibly with a patented technology) in the United States, and exports the phones to Germany. This equipment manufacturer would have an ownership advantage, but it would not take a foreign investment position.

46. See Dunning, *Eclectic Theory*, *supra* note 41; Dunning, *Developmental Approach*, *supra* note 41, at 31.

47. See Dunning, *Eclectic Theory*, *supra* note 41, at 276; Dunning, *Developmental Approach*, *supra* note 41, at 35.

48. See Dunning, *Eclectic Theory*, *supra* note 41; Dunning, *Developmental Approach*, *supra* note 41, at 31.

49. See Dunning, *Eclectic Theory*, *supra* note 41, at 276; Dunning, *Developmental Approach*, *supra* note 41, at 35.

protection on a firm's decision to invest abroad.⁵⁰ First, ownership advantages generally relate the existence of intellectual assets to the occurrence of foreign investment.⁵¹ Of course, only a small share of intellectual assets are eligible for protection under conventional IPR systems, and firms may service foreign countries by means other than FDI.⁵² However, the ownership paradigm has two direct implications. On the one hand, firms that create intellectual property are likely to engage in foreign investment; on the other, IPR policy directly influences firms' foreign investment decisions by endogenizing their ownership advantages.

Second, the protection of intellectual property can also be interpreted as a location advantage, as IPRs are territorial in nature and hence differ across national boundaries. As John H. Dunning points out, in an era of globalization and with the growing mobility of intra-firm intermediate products, governments need to pay special attention to their regulatory environments.⁵³ Different levels of protection in national IPR regimes may influence where a TNC decides to locate.⁵⁴ Finally, IPR protection may also influence a firm's decision to internalize or externalize its intellectual assets.⁵⁵

50. The empirical evidence generally supports the OLI approach. See Dunning, *Eclectic Theory*, *supra* note 41; Dunning, *Developmental Approach*, *supra* note 41. Firms investing abroad usually have a high share of skilled workers in addition to high R&D intensity, technology-intensive production processes and product portfolios, and aggressive advertising and marketing strategies. See Markusen, *supra* note 43, at 174. Hence, the value of transnational companies' intellectual assets is typically large relative to the market value of the transnational company. See *id.* Most transnational companies choose to locate their overseas affiliates in countries with low labor costs, good infrastructure, and other agglomeration benefits. See David Wheeler & Ashoka Mody, *International Investment Location Decisions: The Case of U.S. Firms*, 33 J. INT'L ECON. 57, 64, 66, 69 (1992). The occurrence of technology licensing compared to FDI stocks is relatively small. See RICHARD E. CAVES, *MULTINATIONAL ENTERPRISE AND ECONOMIC ANALYSIS* 169 (2d ed. 1996). This is usually attributed to market failures related to asymmetrical information between both contracting parties. In cases where arm's-length licensing does occur, the evidence suggests that TNCs prefer licensing vis-à-vis foreign investment because of its greater rent extracting potential. See *id.*

51. See, e.g., Markusen, *supra* note 43, at 174 (discussing the reasons knowledge-based assets are more likely to give rise to FDI than physical capital assets).

52. In essence, there are two alternatives to FDI in serving a foreign market: exporting to the market or licensing production to a foreign firm at arm's length. It should be noted that often a combination of two or even all three "modes of delivery" occurs. A firm, for example, could license a technology to a foreign firm in which it has only a minority stake (and thus no direct management control) and also supply this foreign firm with basic inputs via intra-firm exports.

53. See John H. Dunning, *Re-evaluating the Benefits of Foreign Direct Investment*, 3 *TRANSNAT'L CORP.* 23, 48 (1994).

54. See *id.* at 45.

55. For example, Michael J. Ferrantino argues that a system of IPRs is necessary to the

Given the various channels through which IPRs affect FDI, what is the expected relationship between stronger IPR systems and foreign investment flows—or, to what extent and in which direction are IPRs FDI-related? Many analysts argue that firms are more likely to invest in countries with strong protection, since the smaller risk of imitation leads to a relatively larger net demand for protected products.⁵⁶ This argument would point to a positive IPRs-FDI link.

Conversely, there are two effects that could justify the inference that IPRs have a negative influence on foreign investment. First, stronger IPR protection provides title holders with increased market power and could, at least theoretically, cause firms to actually divest and reduce their service to foreign countries.⁵⁷ Second, higher levels of protection may cause TNCs to switch their preferred mode of delivery from foreign production to licensing. Michael J. Ferrantino argues that firms prefer foreign investment over licensing in the case of weak protection because internalized foreign production helps firms to maintain direct control over their proprietary assets.⁵⁸

The net effect of higher levels of IPR protection on FDI is thus theoretically ambiguous. It can be questioned, however, whether possible market power effects are more than just theoretical artifacts, and whether arm's-length technology transfers are significant substitutes for international production. We therefore focus on the thesis that, on average, stronger IPR regimes are likely to induce higher inward flows of FDI.

