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The Externalization of Domestic Regulation: Intellectual Property Rights Reform in a Global Era

PAUL N. DOREMUS*

Intellectual property rights (IPR) issues in the software, biotechnology, and semiconductor industries exemplify the pressure that new technologies and international competition are placing on domestic and international regulatory systems. Traditional patent and copyright rules cannot easily accommodate any of these technologies. At the same time, the high costs of research and development, relative ease of replication, and global markets characteristic of these technologies heighten the importance of both domestic and foreign IPR protection. In the context of rapidly changing technological conditions, borderless markets, and inflexible international regimes, national policymakers face a political dilemma: how to accommodate new technologies at home, encourage similar accommodation abroad, and do both without undermining either long-standing domestic IPR arrangements or the international patent and copyright regimes. This article reviews the different strategies of externalization associated with IPR reform in the software, biotechnology, and semiconductor industries. Variations across these cases indicate that fundamentally different technological, market, and political conditions can lead to different strategies for equilibrating incompatible and highly contested domestic and international regulatory rules.

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I. INTRODUCTION

In 1984, Congress created the first new intellectual property right (IPR) in nearly a century. The legislation, which became the Semiconductor Chip Protection Act of 1984 (SCPA), established a *sui generis* form of IPR protection for semiconductor chip products, a set of rights designed solely for semiconductor technology and statutorily separate from either copyright or patent law. The SCPA is notable not only for its unique contribution to domestic IPR law, but also for its unique approach to coordinating domestic and foreign IPR rules. Instead of abiding by the national treatment provisions of the international patent and copyright regimes, the SCPA links domestic and foreign IPR rules through bilateral reciprocity based on "substantial similarity" to U.S. rules. The rule of national treatment would have required the United States to provide the same IPR terms to foreign as to domestic intellectual property owners in the U.S. market, while accepting whatever IPR terms foreign countries established for semiconductor products in their own markets—which, at the time, were literally nothing. Instead, the SCPA borrowed a more coercive technique from contemporary trade policy: the United States will grant IPR protection for foreign semiconductor products only if the property owner's home country establishes IPR rules similar to those in the SCPA. By most measures, this fairly coercive tactic has been rather successful. Japan negotiated interim reciprocity almost immediately and was followed quickly by several European nations. Numerous countries subsequently negotiated reciprocal protection with the United States.

The primary congressional sponsor of the legislation, Robert W. Kastenmeier, hailed the SCPA as "pav[ing] the way" for innovative policy

1. Semiconductor Chip Protection Act of 1984, Pub. L. No. 98-620, tit. III, 98 Stat. 3347 (codified at 17 U.S.C. §§ 901-14 (Supp. II 1984)). Until the 1984 legislation, the U.S. Congress had not created a new intellectual property right since 1881, when it recognized trademarks as protectable property. As a general term, "intellectual property" encompasses four categories of rights. The two primary categories, patents and copyrights, date to the U.S. Patent and Copyright Acts of 1790 and are rooted in Art. 1 Sec. 8 of the Constitution; the third, trademark protection, dates to 1881; and the fourth, semiconductor mask works, dates to 1984. There are also two somewhat lesser categories of intellectual property which are regulated at the state level: trade secrets and misappropriation of other proprietary information. These are much weaker forms of protection, being based less on property rights per se than on variable notions of fair business practices.

2. The SCPA also allows for reciprocity via multilateral treaty, but the provision is virtually meaningless. No multilateral treaty existed in 1984, and none was expected in the near future—despite the efforts of the World Intellectual Property Organization (WIPO) to create one. To a large extent, the bilateral mechanism established by the SCPA obviated the need for a multilateral treaty.
responses to new information-based technologies that fall outside the range of patent and copyright law, including such important technologies as biotechnology, software, and computer data bases. But instead of taking the newly paved road, Congress and the courts have hesitated and chosen different routes with each of these new technologies. Semiconductor technology has prompted the most radical departure from traditional IPR rules: the United States legislated *sui generis* domestic protection and sought international coordination through bilateral reciprocity. Biotechnology has prompted an entirely different response: U.S. courts have accommodated biotechnology innovations by expanding the scope of patent law, and the United States (along with the European Union and Japan) has sought international coordination through the patent regime. IPR developments for software have shifted substantially over time. In 1980, Congress formally extended copyright protection to software, and did so in a manner consistent with the international copyright regime (even though neither of the international copyright conventions formally recognizes software copyrights). Since the mid-1980s, however, the politics of IPR reform for software have become considerably more complicated. At home, the courts have widened the scope of copyright protection for software and have even accorded patent rights to certain forms of software, developments that have injected considerable uncertainty into U.S. IPR rules for software and further fueled already serious discord within the software industry over the proper scope and form of IPR protection. Abroad, the United States has pursued a series of Section 301 investigations centering on software copyright violations, representing a relatively coercive strategy for coordinating domestic and foreign copyright rules.


4. Software per se is not patentable. The types of software patents that have been granted are for patentable inventions that include software components or software-controlled processes. Diamond v. Diehr, 450 U.S. 175 (1981); In re Alappat, 31 U.S.P.Q. 2d 1545 (Fed. Cir. 1994); In re Lowry, 32 U.S.P.Q. 2d 1031 (Fed. Cir. 1994). *See also* U.S. DEP’T OF COM., PATENT AND TRADEMARK OFFICE, PROPOSED EXAMINATION GUIDELINES FOR COMPUTER-IMPLEMENTED INVENTIONS (1995). Patentability criteria for software-related inventions remain uncertain in many respects. As technological developments blur the distinctions between hardware and software, and between tangible machines and data structures or programs, the scope and applicability of software patents will likely become even more contentious than it is today.

Reforming domestic and foreign IPR rules to accommodate new, information-intensive technologies entails multiple political and economic factors operating at different levels and in different arenas. The technologies are complex, rapidly changing, and not easily accommodated by traditional classes of IPR. The markets involved are global, highly competitive, and integrally linked to other economic sectors. Consequently, the policy dilemma is simultaneously domestic and international, and the policy arena typically spans several sectors and competing political interests. In essence, IPR policy is no longer a matter of domestic regulatory choices alone. Changes in U.S. patent and copyright laws automatically have international implications due to U.S. participation in the international patent and copyright regimes as well as the recently negotiated Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs) in the Uruguay Round of the General Agreement on Tariffs and Trade (GATT). Furthermore, many new information-intensive technologies are created in and used by highly global industries, which not only heightens the importance of having cognate IPR protection in foreign markets but also exposes the domestic reform process to international economic considerations.

This article develops two general analytical propositions for interpreting and explaining how U.S. IPR policy has accommodated technological change, on both domestic and international fronts. First, international economic factors affect domestic IPR reform choices in ways that vary with the market structure of the affected industries. Specifically, different types of markets convey different degrees of trade leverage: the greater the trade leverage, the more likely externalization strategies will be coercive and bilateral; the lesser the trade leverage, the more likely externalization strategies will be cooperative and multilateral.

Second, the style of accommodation and externalization associated with IPR reform must be viewed relative to the domestic political settlement between affected producers and users, whether they are competing producers, dependent users, or even economically unrelated industries (as can occur when existing holders of related property rights may perceive a threat to their interests). Like all forms of regulation, IPR rules embody adversarial political relationships. IPR reform pits contrary societal interests against each other in the courts and in Congress, where public officials seek to balance the interests of intellectual property owners against those of users—not just individual users but also the public at large, which benefits over the long run from the development and dissemination of new knowledge. Consequently, as the
political and economic consequences of IPR reform become more acute for specific domestic actors (which often happens as technologies mature), coalitional conflicts can rise to the degree that IPR reform becomes much more problematic and prone to stalemate. Under conditions of domestic legal uncertainty and coalitional conflict, U.S. policymakers cannot easily pursue coercive externalization strategies.