So far, the discussion has concentrated on horizontal FDI, where firms establish plants abroad to produce the same or similar goods for local or regional markets. A second type of FDI can be classified as vertical foreign investment, which occurs if plants in different

enforcement of licensing contracts. See Ferrantino, *supra* note 38, at 300, 303. In contrast, Julio J. Nogués argues “that the decision to license and transfer technology depends much more on the legal strength of the licensing agreement and the adaptable capacity of the buyer to absorb the technology” than on the strength of the IPRs regime. Julio J. Nogués, *Social Costs and Benefits of Introducing Patent Protection for Pharmaceutical Drugs in Developing Countries*, 31 DEVELOPING ECONOMIES 24, 42 (1993).

56. See, e.g., EDWIN MANSFIELD, INTELLECTUAL PROPERTY PROTECTION, FOREIGN DIRECT INVESTMENT, AND TECHNOLOGY TRANSFER 11 (International Finance Corporation Discussion Paper No. 19, 1994) (noting that research-intensive U.S. firms with easy-to-imitate products will not make substantial investments in countries with weak IPRs protection).

57. Maskus and Penubarti's analysis of the IPRs-trade link, discussed in Part II, *supra*, can also be applied to exporting firms and their overseas affiliates. See Maskus & Penubarti, *supra* note 34, at 227, 229, 244.

58. See Ferrantino, *supra* note 38, at 303.

countries produce outputs that serve as inputs in other plants.⁵⁹ Both forms of FDI are strongly linked to each other (and to trade flows) and together form what can be called an “integrated production system.”⁶⁰ This additional dimension of foreign investment poses the question of how higher levels of protection affect the composition of FDI. In other words, what portion of a firm’s production processes is influenced by IPR protection?

One could argue that without strong protection firms may be reluctant to invest in stages of production that involve a significant transfer of proprietary knowledge, such as R&D and technology-intensive manufacturing processes. By contrast, one would expect IPRs to have less importance with respect to investment in marketing, or sales and distribution outlets. However, the importance of IPRs regarding the composition of FDI depends to a large extent on whether firms are able to maintain control over their proprietary assets in the absence of legal protection.⁶¹

A further dimension of the IPRs-FDI relationship concerns the degree of ownership in foreign-owned companies. Foreign firms are less willing to invest in joint ventures with local companies if they risk losing their proprietary assets.⁶² Inversely, Jeong-Yeon Lee and Edwin Mansfield point out that IPRs are likely to be of less importance in minority investments “because unless a firm has complete control, it is often unlikely to transfer advanced technology to a foreign affiliate.”⁶³ As above, the importance of IPRs on the degree of foreign ownership depends on the extent to which the title holder is able to maintain control over its proprietary assets in the absence of protection.

So far, the analysis has only considered the strategies of single firms in a partial-equilibrium framework.⁶⁴ It is also worth consider-

59. See U.N. CONF. ON TRADE & DEV., WORLD INVESTMENT REP. 1996: INVESTMENT, TRADE, & INT’L POL’Y ARRANGEMENTS at 99, U.N. Doc. UNCTAD/DTCI/32, U.N. Sales No. E.96.II.A.14 (1996).

60. *Id.*

61. “Absence of legal protection” refers to both the absence of IPRs and, in countries with existing IPRs, the inadequate enforcement of those rights.

62. See EDWIN MANSFIELD, INTELLECTUAL PROPERTY PROTECTION, DIRECT INVESTMENT, AND TECHNOLOGY TRANSFER 5 (International Finance Corporation Discussion Paper No. 27, 1995) (presenting data which suggests that firms will not undertake joint ventures in countries where it is perceived that IPRs protection is weak).

63. Jeong-Yeon Lee & Edwin Mansfield, *Intellectual Property Protection and U.S. Foreign Direct Investment*, 78 REV. ECON. & STAT. 181, 185 (1996).

64. Partial-equilibrium analysis is the “examination of resource allocation within a single market without considering the implications for other markets.” LES SEPLAKI, ATTORNEY’S

ing broader efficiency aspects in a general-equilibrium setting,⁶⁵ particularly from a North-South perspective. In this regard, it is useful to distinguish two important channels. First, how do IPRs affect the dynamic allocation of resources devoted to the creation of knowledge? And second, how does such protection influence the (static) international division of labor devoted to the manufacture of protected products? Of course, these two channels are not independent of each other, since both the knowledge-generating and manufacturing sectors compete for scarce resources.

As for the dynamic allocation of resources devoted to the creation of knowledge, it could be argued that higher protection of IPRs in the South stimulates R&D investments in the North. Even if this is the case, it is not clear whether this additional R&D effort is appropriate on aggregate terms or with respect to products of special relevance to developing countries (e.g., drugs to fight tropical diseases). The relevance of such a proposition remains an empirical question, but in theory it opens the door for "Pareto-efficient"⁶⁶ bargains between developed and developing countries.⁶⁷

As for the static international allocation of resources, depending on a country's factor endowments⁶⁸ and factor intensities⁶⁹ in production, developing economies may have a comparative advantage⁷⁰ in the manufacturing process of protected products (e.g., pharmaceuticals). In the absence of foreign investment and in the presence of substantial imitation⁷¹ in developing economies, stronger protection

DICTIONARY & HANDBOOK OF ECONOMICS AND STATISTICS 185 (1991).

65. General-equilibrium analysis is "the study of interdependence within the entire price system in all product and labor markets." *Id.* at 109.

66. Pareto optimality or efficiency is defined as the economic state which prevails "when it is impossible by reallocation of production or consumption activities to make all consumers [better off] without simultaneously making others worse off; i.e. to make at least one person better off while making no one worse off." *Id.* at 185.

67. See Arvind Subramanian, *Putting Some Numbers on the TRIPS Pharmaceutical Debate*, 10 INT'L J. TECH. MGMT. 252, 261 (1995).

68. Factor endowment is defined as a "country's stock of factors of production." BLACK, *supra* note 9, at 170. Factors of production, in turn, are any "resource used in the production of goods or services." *Id.* at 171.

69. Factor intensity is the "relative proportions of various factors of production used in producing goods and services." *Id.* at 170. For example, "[f]or any given set of relative factor prices, some goods are produced using a lot of labor and little capital: such goods are labor-intensive." *Id.*

70. "A country has a comparative advantage in producing a good, relative to another country or the rest of the world, if the relative cost of producing the good, that is, its opportunity cost in terms of other goods forgone, is lower than it is abroad." *Id.* at 71.

71. Imitation refers to (i) unauthorized use of protected material in countries with existing

would relocate production from developing countries to industrialized countries—leading to a potentially inefficient inter-regional allocation of resources. Foreign investment, however, could counter such inefficiencies as TNCs could locate their manufacturing facilities in developing countries. Hence, the likely effect of stronger protection would primarily be a change of control towards increased international intra-firm division of labor. One major problem with this line of reasoning, however, is that the usual gains from trade based on comparative advantage rely on a perfectly competitive market. However, markets for protected products are, by definition, imperfectly competitive. Hence, there may be other gains or losses from trade and foreign investment.⁷²

IV. EMPIRICAL EVIDENCE

The previous section presented the argument that there are valid reasons to expect that IPRs are FDI-related. This section reviews some empirical studies that explore this argument. Empirical evidence comes either from surveys of foreign investors in industrial countries or from econometric work evaluating the impact of different IPR regimes on a cross-section of countries.

Surveys of firms in the North strongly support a positive IPRs-FDI link.⁷³ Mansfield's analysis, based on data collected from patent attorneys and executives of major U.S. manufacturing firms, shows that IPR regimes are relevant for some, but not all types of FDI decisions.⁷⁴ Not surprisingly, IPR protection was found to be more relevant in making decisions related to investment in R&D facilities than in decisions related to FDI in sales and distribution outlets.⁷⁵ Mansfield also found sharp differences in the importance of IPR regimes

IPRs, but inadequate enforcement (in this case imitation is illegal and sometimes referred to as piracy), or to (ii) the use of material protected by IPRs in foreign countries, but not protected domestically because of the absence of IPRs.

72. Very little research has been done in this context. An exception is found in a study by Elhanan Helpman, examining the effects of tighter IPRs in a dynamic two-region, one-product, one-factor model. See Elhanan Helpman, *Innovation, Imitation and Intellectual Property Rights*, 61 *ECONOMETRICA* 1247 (1993). Helpman evaluates the impact of protection on terms of trade, production composition, available products, and allocation of consumption over time. See *id.* His conclusions depend largely on structural parameters, but in most of the cases he examines, the Southern region is likely to lose from tighter IPRs, whereas the Northern region may either gain or lose. See *id.*

73. See MANSFIELD, *supra* note 62, at 2.

74. See *id.*

75. See *id.* at 2-3.

in influencing decisions on FDI across industries.⁷⁶ Companies in the chemical, pharmaceutical, machinery, and electrical equipment industries reported that IPRs played a major role in their decisions with respect to investment in joint ventures abroad.⁷⁷ In contrast, companies in the transportation equipment, metals, and food industries considered IPR protection to have marginal significance on FDI.⁷⁸ Mansfield's extension of the survey in 1995 to German and Japanese firms largely confirmed these results.⁷⁹

Claudio R. Frischtak quotes additional survey evidence from countries within the Organization for Economic Cooperation and Development that identifies IPRs as a relevant variable for FDI decisions.⁸⁰ But, Frischtak also points out that other considerations—*in essence the overall investment climate of a country*—are more important than IPRs for FDI decisions.⁸¹ In general, these surveys provide useful insight into the role of IPRs in transnational firms' strategies; however, the extent to which these surveys give reliable estimates on the empirical significance of IPRs on overall FDI stocks and flows is questionable.