Although both market structure and domestic politics are highly influential, neither is fully determinative. The politics of IPR reform invariably involve a complicated relationship between international economic pressures and the domestic political dynamic that emerges from the politics of adversarial regulation. The full story of IPR reform is rarely compact, nor is the policy problem straightforward and easily negotiated. In this kind of territory, theoretical propositions are necessarily contingent.

In the broadest sense, then, this article investigates the inexorable pressures of technological change and economic globalization on domestic regulatory policy. In essence, the globalization of commerce and capital has redefined the concept and practice of trade to include international transactions in services as well as global exchanges of knowledge and technology. Many of these new forms of global economic exchange have internationalized the scope and impact of domestic policy. International flows of goods and services as well as technology and capital are increasingly entwined with a range of fundamental domestic regulatory policies, including not only IPR but also investment, taxation, antitrust, environmental, and numerous other forms of regulation. The very nature of these relationships demands an interdisciplinary analytical perspective because they inherently involve law, public policy, foreign economic policy, and international political economy. In essence, one needs new analytical tools and theoretical frameworks to better understand the relationship between technological change, international competition, and domestic regulatory policy during a period that some now call “the global era.”

The following section begins this analytical agenda by introducing the cases and describing the two fundamental dilemmas associated with IPR in advanced information-based industries. First, for innovators, obtaining adequate IPR protection is increasingly both important and uncertain. Second, for policymakers, the coordination of domestic and foreign IPR rules is simultaneously necessary yet difficult to achieve through traditional routes.

In each of the three cases considered in this article—software, biotechnology, and semiconductors—the United States has sought to externalize domestic regulatory reform in substantially different ways, for reasons that are explored in Part III.

II. NEW TECHNOLOGIES, NEW IPR RULES, AND DIFFERENT STYLES OF EXTERNALIZATION

This article examines U.S. IPR reform by comparing three case studies involving the software, biotechnology, and semiconductor industries. Each of these industries produces goods whereby the value of the information content far exceeds the value of the physical product on which the information is stored; indeed, information itself is the primary product. The cases are further similar in that they each involve leading-edge, information-intensive industries that are highly international, intensely competitive, and rapidly changing. Moreover, each involves technologies that confound the two main classes of intellectual property—patents and copyrights.

Despite these fundamental similarities, each case represents a different process of domestic accommodation and a different style of externalizing domestic regulatory reform. Software has been granted copyright protection and limited patent protection, while the externalization strategy has varied over time; biotechnology has been accommodated through expanded patent rights that have been cooperatively externalized through multilateral channels; and semiconductor technology has been granted a sui generis IPR accompanied by coercive externalization conditions (see Table 1). In short, the analytical problem can be approached with the classic method of comparing similar cases with divergent outcomes.

7. Intellectual property law for biotechnology is unique in that the extension of property rights to life forms invokes ethical and moral issues that often conflict with market development and competitiveness concerns. See U.S. CONGRESS, OFFICE OF TECHNOLOGY ASSESSMENT, PATENTING LIFE (1989).
Table 1: Varying Styles of Externalization

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<thead>
<tr>
<th></th>
<th>Cooperative Externalization</th>
<th>Coercive Externalization</th>
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<tr>
<td>Software, pre-1985</td>
<td>Through multilateral channels</td>
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<tr>
<td>Software, post-1985</td>
<td>Through bilateral and multilateral channels</td>
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<tr>
<td>Biotechnology</td>
<td>Through multilateral channels</td>
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<tr>
<td>Semiconductors</td>
<td>Through bilateral channels</td>
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In the United States, the traditional justification for providing IPR protection in any industry is based on two simple but powerful assumptions: first, that innovators are motivated by the prospect of reward; and second, that society benefits from innovation by virtue of the economic and cultural growth that ensues. Given these assumptions, the state grants innovators limited monopoly rights in exchange for making the innovation public. Innovators benefit from the economic power of the monopoly, and society benefits from the generation and dissemination of new ideas. By this logic, inadequate IPR protection eviscerates the incentive to innovate, which over the long run dampens economic growth and cultural advancement.

New information-intensive technologies are particularly vulnerable to inadequate IPR protection because most can be disseminated very quickly and reproduced relatively easily (and at a fraction of the cost of development). Semiconductor chips can be reverse-engineered to decipher their design, software products can be readily copied and decompiled to reveal their

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structure, and biotechnology products can often be reproduced or readily imitated. Moreover, the type of intellectual property characteristic of these technologies cannot be protected through alternative channels, such as trade secrets, because the sale of information products usually reveals the commercially relevant proprietary information. In addition, the new information industries can only rarely rely on lead time advantages to recoup research and development (R&D) costs. R&D costs for these technologies have skyrocketed, product cycles have shortened, and competitors have improved their ability to rapidly replicate and market new technologies at a cost equal to, if not substantially lower than, the costs of innovation. When faced with imitative competitors who did not bear the considerable costs of R&D, innovative firms lose the ability to price their products competitively. Under these conditions, inadequate IPR protection can stifle innovation by increasing the uncertainty and risk of R&D investment.

However great the need, though, it is extremely difficult to establish and enforce IPR protection for these types of technologies. The root problem is that information-intensive technologies tend to confound the criteria which differentiate the main classes of intellectual property. Semiconductor and software technology have characteristics that cross the borders of copyright and patent law; biotechnology products by no means look like the industrial inventions for which patent law was designed. In addition, new and powerful reproduction and transmission technologies—such as advanced photocopiers, audio and video recording devices, computers, electronic storage and retrieval systems, satellites, and cable—have created unparalleled domestic and international enforcement problems.

Herein lies the dilemma for innovators in the new information technologies: their products are extraordinarily expensive to create yet comparatively cheap to duplicate and disseminate, which makes adequate IPR protection simultaneously more valuable and more problematic. The dramatic costs of inadequate IPR protection have created political pressure for IPR reform at home and abroad. In addition to the costs of lost markets and legal uncertainties at home, U.S. intellectual property owners have been absorbing increasingly large financial losses from inadequate intellectual property protection abroad. Estimates reach $61 billion a year, which alone captures
The economic and political significance of IPR protection is magnified by the wide-ranging economic relevance of the new information technologies, as their relative economic health and innovative capacity reverberate throughout such critical manufacturing and service industries as telecommunications, microelectronics, pharmaceuticals, and finance.

The natural difficulty of adjusting IPR rules to accommodate the new information technologies is exacerbated by the inherently international character of the industries involved. Unlike traditional trade in goods, the commercial development and success of intellectual property products frequently depends on foreign laws and enforcement actions. For all practical purposes, the U.S. government simply cannot protect the IPR of its citizens through domestic policy alone. To strengthen the effective protection available to American intellectual property owners, the U.S. government must also pursue stronger foreign and/or international rules and enforcement practices.

For over a century, the primary channels for coordinating domestic and foreign IPR rules have been the international patent and copyright regimes. Each regime is a formal system of rules created by treaty and administered by an international organization. Neither regime establishes rights independently; rather, they adjust in the wake of domestic change and gradually harmonize the divergent patent and copyright rules of member states. IPR rules for new technologies generally develop within the countries in which the technology emerged, usually through an expansion or modification of either patent or copyright laws. The international patent and copyright regimes then harmonize domestic-level adjustments as they develop.

Most of the new information-based technologies emerged in the United States, and the U.S. IPR system has often been the first to adapt to these

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9. Pinpointing monetary losses resulting from inadequate IPR protection is notoriously difficult, for it requires estimates of reduced profit margins, domestic and foreign sales displaced by infringing goods, damage to corporate reputations, and business foregone for lack of adequate property rights. The first comprehensive study of IPR-related business losses was conducted by the International Trade Commission (ITC) in 1988; although problematic in many respects, their estimate that $43 to $61 billion is lost annually remains a widely cited figure. U.S. INT'L TRADE COMM'N, PUB. NO. 2065, FOREIGN PROTECTION OF INTELLECTUAL PROPERTY RIGHTS AND THE EFFECT ON US INDUSTRY AND TRADE (1988).

technologies. Some IPR regimes have responded to particular technologies more quickly than the United States, which appears to be the case with copyright protection for computer databases in the European Union. Other nations have avoided IPR reform altogether, whether for databases or any other new information technology. Among those national IPR regimes that have responded, there are considerable differences and inconsistencies in approach and outcome.

The uncoordinated and divergent development of domestic IPR rules magnifies the natural difficulty of coordinating IPR reform through the international patent and copyright regimes. Despite years of effort, the WIPO has gotten little support for its proposed multilateral treaty to protect semiconductor mask works; neither of the copyright conventions explicitly recognizes software copyrights, although many nations are treating software copyrights in a manner consistent with the regime; and the WIPO's consideration of biotechnology patents lags considerably behind domestic developments in the United States, the European Union, and Japan.

Herein lies the dilemma for U.S. policymakers facing domestic pressure for IPR reform at home and abroad: at the very time that international coordination is most needed, it is simultaneously most unlikely. In the context of rapidly changing technologies, international markets, and inadequate international regimes, national policymakers must decide how to adjust domestic policy in a manner that appropriately accommodates the new technologies at home and encourages similar accommodation abroad, preferably without undermining the otherwise useful international IPR regimes.

Different strategies of externalization carry different political implications. As is the case in trade policy generally, a coercive approach to international IPR reform could undermine foreign support for the particular policy goals and perhaps damage the prospects for international cooperation in other areas. The choice of forum—multilateral or bilateral—has equally wide-ranging implications. The international patent and copyright regimes may move slowly, but they do provide a sure and predictable method of coordinating domestic and foreign IPR rules, which facilitates investment in technologies that are financially sustainable only in global markets, as is generally the case
in information-intensive technologies. In addition, the international agreements help to disseminate new technology globally by reducing the transaction costs of obtaining and enforcing exclusive rights in different countries. Bilateral strategies may be quick and effective in the short term. However, in the long run, they can introduce policy inconsistencies, create interpretive difficulties for domestic businesses, increase administrative complexity, and otherwise raise the transaction costs of obtaining IPR abroad (as firms are compelled to seek intellectual property protection for the same product in several countries with different standards and procedures). If it circumvents the regimes, the United States could lose its ability to influence how other nations and the international regimes accommodate the new technologies and protect U.S. intellectual property products in general.

The broad political stakes and serious economic consequences of IPR reform have exacerbated major cleavages in the world economy, cleavages which not only set rich countries against poor but also set rich countries against each other. Many countries do not even share the basic normative underpinnings of western IPR concepts. For example, copying in traditional Korean society is an expression of honor, not an infringement of an inherent ownership right. Other countries object to U.S.-style IPR protection on straightforward economic grounds. Brazil, for example, has long denied IPR protection for U.S. pharmaceutical products on the dual grounds that doing so would lock Brazil into technological dependency and would also create an enormous public health problem by making much needed pharmaceutical products prohibitively expensive. Given these conditions, it is of little surprise that the United States has pursued high-profile bilateral trade disputes designed to force individual countries to establish IPR rules consonant with the IPR regimes (at least) and U.S. IPR rules (at best). The Reagan Administration initiated this tactic and secured major de jure IPR revisions in Korea, Taiwan, Singapore, Indonesia, Malaysia, Mexico, and Thailand. The Bush and Clinton Administrations have carried the agenda forward, pressing bilateral IPR cases

11. Because most markets for information-intensive products are global, the availability of foreign IPR protection can significantly affect the R&D investment choices and market development strategies of multinational firms.


with China, Brazil, and other countries, and raising the political sights of the United States to *de facto* as well as *de jure* IPR protection.  

Although most of the advanced industrial states have IPR regimes with similar normative underpinnings, there are nonetheless substantial conflicts between them over the proper scope and terms of IPR protection. For instance, the whole issue of designing IPR protection for semiconductor mask works developed largely in response to powerful U.S. semiconductor manufacturers' claims that Japanese copying of U.S. innovations led to the rapid and devastating loss of the 64K DRAM market in the early 1980s. In a different vein, large U.S.-based software producers have bitterly battled several European countries, accusing them—all net importers of software—of exploiting loopholes in the Berne Convention to avoid paying U.S. copyright royalties. U.S. software producers, led by the Business Software Alliance, also have turned to fairly dramatic legal efforts to combat corporate and residential copying within the member countries of the Organisation for Economic Co-operation and Development (OECD), which they estimate deprives them of several billion dollars annually in sales revenue. IPR rules in many OECD countries remain unclear or unsettled on software patents and decompilation rights as well as on whether certain categories of biotechnology are patentable. 

At a time when most OECD economies are shifting toward services and information-based products, the problem of inadequate IPR protection has taken on profound significance. Information and information-based products and services are not just intrinsically valuable commodities; they also affect productivity and competitiveness across numerous sectors. The character of domestic and international IPR rules for new information-based technologies

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15. The accuracy of this claim is a matter of dispute, but there is no denying that U.S. semiconductor producers made the claim frequently and were rarely questioned about it in policy circles.

can profoundly alter transborder data flows, trade in information products and services, and trade in a wide range of information-intensive industries. Given the central position of information-based technologies in the economic food chain, the nature of IPR reform could strongly affect overall levels of innovation and growth in the post-industrial service economies: inadequate IPR protection raises the uncertainties and risks of conducting R&D, which slows the pace of innovation and consequently could eviscerate the long-term competitiveness of the economy's most critical growth sectors.

Serious political attention to the linkages between IPR protection, innovation, and competitiveness emerged in the early 1980s, congruent with a sense of impending crisis over the intractable trade and budget deficits as well as the comparative decline in U.S. competitiveness in general. The profound consequences of inadequate IPR protection became an important topic not just in trade circles but also in rather high political circles, as reflected in the 1985 report on the "new reality" of global competition conducted by the President's Commission on Industrial Competitiveness:

Technological innovation is a mainstay of the American economy. It is the foundation of our economic prosperity, our national security, and our competitiveness in world markets. Yet, despite its importance, technological innovation has not always been optimally nurtured in America. One weakness in U.S. policy has been the lag between the advances in technology and the adaptations of U.S. intellectual property law to protect them. . . . If ownership rights are not improved domestically and internationally, the United States will limit its innovative capability and, consequently, its national economic and social development for generations to follow. At a period when other nations are focusing on ways to enhance their technological base, the United States could well be left behind.17

This concern with the implications of IPR rules for national competitiveness has not been purely rhetorical. U.S. courts have been

according stronger proprietary rights to intellectual property owners,\textsuperscript{18} Congress has explicitly linked trade sanctions to foreign IPR conditions in the 1984 and 1988 Trade Acts,\textsuperscript{19} and the Executive Branch has pursued foreign IPR reform through Section 301 and related bilateral tactics.\textsuperscript{20}

Such political attention to the link between IPR and international competitiveness illustrates just one way in which the United States has been grappling with profound changes in the international economy, changes that have imposed new and distinct pressures upon domestic policy establishments. The globalization of commerce and capital has redefined the concept and practice of trade to include international transactions in services as well as global exchanges of knowledge and technology. Many of these new forms of global economic exchange have internationalized the scope and impact of domestic policy. International flows of goods and services as well as technology and capital are increasingly entwined with a range of domestic regulatory policies, including not only IPR but also investment, tax, antitrust, environmental, and other forms of regulation (see Table 2).