Cross-country regression analyses provide additional insights in identifying the overall significance of IPRs on FDI. Based on Mansfield's survey results,⁸² Lee and Mansfield compiled an index of IPRs protection for sixteen developing and newly industrialized countries,⁸³ attempting to explain U.S. FDI flows in these countries in a multivariate regression analysis.⁸⁴ The estimation result with regard to the Mansfield index indicates that countries with higher levels of protection attract significantly higher FDI flows.⁸⁵ Moreover, Lee and Mansfield collected data from fourteen major U.S. chemical firms regarding the composition of their foreign investment positions.⁸⁶ Us-

76. *See id.* at 2.

77. *See id.*

78. *See id.*

79. *See id.*

80. *See Frischtak, supra* note 27, at 89, 100.

81. *See id.* at 99.

82. *See MANSFIELD, supra* note 62, at 2.

83. *See Lee & Mansfield, supra* note 63, at 183; *see also infra* Appendix.

84. Besides the survey index, Lee and Mansfield's explanatory variables include a measure of market size, a dummy variable for Mexico, the stock of foreign direct investment, a measure of the degree of industrialization, and a measure for openness. *See Lee & Mansfield, supra* note 63. For an introduction to multivariate regression analysis, see JOHN JOHNSTON, *ECONOMETRIC METHODS* (3d ed. 1984).

85. *See Lee & Mansfield, supra* note 63, at 185-86.

86. *See id.* at 184

ing Mansfield's survey index confined to the chemical industry and several other regressors, Lee and Mansfield find that the percentage of a firm's investment devoted to R&D or to manufacturing intermediate and final products is directly related to the perceived strength of IPR protection.⁸⁷

Lee and Mansfield's analysis, however, can be criticized on two grounds. First, the IPRs index based on Mansfield's survey implicitly includes firms' perceptions about other factors influencing foreign investment and transfer of technology, such as the presence of potential imitators.⁸⁸ Second, Lee and Mansfield's sample selection is biased towards countries that have at least some technological capabilities and in which international disputes over IPRs are common.⁸⁹ Thus, it may be that Lee and Mansfield's results overstate the influence that the protection of intellectual property has on FDI decisions.

In an earlier study,⁹⁰ we also relied on data detailing U.S. foreign investment, but used a larger set of countries and the index of patent protection developed by Richard T. Rapp and Richard P. Rozek.⁹¹ The dependent variables were total assets of U.S. firms for total manufacturing and certain manufacturing industries.⁹² In addition to the Rapp and Rozek index, we used the Gross Domestic Product (GDP) of the recipient countries and a dummy for Canada and Mexico as explanatory variables.⁹³ The estimation results show a statistically positive influence of stronger IPR regimes to total manufacturing.⁹⁴ The sectoral results are less robust, although the coefficient on the Rapp and Rozek index always indicated a positive influence overall and resulted in a statistically significant influence in the "primary and fabricated metals" and "electric and electronic equipment" industries.⁹⁵ These results, however, are tentative because only two additional explanatory variables were used as controlling variables for other determinants of U.S. foreign investment.⁹⁶

87. *See id.* at 185.

88. *See id.* at 183; *see also infra* Appendix.

89. *See* Lee & Mansfield, *supra* note 63, at 182-83.

90. *See* Braga & Fink, *supra* note 1, at 99, 114-15.

91. *See infra* Appendix; *see also* RICHARD T. RAPP & RICHARD P. ROZEK, BENEFITS AND COSTS OF INTELLECTUAL PROPERTY PROTECTION IN DEVELOPING COUNTRIES 24-25 (National Economic Research Associates Working Paper No. 3, 1990).

92. *See* Braga & Fink, *supra* note 1, at 99, 114-15.

93. *See id.* at 114-15.

94. *See id.*

95. *Id.* at 114.

96. *See id.*

Fink takes a slightly different approach in examining the impact of IPRs protection on U.S. multinationals. This study uses a gravity-type model to jointly estimate the effects of stronger protection on U.S. arm's-length exports (defined as total U.S. exports less intra-firm exports to overseas affiliates) and overseas sales by U.S. affiliates in forty-two countries.⁹⁷ The data set is pooled across three manufacturing industries—chemicals and allied products, non-electrical machinery, and electric and electronic equipment—and includes industry-specific intercepts.⁹⁸ Fink's explanatory variables are Gross National Product (GNP), GNP per capita, geographic distance, average tariff rates in each of the three industries, language, and a dummy variable for both Mexico and Canada.⁹⁹ The strength of countries' IPR regimes is approximated by the index developed by Walter G. Park and Juan Carlos Ginarte.¹⁰⁰