\textsuperscript{18} The evidence that U.S. IPR rules have shifted in favor of proprietary rights is compelling and widely accepted. For one, the scope of intellectual property protection has been extended to previously unprotected objects (such as life forms and mathematical algorithms). In addition, U.S. courts have been ruling increasingly in favor of intellectual property owners; most often noted is the clearly pro-patent decision record of the U.S. Court of Appeals for the Federal Circuit (CAFC), which was established in 1982 to consolidate and systematize patent law. On the CAFC, see Rochelle Cooper Dreyfuss, \textit{The Federal Circuit: A Case Study in Specialized Courts} 64 N.Y.U. L. Rev. 1, 26-30 (1989). According to one critic, the CAFC has decided in favor of patent holders in over 60% of the cases heard; overall, “the CAFC has greatly strengthened the presumption of patent validity and upheld royalties ranging from 5 to 33 percent.” Brian Kahin, \textit{The Software Patent Crisis}, 93 TECH. REV. 57 (1990).

\textsuperscript{19} During the 1980s, Congress passed several legislative provisions that allowed trade retaliation for inadequate IPR protection in foreign markets. \textit{See} Caribbean Basin Economic Recovery Act of 1983, 26 U.S.C.A. § 6015, \textit{repealed} (linking foreign aid to IPR protection); Trade and Tariff Act of 1984, 19 U.S.C.A. § 1654 (explicitly linking GSP preferences to the protection of U.S. IPR and also making foreign IPR protection subject to direct trade retaliation through the Section 301 provisions of the Trade Act of 1974, \textit{supra} note 5 (which is the principal statutory basis for addressing unfair or discriminatory foreign government practices that burden or restrict U.S. commerce—such as inadequate IPR protection.)); Omnibus Trade and Competitiveness Act of 1988, \textit{supra} note 5 (Special 301 provisions require the U.S. Trade Representative to identify “priority” foreign countries that deny adequate and effective IPR protection and/or fair and equitable market access for firms that rely on IPR protection and countries placed on this list subsequently become the focus of increased bilateral attention).

\textsuperscript{20} As noted above, the USTR has successfully achieved IPR reform through bilateral trade disputes with Korea, Taiwan, Singapore, Indonesia, Malaysia, Mexico, China, Thailand, and others. \textit{See} sources cited \textit{supra} notes 12, 13, & 14.
## Table 2: The Intersection of Domestic Regulation and International Competition: Relevant Policy Arenas

<table>
<thead>
<tr>
<th>Policy Arena</th>
<th>Policy Instruments</th>
<th>Affected Industries</th>
</tr>
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<tbody>
<tr>
<td>Intellectual property rights</td>
<td>Patent, copyright, and trademark rules and enforcement</td>
<td>Semiconductors, software, biotechnology, recording and publishing, pharmaceuticals, and others</td>
</tr>
<tr>
<td>Foreign investment</td>
<td>Ownership limits; local content rules; licensing and other technology transfer rules</td>
<td>Global manufacturing and service industries</td>
</tr>
<tr>
<td>Taxation</td>
<td>Investment credits; R&amp;D credits; depreciation rules; transfer pricing</td>
<td>Global manufacturing and service industries</td>
</tr>
<tr>
<td>Antitrust</td>
<td>Merger and acquisition rules and enforcement; R&amp;D consortia; traditional antitrust (pricing; market concentration)</td>
<td>Oligopolistic industries, such as aerospace, semiconductors, automotive, telecommunications, and—perhaps—software</td>
</tr>
<tr>
<td>Environmental regulation</td>
<td>Emissions and other output rules; &quot;green&quot; standards; take-back rules; design conventions</td>
<td>Refrigerants, automotive, electronics, forestry, utilities</td>
</tr>
<tr>
<td>Standards</td>
<td>Product quality, process and interoperability controls, health and safety</td>
<td>Electronics, data processing, computers, software, biotechnology</td>
</tr>
<tr>
<td>Technology policy</td>
<td>Direct and indirect forms of government R&amp;D support; sector targeting; public/private alliances; procurement</td>
<td>Semiconductors and electronics, aerospace, instruments, optics, advanced materials, information technology</td>
</tr>
</tbody>
</table>
For the most part, the trade implications of domestic regulatory policies are not suitably addressed by contemporary international trade institutions. The dominant postwar international institution for governing trade, the GATT, applied only to trade in goods and consequently left an increasingly large part of international economic relations uncovered. Largely as a result of U.S. pressure, the Uruguay Round sought to expand the GATT's scope by negotiating three agreements covering the "new trade issues"—the General Agreement for Trade in Services (GATS), the Agreement on Trade-Related Investment Measures (TRIMs), and the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs).

At root, the Uruguay Round strategy of expanding and harmonizing international IPR rules through the GATT/WTO represented an attempt to thoroughly revise the long-standing rules of engagement structured by the international patent and copyright regimes. The TRIPs agreement may strengthen IPR protection worldwide and could change the rules of international coordination through the enforcement power of trade retaliation. However, the TRIPs agreement builds upon minimal rules in the existing IPR regimes and does not address the manifold problems associated with accommodating new information-intensive technologies.\footnote{21. As stated by the OECD, "A more fundamental approach appears to be needed in order to devise internationally consistent rules that are aligned more closely with the characteristics of contemporary knowledge generation, invention and diffusion." OECD, Science and Technology Policy: Review and Outlook 1991, 93 (1992).}

In addition to having a narrow scope, the TRIPs mechanism has the additional liability of being excruciatingly slow; it is far too cumbersome to accommodate the rapid rate of technological change and economic development in new information-based industries.

U.S. industry and the U.S. government consequently have been left to seek alternative strategies for promoting foreign IPR reform. The primary strategic choice is whether to remain within the confines of the international IPR regimes, which in essence is a choice between multilateralism and bilateralism. The United States has opted for a bilateral strategy with regard to semiconductor mask works, but has retained an essentially multilateral strategy with biotechnology and has used both mechanisms in software.\footnote{22. The style of externalization in software may be confusing at first glance. Although the United States has used coercive tactics such as Section 301 investigations, the goal has been to win foreign adherence to the international copyright regime; accordingly, the strategy is essentially multilateral, despite the aggressive attitude.} Whatever the choice of forum, domestic reformers can pursue foreign accommodation either

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22. The style of externalization in software may be confusing at first glance. Although the United States has used coercive tactics such as Section 301 investigations, the goal has been to win foreign adherence to the international copyright regime; accordingly, the strategy is essentially multilateral, despite the aggressive attitude.
coercively or cooperatively. The most cooperative strategy is to facilitate the regime’s harmonization process through international conferences, cross-national policy reform discussions, and so forth—as has primarily been the case with regard to biotechnology patent rules. Coercive tactics are somewhat broader in range—the United States can encourage foreign adherence to regime rules through “carrot and stick” tactics such as the reciprocity provisions of the SCPA, or it can use even more forceful tactics such as the threat of trade retaliation (as has been the case in software).

In short, the United States has used diverse styles of externalization to accommodate IPR reform in new information-intensive technologies. The following section begins the process of interpreting these differences, developing lines of inquiry based on the particular market structure of the affected industries as well as the political character of IPR regulation.

III. EXPLAINING STYLES OF EXTERNALIZATION: PUBLIC POLICY IN THE CONTEXT OF INTERNATIONAL COMPETITION

Until relatively recently, IPR policy and trade policy were entirely separate arenas. Each had its own set of domestic laws and international agreements, administered by entirely distinct agencies and organizations whose efforts rarely required coordination. In their operations abroad, U.S. corporations generally dealt with IPR matters on local terms, negotiating agreements with individual governments on a case-by-case basis. However, in the late-1970s and early-1980s, a number of changes in the international economic environment rendered particular domestic industries increasingly vulnerable to inadequate IPR protection abroad. That vulnerability led to private-sector activism that ultimately dissolved the political and institutional barriers between international trade and domestic IPR policy.

The first U.S. firms to target inadequate foreign IPR protection were industries sensitive to trademark protection. In fact, the very idea of linking IPR and trade dates to 1978, when the Levi Strauss Corporation began a concerted effort to combat foreign counterfeiting of their trademark blue jeans. Levi Strauss’ first step was to strengthen border sanctions; it lobbied Congress to add seizure and forfeiture provisions to Section 1526 of the Tariff Act of 1930, and Congress promptly obliged in the Customs Procedural Reform and
Simplification Act of 1978. In the spring of 1978, Levi Strauss went one considerable step further. Encouraged by the adoption of "codes of agreement" during the Tokyo Round of GATT negotiations, the company banded together with a group of trademark-sensitive firms and pressed for an anti-counterfeiting code. The Office of the U.S. Trade Representative (USTR) took up the cause and, despite introducing the initiative very late in the GATT negotiations, nearly succeeded. Although unsuccessful in the Tokyo Round, Levi Strauss and the newly created International Anti-Counterfeiting Coalition (IACC) had set a powerful precedent: they had swung U.S. trade policy behind the idea of linking IPR conditions to trade, and had firmly established the desirability of a new international mechanism for coordinating national IPR rules through the GATT.

By the early-1980s, some of the largest manufacturers of industrial and leading-edge high technology products joined the trademark industries in demanding improved foreign IPR protection. The pressure for foreign IPR reform became more widespread and more urgent as the U.S. economy and international trade in general became increasingly oriented around products and services with a high intellectual property content. In addition, inadequate IPR protection abroad became more costly as new product generations commanded higher and higher R&D outlays at the same time that relatively inexpensive reproduction technologies emerged.

These economic and technological trends brought diverse industries—ranging from automotive products and agricultural chemicals to pharmaceuticals and electronics—into the IPR debate. For the most part, these industries have been interested in establishing foreign IPR rules equivalent to those in the United States, or at least to those mandated by the international patent and copyright regimes. Those ends alone have proven to be challenging.

For new information-based technologies, the problem of achieving adequate IPR protection has been doubly vexing, for these technologies do not easily fit within existing categories of IPR. For example, domestic IPR protection for the semiconductor, software, and biotechnology industries did not take shape until relatively recently. In 1980, Congress extended the Copyright Act of 1976 to software products, although the scope and form of


that protection has remained highly contentious. The Supreme Court set the precedent allowing patents for biotechnology products in 1980, with the landmark *Diamond v. Chakrabarty* decision,25 and Congress created a *sui generis* form of industrial property right for semiconductor mask works in 1984.

Because these technologies are so complex and unusual, and because the industries that deploy them are largely international in scope, the politics of adjusting domestic IPR rules invariably coexists with political pressure for foreign IPR reform. The dual character of IPR reform in these technologies suggests two lines of inquiry regarding externalization strategies. First, because the entire problem of accommodating the new information technologies emerged during a period of renewed political attention to innovation and competitiveness, strategies of externalization are likely to be shaped by the pressures of international competition. Second, because these technologies have required fundamental adjustments to domestic IPR rules, strategies of accommodation and externalization are also likely to be shaped by the domestic political bargaining involved in creating and regulating new forms of IPR. The interpretation and explanation of variances in externalization strategies, in other words, requires a multi-level analysis: the first stage involves outlining fundamental variances in market structure and associated levels of trade leverage, while the second stage situates domestic political conditions within that broader market context.

In terms of market structure, the semiconductor, software, and biotechnology industries are each relatively new and are based on rapidly changing, information-intensive technologies. In addition, the markets for each are global in the sense that products are developed, produced, and sold on an international scale. However, neither condition is uniform. Technology varies in terms of its level of development (developing or mature), and markets vary roughly in terms of the product cycle (market creation, market expansion, and market saturation). Accordingly, competition involving emerging technologies in new markets tends to center on R&D and market creation—that is, competition is a positive sum game. Competition involving mature technologies in highly developed markets tends to be a more contentious battle for market share; as technology disperses and markets become saturated, competition invariably becomes a zero-sum game. Intermediate markets--

highly commercialized but not saturated—tend to be characterized by competition for market expansion.

By extension, the political and economic implications of IPR reform should vary across different technological and market circumstances. For instance, in very developed markets involving mature technologies (like semiconductors), IPR reform will tend to have immediate implications for competition over market share. In new markets involving developing technologies (like biotechnology), IPR reform will have more long-term implications for economic competitiveness.

The three industries assessed in this article nicely illustrate the relationship between market structure and the political salience of IPR reform. At the time of the SCPA, the commercial implications of IPR reform in semiconductors were sobering. Large U.S.-based semiconductor firms had been steadily losing market share to Japanese competitors, and attributed at least part of that loss to inadequate IPR protection. The implications of IPR reform in software have been significant but, arguably, less dramatic. U.S. software firms clearly dominate world markets, such that inadequate IPR protection threatens not their very existence (as semiconductor producers characterized the stakes for themselves) but instead their ability to compete “fairly” in domestic and foreign markets. The commercial implications of IPR reform in biotechnology may also be significant but are less compelling than in semiconductors or software. Since the technology remains largely precommercial, IPR reform primarily affects the potential for developing new products and markets. Consequently, IPR reform does not provoke immediate trade conflicts.

In short, the different structural features of each market convey a different degree of potential trade leverage for IPR reform. The semiconductor industry has had a high degree; the software industry, a moderate yet increasing degree; and the biotechnology industries, a relatively low degree. These variances

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26. The character of IPR rules tends to vary with the technology's level of development. The scope of IPR applied to developing technologies often is rather broad, and the terms generous; as knowledge expands and the technology matures, the scope narrows and the terms become more specific and restrictive. This pattern is generally more true of patents than copyrights, although the extension of copyrights to software (and perhaps other utilitarian articles) tends to follow this pattern.


generate the hypothesis that trade leverage can shape IPR reform in particular ways: the higher the trade leverage, the more likely that externalization strategies will be coercive and bilateral; the lower the trade leverage, the more likely that externalization strategies will be cooperative and multilateral.

However, although trade leverage may be highly influential, it is rarely determining. IPR rules embody a fundamental domestic political tension. On the positive side, IPR provide financial incentives to individual innovators, incentives needed to promote creative activity and, over the long run, maximize societal welfare through technological and economic growth. On the negative side, IPR grant economic and legal powers to innovators that, if too encompassing, can be used to extract excessive profits and restrict competition—which, over the long run, would damage societal welfare. IPR, in short, are a form of adversarial regulation. IPR rules distribute costs and capabilities among competing groups that are in a zero-sum relationship (as opposed to policies that regulate individuals or groups for their own individual or collective benefit).

In essence, IPR rules represent a state-sanctioned distribution of power, a form of social contract designed by the government to balance the rights of innovators and users and to further society’s interest in economic and cultural innovation. IPR reform potentially affects not only the interests of prospective rights holders and related users, but also the interests of long-standing rights holders, whether or not they are in economically related arenas. Accordingly, one would expect the politics of IPR reform to be shaped considerably by the classic organizational and associational characteristics of affected groups—their structure (concentrated or dispersed), their cohesiveness (cooperative or conflictual), and the general nature of the policy cleavage (within an industry or between industries).