Table 1 presents Fink's estimation results.¹⁰¹ In Model I, the impact of the Park and Ginarte index is forced to be uniform across the three manufacturing industries.¹⁰² The estimated coefficients on the index are negative, but statistically insignificant for both arm's-length exports and sales by affiliates.¹⁰³ In Model II, the impact of IPRs is allowed to differ across the three industries.¹⁰⁴ The resulting coefficients are all negative, but only statistically significant in the case of sales by affiliates in the chemical industry. Fink's results, therefore, do not confirm a positive link between IPRs and multinational activity. At best, they suggest a weakly negative relationship.¹⁰⁵

97. See Carsten Fink, *Intellectual Property Rights and U.S. and German International Transactions in Manufacturing Industries 1* (Mar. 1997) (unpublished manuscript, on file with the *Duke Journal of Comparative and International Law*).

98. See *id.* at 2.

99. See *id.* at 9.

100. See *infra* Appendix; see also Walter G. Park & Juan Carlos Ginarte, *Determinants of Intellectual Property Rights: A Cross National Study*, Table 1 (1996) (unpublished draft paper, on file with the *Duke Journal of Comparative and International Law*).

101. See Fink, *supra* note 97, at 31.

102. See *id.* at 8.

103. See *id.* at 13.

104. See *id.*

105. Ferrantino also investigates the influence of IPRs in U.S. arm's-length trade, intra-firm trade, and sales of overseas affiliates in the local market. See Ferrantino, *supra* note 38, at 303. Ferrantino introduces IPRs in his model as policy distance variables while using dummies for membership in the Paris, Berne, and Union for the Protection of Plant Varieties (UPOV) Conventions, and information on the term of patent protection in order to construct proxies for the strength of the IPRs regime in U.S. trading partners. Ferrantino's overall results suggest at best a weak association between IPRs and arm's-length exports, no influence of IPRs on overseas affiliates, but significant effects with respect to intra-firm trade. This is interpreted as an indi-

Fink similarly examines the effects of IPRs on German firms' export and foreign investment decisions in twenty-five countries.¹⁰⁶ Due to the limited data availability, the study uses total German exports and stock of German foreign direct investment as explanatory variables.¹⁰⁷ The data set is pooled across four manufacturing industries: chemicals, non-electrical machinery, electrical engineering, and transportation equipment. The estimation set-up and explanatory variables mirror those of the U.S. multinationals.

Estimates of the effects of IPRs on German firms' exports and FDI are presented in Table 2.¹⁰⁸ As in the U.S. analysis, Model I forces the impact of IPRs to be uniform across the four industries. The results show that the estimated coefficient on the IPRs index has a statistically significant positive impact for total exports, but is close to zero and insignificant for FDI stock. When the impact of IPRs is allowed to differ across the four industries in Model II, the resulting coefficients suggest a significantly positive impact on exports in all industries except electrical engineering, but no statistically significant impact on German FDI stock in any of the four industries. These results suggest that in the case of Germany, IPRs in Germany are trade-related, but not FDI-related.¹⁰⁹

A final study reviewed by this Article is Belay Seyoum's econometric analysis on the strength of patent, trademark, trade secret, and copyright protection.¹¹⁰ Seyoum's data is based on questionnaire responses submitted by intellectual property experts from twenty-seven less-developed, newly industrialized, and developed countries.¹¹¹ These responses on the effectiveness of IPRs protection

cation that U.S. transnational corporations prefer to maintain production within U.S. borders and engage in intra-firm trade, rather than risk a loss of proprietary information by adopting a more integrated system of production in partner countries that have weaker IPR regimes.

106. See Fink, *supra* note 97, at 18.

107. The stock of FDI is the sum of past FDI inflows minus depreciation of capital assets. Investment, whether foreign or domestic, is always a flow measure and relates to a specific time period (e.g., investment between January 1, 1992 and December 31, 1992). Investment stock refers to a specific point in time (e.g., investment stock at December 1992).

108. See Fink, *supra* note 97, at 32-35.

109. See *id.* at 31-35. In Tables 1 and 2 of this Article, the estimated covariances between the error terms of the export and FDI regressions indicate the extent to which trade and FDI are substitutes or complements. In the U.S. case (Table 1), the estimated covariance takes a small positive value suggesting a weakly complementary relationship between trade and sales by affiliates. In the German case (Table 2), the estimated covariance takes a value close to zero suggesting a nearly independent relationship between exports and FDI stock.

110. See Belay Seyoum, *The Impact of Intellectual Property Rights on Foreign Direct Investment*, COLUM. J. WORLD BUS., Spring 1996, at 50.