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29. This policy characterization is based on Lowi’s policy typology, which was first outlined in Theodore J. Lowi, *American Business, Public Policy, Case-Studies, and Political Theory*, 16 World Politics 677 (1984). On the definitions of and distinctions among distributive, regulatory, redistributive, and constituent policies, see Theodore J. Lowi, *Four Systems of Policy, Politics, and Choice*, in Public Administration Review 298 (1972). As Lowi noted, adversarial regulation can involve either behavior that is intrinsically undesirable (e.g. crime) or behavior that is undesirable only in its consequences (e.g. monopolies); the critical condition is that one set of actors is being regulated to protect or enhance the interests of an opposing set. IPR policy, along with similar forms of economic regulation (such as antitrust regulation) and social regulation (such as environmental and civil rights regulation), clearly fits in the category of behavior that matters because of its consequences. Wilson, to the contrary, treats social regulation and regulation of competitive practices as different classes; his differentiation is based more on the issues at stake than the fundamental relationships characteristic of adversarial regulation. See *The Politics of Regulation* (James Q. Wilson, ed. 1980).
Of course, the problem of adapting IPR rules to the new information technologies is not simply a domestic matter. Choosing how to regulate private gain and public welfare in the new information-based technologies automatically assumes an international dimension, because private gain involves foreign IPR rules and public welfare involves international technologies in international markets. The global character of the new information technologies exposes the politics of adversarial regulation to the considerable pressures of trade and international competition.

In sum, the politics of IPR reform invariably involves a complicated relationship between international economic pressures and the domestic political dynamic that emerges from the politics of adversarial regulation. The complex role and significance of variances in market structure and domestic policy dynamics assumes full force when the three cases are viewed as a set. The next section provides a brief and highly stylized explanatory overview of the cases, illustrating the significance of a multilevel analysis of market structures and political dynamics. Building theory around this type of research question is, however, a highly contingent venture: the technologies and industries are complex and rapidly changing, the pressures on domestic and international rule systems are multitudinous and unrelenting, and the legal and political responses to these pressures at home and abroad are multifaceted and usually uncoordinated. These circumstances are certainly less conducive to theory-building than the comparatively static international environment of past decades. Then again, the research question approaches one of the most politically and theoretically salient needs of our times—how to grapple with the profound impact of technological change and the globalization of capitalism on domestic policy choices and the process of international policy coordination.

IV. IPR REFORM IN SEMICONDUCTORS, SOFTWARE, AND BIOTECHNOLOGY

The software, biotechnology, and semiconductor industries are fundamentally similar in that they each involve leading-edge, information-intensive industries that are highly international, intensely competitive, and rapidly changing. In addition, each involves technologies that confound the two main classes of intellectual property—patents and copyrights. Despite these fundamental similarities, each industry has displayed a different process of domestic accommodation and a different style of externalizing domestic
regulatory reform. These variances conform to fundamental differences in the interaction between structural market conditions and the political dynamics associated with adversarial regulation (see table 3).
### Table 3: Explaining Different Styles of Externalization: Market Structure and Domestic Politics

<table>
<thead>
<tr>
<th>MARKET STRUCTURE</th>
<th>Software, pre-1985</th>
<th>Software, post-1985</th>
<th>Biotechnology</th>
<th>Semiconductors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technological development</td>
<td>Developing; low commercialization</td>
<td>Intermediate, highly commercialized</td>
<td>Developing; low commercialization</td>
<td>Mature, highly commercialized</td>
</tr>
<tr>
<td>Competition</td>
<td>Positive sum, over market-creation</td>
<td>Mixed sum, over market expansion</td>
<td>Positive sum, over market-creation</td>
<td>Zero-sum, over market share</td>
</tr>
<tr>
<td>Trade leverage</td>
<td>Low (negligible trade volume)</td>
<td>Mid to high (increasing export sensitivity; overseas expansion threatened.)</td>
<td>Low (negligible trade volume)</td>
<td>High (both domestic and export market shares contested)</td>
</tr>
<tr>
<td>DOMESTIC POLITICS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry organization</td>
<td>Dispersed, cooperative</td>
<td>Dispersed, increasingly conflictual</td>
<td>Dispersed, cooperative</td>
<td>Concentrated, cooperative</td>
</tr>
<tr>
<td>Legal-regulatory conflict</td>
<td>Low</td>
<td>Mid to high</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Adversarial coalitions</td>
<td>Extra-industry</td>
<td>Intra-industry</td>
<td>Extra-industry</td>
<td>Inter-industry</td>
</tr>
<tr>
<td>STYLE OF EXTERNALIZATION</td>
<td>Cooperative, multilateral</td>
<td>Coercive, bi/multilateral</td>
<td>Cooperative, multilateral</td>
<td>Coercive, bilateral</td>
</tr>
</tbody>
</table>
In the case of the software industry, the shift from cooperative multilateralism to a more coercive style of externalization with both bilateral and multilateral elements conforms to fundamental changes over time in the industry's market structure, the increasingly complex character of the technology, and the gradual evolution of coalitional factionalization.

In the late 1970s, software technology was relatively new, retail markets were only developing, and competition centered primarily on creating new products. The very extension of copyright protection to computer software in the Copyright Act of 1980 was intended to encourage the growth of independent software producers and reinforce the open and fluid competitiveness characteristic of the software industry in the late 1970s. By design, the 1980 Copyright Act amendments set in motion a gradual harmonization process that encouraged similar adjustments in member nations.\textsuperscript{30} Between 1980 and 1985, other nations moved toward copyright protection for computer programs to a strong enough degree that WIPO abandoned its effort to draft an international treaty for IPR in software. During this period, cooperative multilateralism was a viable and productive externalization strategy. Other nations were moving in the same direction, and cross-national differences in copyright protection had not yet begun to create significant economic problems.

In the mid-1980s, however, international trade and competition in the software industry changed dramatically, which in turn encouraged an entirely different approach toward equilibrating incompatible national IPR laws. As the software industry internationalized and shifted toward market-expansion competition, U.S. firms became increasingly exposed and sensitive to foreign counterfeiting and other difficulties caused by cross-national differences in IPR protection for software. Under these conditions, the software industry needed quick, widespread adaptation of copyright laws to accommodate software as a literary work. The best route for gaining widespread change was through the long-standing international copyright regime. However, the regime's harmonization processes are slow, its minimum rules are quite weak, and it entirely lacks enforcement power. Consequently, the U.S. software industry created a powerful alliance with other copyright-sensitive industries and pressed for wholesale reform of the multilateral copyright regime.

Encouraged by the near passage of an anti-counterfeiting code in the Tokyo Round, the coalition pressed the U.S. government for what eventually became the TRIPs proposal in the Uruguay Round, which essentially strengthened the minimal copyright terms provided by the Berne Convention and added the enforcement power of trade retaliation. In the face of strong early opposition to this strategy, the copyright coalition encouraged the use of Section 301 tactics to develop both the substantive basis and the political support for the TRIPs program, as well as to provide a fail-safe in case the Uruguay Round might collapse. From the outset, the USTR treated the bilateral Section 301 cases and the multilateral TRIPs agreement as symbiotic exercises; the bilateral cases were designed to convey U.S. intentions and gradually develop a web of agreements that would substantively support the multilateral policy goals of the TRIPs agreement.