111. See *id.* at 51.

were combined with four additional explanatory variables (change in GDP, public investment as a ratio of GDP, external debt to exports, and exchange rates) to explain total inward flows of foreign direct investment.¹¹² Seyoum's regression results indicate that trademark, trade secret, and copyright protection result in a significantly positive impact on FDI for the total sample size.¹¹³ However, when the total sample is broken down into sub-samples of less-developed countries, newly industrialized countries, and developed countries, only copyright protection results in a significantly positive impact on FDI.¹¹⁴

We conclude that cross-country regression analyses share common shortcomings. First, most studies evaluate different countries' IPR regimes by single rankings based on survey results or selected indicators.¹¹⁵ It is doubtful whether such indices fully capture the complexities and multiple dimensions of modern IPR systems. Second, the data on bilateral foreign investment and transnational activity discussed in this Article is available only for selected (industrial) countries. Moreover, the data that is available is often of a highly aggregated nature.¹¹⁶ Although one could argue that almost all FDI stocks and flows are indirectly affected by IPRs protection, the direct impact of IPRs protection is likely to be confined to selected FDI stocks and flows (e.g., foreign investment in pharmaceutical R&D facilities). Finally, IPR regimes are highly correlated with the level of economic development across countries. Although most of the regression studies account for effects of per-capita GDP and other variables on foreign investment,¹¹⁷ it is not clear to what extent estimates on the IPRs variables can indeed be attributed to the effects of intellectual property protection rather than to other development-related effects.

In summary, surveys of foreign investors in industrial countries generally confirm a positive IPRs link. However, it is not clear how strong this link is or how important IPRs protection is compared to other factors influencing foreign direct investment decisions, such as tax incentives, quality of infrastructure, cultural ties, skills availabil-

112. *See id.* at 52.

113. *See id.* at 53-57.

114. *See id.*

115. *See, e.g.,* Lee & Mansfield, *supra* note 63; Ferrantino, *supra* note 38; RAPP & ROZEK, *supra* note 91, app. at 1-4.

116. *See, e.g.,* Lee & Mansfield, *supra* note 63; Ferrantino, *supra* note 38; RAPP & ROZEK, *supra* note 91, app. at 1-4.

117. *See, e.g.,* Lee & Mansfield, *supra* note 63; Ferrantino, *supra* note 38; RAPP & ROZEK, *supra* note 91, app. at 1-4.

ity, and input prices.¹¹⁸ There have been several econometric studies that have tried to evaluate the effect of IPR regimes on U.S. and German foreign investment as well as on selected countries' inward flows of foreign capital.¹¹⁹ Although some of these studies find a significantly positive impact of higher levels of protection on FDI, limitations in data and estimation set-up suggest that this evidence should be considered as tentative.

V. CONCLUSIONS AND SUGGESTIONS FOR FUTURE RESEARCH

The basic conclusions of this Article can be summarized as follows. First, there is growing evidence that IPRs affect FDI decisions around the world; empirical evidence of the overall strength of this effect is not, however, conclusive. Second, although the channels through which IPRs influence FDI decisions are many and quite complex—given the interaction between trade, FDI, and technology-transfer decisions—the basic presumption is that countries with stronger IPR regimes will be in a better position to attract knowledge-related FDI flows.

Developing countries engaged in the process of reforming their IPR regimes must recognize that changes in substantive laws are just the first step in this process. Unless adequate resources are committed to the administration and enforcement of IPRs and entrepreneurs become convinced of the sustainability of these new regimes, IPRs reforms will fall short of their potential.

Research in this area is still in its infancy. The fact that many developing countries are now reforming their IPR regimes offers a unique opportunity for “before” and “after” studies. Moreover, further studies about the linkages between IPRs and the different modes of knowledge diffusion—trade, FDI, and technology transfer—should be a priority.

118. See Lee & Mansfield, *supra* note 63, at 181.

119. See studies cited *supra* note 115.

APPENDIX DIFFERENT MEASURES OF IPRS PROTECTION

With the increasing academic and policy-oriented interest in intellectual property protection, several measures or indices of IPR regimes have emerged in the literature. The first such index was developed by Rapp and Rozek in 1990.¹²⁰ Rapp and Rozek rated the patent laws of 157 countries on a scale from zero (for countries without patent laws) to five (for countries with patent laws that fully conform to the minimum standards described in United States Chamber of Commerce).¹²¹ As a measure of the strength of IPR regimes, however, the index is incomplete because it only considers one type of intellectual property, patents, and does not take into account the enforcement of a country's patent law.

In 1996, Park and Ginarte developed an index that significantly expanded on the work by Rapp and Rozek.¹²² The Park and Ginarte index also graded the IPR regimes of 110 countries on a scale from zero to five, but provided a more elaborate ranking. To compute a country's ranking, Park and Ginarte created five different categories: coverage, membership in international treaties, loss of protection, enforcement, and duration. For each category, they used several benchmark criteria (e.g., patentability of pharmaceuticals for extent of coverage) and computed the share of fulfilled criteria. The unweighted sum of these shares over all categories represented a country's score. Currently, the Park and Ginarte index constitutes the most useful index in evaluating how IPRs laws are written "on the books."