In essence, the externalization strategy of coercive multilateralism grew out of the high and increasing degree of internationalization in the software industry and the unusual distribution of market share. The size and dominance of the U.S. market has provided a platform from which U.S. software firms have been able to compete in foreign markets. As U.S. software firms internationalized, they became increasingly sensitive to export market access; in this context, inadequate IPR emerged as a serious market barrier in numerous foreign countries. In effect, the burgeoning export trade sensitivity of U.S. producers created an imperative for rapid and widespread international IPR reform. The international copyright regime held out the best prospect for achieving widespread reform, although the pace of adjustment was excruciatingly slow. Section 301 offered a channel for accelerating the process, and the software industry had sufficient internal coherence, external alliances, and political clout to see its preferred strategy implemented. The result was coercive externalization, through both bilateral and multilateral channels.

In merely five years, the United States took a relatively arcane regulatory issue, legitimized its treatment as an important trade issue, and catalyzed what quickly became an international consensus on substantive copyright protection for computer software. Granted, several countries may have adopted a similar copyright solution either for internal reasons or to remain consistent with the

32. Id.
international copyright regime. Nevertheless, numerous other countries (especially in the developing world) would not have moved in that direction were it not for the coercive element of the U.S. strategy. Indeed, the United States continues to exert pressure of this sort in its quest to improve enforcement conditions in several countries.

Although impressive, the international acceptance of software as a copyrightable literary work has not closed the book on copyright reform for computer software. In the United States and abroad, the increasing complexity of software technology and the gradual onset of market-share competition have unraveled the former consensus on basic copyright reform. Since the late 1980s, developments in software technology and copyright law have exacerbated the legal uncertainties inherent in the 1980 copyright settlement and have fostered increasingly bitter disputes within the U.S. software industry. Current legal and political trends indicate that the early public concern with encouraging innovation (as voiced in 1980) has shifted to concern with preserving competition. The complex and contentious legal battles over interface protection and decompilation rights have fostered inter-industry and intra-industry hostilities that foretell a major conflict over IPR reform in the near future. In the context of domestic legal flux, little can be done about discrepancies between U.S. copyright rules and those of other nations, such as those between the United States and the European Union regarding software decompilation rights.

Changes in the market structure of the software industry, in short, have produced different IPR dynamics and have encouraged different strategies of externalization. The widespread lack of adequate IPR protection abroad and the increasing export sensitivity of U.S. software producers established strong incentives for a multilateral externalization strategy; the shift from market-creation competition to market-expansion competition established incentives to shift from a cooperative to a coercive externalization attitude. The software industry's current shift into a mode of market-share competition corresponds with divisive IPR disputes that portend the end of an era of consensus in the international harmonization of IPR rules for computer software.

Although changes in the market structure of the software industry have directly shaped the strategy of externalization used to equilibrate U.S. and

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foreign copyright rules, the analytical significance of market conditions cannot be separated from the domestic politics of IPR reform. As the software case also illustrates, the politics characteristic of adversarial regulation change as the political and economic consequences of regulatory policies become more acute for specific domestic actors; as policy choices move toward a zero-sum game, coalitional conflicts can rise to the degree that IPR reform becomes much more problematic and, consequently, much more prone to stalemate.

In 1980, the U.S. copyright system was able to develop basic IPR protection for software technology without creating discord within the industry and without upsetting existing IPR bargains in other industries. The 1980 copyright amendments aroused little opposition for the very reason that they did not factionalize the software industry or adversely affect other copyright industries. The potential for blocking the proposal certainly existed: the panel that recommended copyright protection in 1980 was composed partly of representatives from other copyright industries, and throughout its deliberations it consulted a wide range of representatives from commercial interests other than the software and computer industry.34

However, the political and economic consequences of IPR policy typically become more acute as technologies develop and become more mature. In the early stages of a technology, most developments appear novel and original, and there are few reference points from which to judge developments as either incremental or purely innovative. Consequently, early IPR grants tend to be broad, fairly unrefined, and politically inconsequential. As the technology develops, its dimensions become more fully understood, and the truly novel characteristics of the technology become more well defined. Consequently, IPR rules tend to become more narrow and precise. Ultimately, as the technology becomes mature, what were once innovative products or processes become standardized, and technological change becomes much more incremental. In this context, IPR rules tend to define important boundaries that can have distinctly different consequences for affected industries and firms. In the context of market-share competition, strengthening IPR rules is not a positive sum game; stronger IPR protection may increase the competitiveness of individual firms, but usually at the expense of competing firms and possible the industry as a whole. Consequently, at the very time that market competition increases the natural level of tension between firms in the same industry, the narrowing of IPR disputes increases the potential for adversarial

relations between competing firms. In the context of market-share competition in a developed technology, IPR rules begin to take on a zero-sum character: firms use IPR claims to protect their competitive advantage and either maintain or increase market share, which typically comes at the expense of immediate competitors. In the context of market-share competition, policy debates over IPR reform shift from considerations of innovation to considerations of competition. The evolution of IPR debates over software technologies follows this pattern closely: recent IPR disputes over computer interfaces, decompilation rights, and the applicability of patents indicate that policy judgments have been shifting away from preserving innovation incentives (as was the concern in 1980) and toward preserving competition by restraining monopoly power.

Despite the considerable ambiguities and uncertainties in current IPR law, neither the software industry nor U.S. legislators have pressed in any concentrated fashion for a coherent form of *sui generis* protection. Instead, the software industry has debated the terms of copyright protection, while Congress has stood back and watched the courts struggle to secure copyright guidelines for software technology. This situation will likely prevail for some time, although not indefinitely. Software has been accumulating enough unique provisions within copyright law that in many respects it already looks like a *sui generis* form of protection. Many analysts and activists note that software is getting complex enough that statutory reform may be inevitable. In a sense, the reform of domestic and foreign IPR laws to accommodate software technology has only just begun.

By comparison, IPR reform in biotechnology conforms to the early period of software reform. The cooperative, multilateral style of externalization in the biotechnology case is consistent with the industry's relatively low level of

35. Software has special provisions for fair use, for depositing (developers can mask out up to 40% of deposited programs), for rental rights, and perhaps also for reverse engineering. Moreover, it is the only form of intellectual property that can be covered by both patents and copyrights. *Cf.* Copyright Act, 17 U.S.C. §§ 101, 117 (1976).

36. A number of members of the IPR legal community agree with this characterization, as do members of the USTR. Officials at the U.S. Copyright Office, on the other hand, argue that copyright law is fully capable of handling software technology. However confident the U.S. Copyright Office, though, unsettled legal conflicts continue to deepen the already profound uncertainty over the scope of copyright protection. For instance, the U.S. Supreme Court recently deadlocked on a crucial and widely followed case pitting Lotus Development Corporation against Borland International Inc.; by issuing no opinion and setting no precedent for future cases, the Court failed to resolve longstanding legal disputes over the copyright status of user interfaces. For a brief account of the case, see Linda Greenhouse, *Supreme Court Deadlocks in Key Case on Software*, N.Y. TIMES, Jan. 17, 1996, at C2.
Although biotechnology is highly international in terms of R&D and marketing requirements, it is still a developing technology and consequently confers a relatively low degree of trade leverage. Because international markets are underdeveloped and expanding, IPR disputes have not provoked trade tensions. Moreover, biotechnology is characterized by a symbiotic and generally cooperative relationship between small, highly innovative R&D firms and large multinational enterprises, both of which stand to gain from stronger patent protection for biotechnology products. Their ability to pursue IPR reform has been aided by the lack of a contrary industry coalition, either from the biotechnology field or from unrelated holders of industrial patent rights. Rather, the primary resistance to increased IPR protection for biotechnology products has come from consumer advocates and some public sector agencies who are wary of both the ethical implications of patenting life and the uncertain health and safety implications of new biotechnology products. The tenuous socio-legal response to biotechnology, in the United States as well as abroad, has counterbalanced the industry's relatively consensual preference for expanded patent protection. Moreover, the industry's relatively low level of trade sensitivity has not conveyed any countervailing form of leverage. Collectively, these circumstances have been conducive to a slow, cooperative externalization strategy that relies on the traditional method of multilateral harmonization established by the Paris Convention and administered by the WIPO.

IPR reform in the semiconductor industry represents the other end of the spectrum from biotechnology, in terms of both market structure and domestic politics. Since the mid-1980s, competition in the semiconductor industry has existed within a fully developed market that is dominated by American and Japanese firms, each highly trade sensitive and both focused primarily on the U.S. market. This basic market structure has conveyed an enormous amount of real and rhetorical trade leverage upon the U.S. semiconductor industry. Rhetorically, the extreme nature of U.S.-Japanese competition for market share produced a high degree of trade leverage; indeed, the very need for IPR reform was repeatedly defined in terms of competition with Japanese semiconductor producers. Substantively, the dependence of foreign producers (particularly the Japanese) on the U.S. market gave advocates of sui generis reform reason to expect that coercive bilateralism would work. Since Japanese producers were dependent on selling in the U.S. market, they could be expected to press the Japanese government to pass cognate IPR reforms and consequently obtain
the reciprocal protection in the U.S. market provided by the SCPA. Overall, in light of the serious commercial implications of IPR protection in the semiconductor industry, Congress eventually considered the coercive bilateral strategy worth the risk of undermining the international IPR regimes and foregoing the certainty of regime-sanctioned harmonization.

A solely market-based interpretation of the semiconductor case is, however, entirely misleading. The semiconductor industry reached a domestic consensus on a *sui generis* IPR solution only after its preferred option, copyright protection, was repeatedly stalemated by the vociferous and unrelenting opposition of the American Association of Publishers (AAP). The AAP represented a large and diverse group of industries that uniformly opposed copyright protection for semiconductor mask works, and viewed the proposed terms as a serious breach of fundamental copyright principles that would ultimately undermine their own copyright protection.37 The coalitional stalemate between the AAP and the semiconductor industry played out over several years and was essentially unresolvable. Eventually, the semiconductor industry abandoned the copyright initiative and pursued an alternative, *sui generis* solution. The unusual character of the ultimate solution is in no small part a testament to the semiconductor industry’s oligopolistic structure and its cohesive representation through the Semiconductor Industry Association, which formed an intra-industry consensus on a *sui generis* IPR solution and pursued a coherent and politically powerful reform strategy. The serious commercial implications of IPR reform in semiconductors gave the industry sufficient political weight to create an entirely new category of IPR with coercive externalization provisions.

Of course, these are but sketches of very complex political patterns, sufficient to illustrate only the general empirical pattern of the cases. Viewed in their entirety, the cases demonstrate how variances in international competition and trade leverage can interact with the dynamic politics of adversarial regulation to shape domestically and internationally contentious IPR policy choices.

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In analytical terms, the cases surveyed in this article support two general propositions for explaining variances in the strategies the United States has pursued to equilibrate national IPR rules. First, the choice of externalization strategy conforms in part to the market structure of the affected industries. Global industries characterized by zero-sum competition for market share convey a high degree of trade leverage, a necessary (but not sufficient) condition for supporting coercive and bilateral externalization strategies. Industries characterized by positive-sum competition for market creation or market expansion convey considerably less trade leverage, a condition that tends to support more cooperative and multilateral externalization strategies. Second, as technologies mature, domestic coalitional conflicts can rise to the degree that IPR reform becomes much more problematic and prone to stalemate. Under conditions of domestic legal uncertainty and coalitional conflict, U.S. policymakers cannot easily pursue coercive externalization strategies.

These two explanatory propositions are necessarily contingent, as they derive from three complicated cases within one very complicated regulatory arena, and altogether from the perspective of the United States alone. At a minimum, the cases suggest the need for interdisciplinary analytical approaches to studying the complex intersection of domestic regulation and economic globalization. The particular explanatory propositions can be developed, refined, and tested through additional cases of IPR reform, as well as cognate cases in other regulatory areas, such as competition policy, environmental regulation, standards, and the regulation of foreign direct investment.

The cases and general trends in IPR reform discussed in this article also suggest broader observations regarding both the impact of technological change on intellectual property systems and the adequacy of existing institutional mechanisms and political strategies for equilibrating incompatible national IPR systems.

First, technological change clearly has been testing the boundaries of the U.S. and other national IPR regimes. Like most complex legal-regulatory institutions, intellectual property regimes are inherently more static than dynamic; when faced with rapid rates of technological change, coalitional conflict and associated legal and policy uncertainties are likely to emerge. In the United States and elsewhere, IPR systems are being tested most severely
by rapidly growing industries that create and/or use technologies that do not clearly fit within existing classes of intellectual property. The software industry alone illustrates how new information technologies challenge fundamental intellectual property concepts, such as those of authorship, expression, novelty, and nonobviousness. The continued controversy over the patentability of certain forms of software, along with the failure of the legal system to resolve such vexing copyright problems as user interface protection and decompilation rights, suggests that statutory reform may be inevitable.

In the interim, ongoing legal uncertainty may affect innovation and competition in the software industry or other information-intensive industries, although to an unknown degree. In some industries, the lack of certain intellectual property protection may not significantly affect innovation and competition. For instance, few would argue that the fantastic technological advancements and economic growth in the semiconductor industry derive from the IPR certainty provided by the Semiconductor Chip Protection Act of 1984. In the semiconductor industry, the salience of IPR protection is considerably lower than in other industries due to industry-specific factors such as rapid product cycles (based largely on incremental technological advancements), enormously steep price curves, and the significance of manufacturing capability and know-how to competitive success. The scope and terms of intellectual property protection appear to have a stronger bearing on the software industry; in biotechnology, patent protection is undoubtedly critical. Eventually, deeper legal uncertainty may have a deleterious effect on innovation and/or competition in these and other industries.

Second, much like domestic intellectual property regimes, the institutional structure of the international IPR regimes reduces their capacity to harmonize divergent national IPR responses to rapidly changing technologies. The international IPR regimes may become increasingly irrelevant to important realms of IPR law, as the widening gaps between national IPR regimes outstrip the gradual harmonization processes fostered by the practice of national treatment. Integrating international IPR issues with trade concepts and institutions, such as the TRIPs agreement in the GATT/WTO, is unlikely to speed international harmonization processes substantially: adjustment processes are still very slow, dispute resolution mechanisms remain weak, and the system overall is far less able to accommodate rapid rates of technological change in new information industries than are most domestic IPR regimes. In this context, bilateral and plurilateral trade-based strategies provide the only
alternative routes toward resolving particular discrepancies between national IPR regimes.

Ultimately, bilateral trade-based strategies may not be effective. For instance, although bilateral U.S. pressure has led to significant de jure IPR reform in many countries, effective and enforceable de facto IPR reform often remains elusive. Such limits to policy coordination and behavioral reform do not augur well for international policy harmonization in other, even more contentious regulatory arenas, such as labor and health standards, environmental regulations, and competition policy. Among the major industrialized countries alone, policymakers are divided and uncertain about how to harmonize national regulatory approaches to competition policy and foreign direct investment. Policy discussions of these issues at the OECD level remain largely formative. The fact that national regulatory regimes are far more similar among the OECD member nations than between the OECD countries and the rest of the world suggests that economic globalization is unlikely to foster an equivalent globalization of law and regulation.

38. See, e.g., OECD, NEW DIMENSIONS OF MARKET ACCESS IN A GLOBALISING WORLD ECONOMY (1995).