Because written laws may translate differently into practice (e.g., regulations concerning the enforcement and administration of IPRs), survey evidence may be of guidance. Based on Edwin Mansfield's 1994 article, Jeong-Yeon Lee and Mansfield compiled an index of IPRs protection for sixteen developing and newly industrialized countries.¹²³ As a measure of IPR protection, they used the share of U.S. firms that report that the IPRs regime is too weak to allow the investment, transfer, or licensing of technology. An advantage of the Lee and Mansfield index is its ability to capture aspects of IPR protection, such as corruption or lax enforcement, that are not recorded

120. See RAPP & ROZEK, *supra* note 91, app. at 1-4.

121. See *id.* at 7.

122. See Park & Ginarte, *supra* note 100.

123. See Lee & Mansfield, *supra* note 63.

“on the books.” However, the Lee and Mansfield index is subjective in character, and may implicitly include the behavior of U.S. firms regarding their strategies to transfer proprietary assets abroad and related conditions in host countries that determine the attractiveness of receiving U.S. technologies. It is also not clear to which type of intellectual property the survey-based index refers.

In 1997, Robert Sherwood developed a hybrid of an “on the books” analysis and a survey-based index for eighteen developing countries.¹²⁴ Starting from a maximum score of one hundred, the index subtracts points for weakness in each of the following areas: enforceability; administration; treaties; and substantive laws for copyright, patents, trademarks, trade secrets, and life forms. The index adds up to three points for a country’s strong general commitment to IPR protection. In computing a country’s ranking, Sherwood relied on his own examination of the country’s IPR laws and on information provided by local agents involved in the country’s IPRs system. Sherwood’s approach probably represents the most comprehensive means of ranking national IPR regimes. However, similar to the Lee and Mansfield survey, Sherwood’s index is limited by its subjective character.

As far as feasible comparisons of country coverage, a strong correlation appears between the Rapp and Rozek index and the Park and Ginarte index. This correlation can be attributed to the similarity in approaches and reference periods. The Lee and Mansfield index, on the other hand, shows a relatively weaker correlation with both the Rapp and Rozek index and the Park and Ginarte index. Although one should be careful in interpreting this result because comparisons are based on relatively few observations, different methodological approaches may account for this difference. In this case, the relatively weaker correlation with the Lee and Mansfield index would suggest that the practical application of national laws differs to some extent across countries. Correlations with the Sherwood index are not meaningful because the index examines the mid-1990s (as opposed to the late 1980s and early 1990s for other indices), and many countries included in Sherwood’s study significantly reformed their IPR regimes in the early 1990s. Finally, the number of common observations, especially with the Mansfield index, is too small to draw reliable conclusions.

124. See Robert M. Sherwood, *Intellectual Property Systems and Investment Simulation: The Rating of Systems in Eighteen Developing Countries*, 37 IDEA 261, 261 (1997).

TABLE 1: INTELLECTUAL PROPERTY RIGHTS AND U.S. ARM'S-LENGTH EXPORTS AND SALES BY OVERSEAS AFFILIATES IN THREE MANUFACTURING INDUSTRIES

Dependent Variable (in natural logarithms)	Model I		Model II	
	Arm's Length Exports	Sales by Affiliates	Arm's Length Exports	Sales by Affiliates
Chemicals and allied products	-1.305 (-0.67)	-15.957 (-5.74)	-1.205 (-0.60)	-15.774 (-5.62)
Non-electrical machinery	-0.466 (-0.23)	-17.076 (-6.02)	-0.290 (-0.14)	-18.247 (-6.14)
Electric and electronic equip- ment	-1.031 (-0.53)	-17.203 (-6.14)	-1.124 (-0.56)	-17.545 (-6.18)
ln(GNP)	0.652 (7.23)	1.427 (11.09)	0.647 (6.98)	1.419 (10.88)
ln(GNP per capita)	-0.300 (-1.93)	-0.522 (-2.35)	-0.295 (-1.84)	-0.474 (-2.10)
ln(Distance)	0.159 (0.64)	-0.754 (-2.12)	0.158 (0.62)	-0.674 (-1.88)
Tariff	-0.044 (-3.01)	-0.129 (-6.15)	-0.043 (-2.80)	-0.127 (-5.89)
Border	1.936 (3.57)	-0.397 (-0.51)	1.945 (3.50)	-0.242 (-0.31)
Language	0.618 (2.90)	1.089 (3.57)	0.620 (2.86)	1.061 (3.48)
IPRs	-0.075 (-0.49)	-0.319 (-1.44)		
IPRs * (Chemicals and allied products)			-0.081 (-0.43)	-0.516 (-1.96)
IPRs * (Non-electrical ma- chinery)			-0.017 (-0.07)	-0.330 (-1.03)
IPRs * (Electric and electronic equipment)			-0.105 (-0.51)	-0.051 (-0.17)
Adj. R-sq.	0.644	0.717	0.635	0.718
Obs.	85	85	85	85
F-statistic	17.87	24.68	14.27	20.49
Variance	0.638	1.300	0.654	1.294
Covariance	0.292	0.292	0.302	0.302

Source: For Table 1 see Fink, *supra* note 97, at 50-51. (Note: t-statistics in parentheses.) Data on total exports may be found in the U.N. Comtrade database; local sales of U.S. affiliates and intra-firm exports to affiliates are provided by the U.S. Department of Commerce; GNP and GNP per capita are courtesy of the World Bank. Data on geographic distance is from Erzan, Holmes, and Safadi. See REFIK ERZAN ET AL., HOW CHANGES IN THE FORMER CMEA AREA MAY AFFECT INTERNATIONAL TRADE IN MANUFACTURES (World Bank Policy Research Working Paper No. 973, 1993). Industry-specific average most-favored-nation tariff rates were taken from the UNCTAD-TRAINS database. The forty-two represented countries include: Argentina, Australia, Austria, Brazil, Canada, Chile, Colombia, Denmark, Ecuador, Egypt, Finland, France, Germany, Greece, Honduras, Hong Kong, India, Indonesia, Ireland, Israel, Italy, Japan, Rep. of Korea, Malaysia, Mexico, Netherlands, New Zealand, Nigeria, Norway, Peru, Philippines, Portugal, Saudi Arabia, Singapore, South Africa, Spain, Sweden, Thailand, Trinidad and Tobago, Turkey, United Kingdom, and Venezuela. Forty-one observations were excluded because of limitations in the data from the U.S. Department of Commerce. The estimation technique used was ordinary least squares regression.

TABLE 2: INTELLECTUAL PROPERTY RIGHTS AND GERMAN TOTAL EXPORTS AND FDI STOCKS IN FOUR MANUFACTURING INDUSTRIES

Dependent Variable (in natural logarithms)	Model I		Model II	
	Total Exports	Stock of Foreign Direct Investment	Total Exports	Stock of Foreign Direct Investment
Chemicals	2.212 (1.50)	-9.864 (-3.84)	2.038 (1.37)	-9.797 (-3.77)
Non-Electrical Machinery	2.674 (1.81)	-10.820 (-4.21)	2.773 (1.87)	-11.583 (-4.48)
Electrical Engineering	2.094 (1.41)	-9.997 (-3.88)	2.462 (1.64)	-9.193 (-3.51)
Transportation Equipment	2.365 (1.59)	-10.374 (-4.01)	1.534 (1.00)	-9.318 (-3.48)
ln(GNP)	0.540 (9.75)	0.802 (8.32)	0.545 (9.93)	0.804 (8.42)
ln(GNP per capita)	-0.353 (-2.92)	-0.460 (-2.18)	-0.351 (-2.92)	-0.496 (-2.37)
ln(Distance)	-0.472 (-6.83)	-0.390 (-3.25)	-0.473 (-6.92)	-0.388 (-3.26)
Tariff	-0.034 (-3.41)	-0.050 (-2.93)	-0.035 (-3.58)	-0.052 (-3.06)
Border	-0.070 (-0.30)	-0.133 (-0.33)	-0.074 (-0.32)	-0.121 (-0.30)
Language	0.477 (1.50)	0.886 (1.60)	0.481 (1.53)	0.887 (1.62)
IPRs	0.324 (3.16)	-0.026 (-0.15)		
IPRs * (Chemicals)			0.339 (2.36)	0.044 (0.18)
IPRs * (Non-electrical machinery)			0.250 (1.74)	0.312 (1.24)
IPRs * (Electrical engineering)			0.164 (1.14)	-0.194 (-0.77)
IPRs * (Transportation Equipment)			0.539 (3.60)	-0.262 (-1.00)
Adj. R-sq.	0.797	0.560	0.802	0.569
Obs.	96	96	96	96
F-statistic	38.37	13.11	30.56	10.63
Variance	0.294	0.888	0.287	0.872
Covariance	0.072	0.072	0.084	0.084

Source: For Table 2 see Fink, *supra* note 97, at 52-53. (Note: t-statistics in parentheses.) Data on total exports may be found in the U.N. Comtrade database; stocks of German foreign direct investment are provided by the Deutsche Bundesbank. Data sources on explanatory variables are the same as in the U.S. case (see Table 1). The tariff rate for Germany's co-EU members was set to zero. The twenty-five represented countries include: Argentina, Austria, Brazil, Canada, Denmark, Finland, France, Greece, Hong Kong, India, Ireland, Italy, Japan, Rep. of Korea, Malaysia, Mexico, Netherlands, Norway, Portugal, Singapore, Spain, Sweden, Turkey, United Kingdom, and United States. Four observations had to be excluded because of limitations in the FDI data. The estimation technique used was ordinary least squares regression.