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### ABSTRACT

An extensive theoretical literature has examined the impact of information problems on interactions between government bodies and private firms. One little-explored empirical testing ground is the patent system. This paper examines the administrative practices of patent offices in sixty countries over a 150-year period. I show that the usage of patent renewal fees and other mechanisms to grant discretion to patentees is consistent with theoretical suggestions. Nations where information asymmetries between government officials and patentees are likely to be more prevalent—larger countries, wealthier economies, and those where international trade is more important—incorporate discretionary features into their patent systems more frequently. I also find evidence that policymakers are more likely to restrict patent office officials' flexibility and to divide the responsibility for determining patentability between the patent office and the courts when information problems are likely to be severe.

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## 1. Introduction

An extensive theoretical literature has examined interactions between government bodies and private firms. The profound impact of information problems—both the private information initially held by firms and the government officials' difficulties in verifying the actions of companies *ex post*—have increasingly been appreciated, as well as the possibility of collusion between government officials and firms. These theories have attracted increasing attention in empirical studies of regulatory bodies.

One potentially interesting testing ground that has not been empirically explored in much depth is the patent system. Patent offices have been in existence in a wide variety of countries for well over a century, and their administrative practices today and in the past are well documented. Furthermore, the practices of these offices display a considerable degree of heterogeneity. Thus, the study of patent policy has the potential to complement the bulk of the empirical literature, which has typically focused on individual agencies or governments.

This paper examines the administrative practices of patent offices in sixty countries over a 150-year period, in the hopes of shedding light on the theoretical literature. The analysis focuses on two questions. First, the paper examines the flexibility offered to the patent applicant. Theoretical work on regulatory economics in general (as summarized, for instance, in Laffont and Tirole [1993] and Spulber [1989]) and patent policy in particular (especially Cornelli and Schankerman [1999] and Scotchmer [1999]) suggests that in settings where firms have substantial private

information, government officials seeking to maximize social welfare should offer a range of alternatives. In this paper, I show that the usage of patent renewal fees and other discretionary mechanisms is consistent with theoretical suggestions. Nations where information asymmetries between government officials and policymakers are likely to be more prevalent—larger countries, wealthier economies, and those where international trade is more important—more frequently incorporate these features into their patent systems.

The second half of the analysis focuses on the flexibility afforded the patent officials themselves. Recent theoretical work—drawing in turn on an older literature on political capture—has highlighted the distortions that may result from providing government officials with unfettered discretion. The work suggests that in settings where the danger of collusion between bureaucrats and firms is large, policymakers will seek to limit the officials' discretion. In analyses of the options granted patent office officials and the division of the responsibility for determining patentability between the patent office and the courts, I find evidence consistent with theory.

In addition to being relevant for the testing of theory, this study may inform the recent debates about the harmonization of patent policy. A major focus of international bodies such as the World Intellectual Property Organization and regional groups such as the European Patent Office has been to encourage consistent patent office practices across nations. The presence of substantial differences across nations in ways that are

consistent with economic theory suggests that policymakers should balance the possible costs from harmonizing these practices with the benefits.

The plan of this paper is as follows. In the second section, the relevant theoretical work is briefly summarized. In the third section, the construction of the data set is described. Section 4 presents the cross-sectional and regression analyses. The final section concludes the paper.

## **2. Theoretical Predictions**

### *A. Discretion Granted the Patentee*

While a vast earlier literature examined the interactions between government agencies and firms, it was not until the early 1980s that the importance of information asymmetries was fully appreciated. Beginning with Loeb and Magat [1979] and Baron and Myerson [1982], the relationship between firms and government officials was depicted in the context of agency theory. The “New Regulatory Economics” highlights the extent to which private information on the part of firms necessitates the institutional features of government agencies.

A parallel literature, beginning with Wright [1983], has examined how information problems affect the patent system. These works highlight that the patent system is an outgrowth of the presence of information asymmetries between patentees and the government. Were there no information gaps, the government could simply subsidize innovative firms and place the inventions in the public domain (even if, for

instance, the outcomes of the projects were not known with certainty). In this way, the distortions associated with patent awards—in particular, the social loss from monopoly pricing—could be avoided. Patent awards, by linking the size of the award (the patentee's monopoly profits) to the patentee's private information (the importance of the innovation) can address this information problem. But as Wright and subsequent authors (Scotchmer and Green [1990], Kremer [1998], Shavell and van Ypersele [1999]) point out, patent awards can have a wide variety of deleterious consequences, from wasteful duplication of research to insufficient incentives for pioneering innovators.

One insight that emerges from the regulatory economics literature (e.g., Laffont and Tirole [1986], Lewis and Sappington [1989]) is the extent to which these information problems can be overcome if the regulator offers a menu of incentive contracts. Even if the regulator cannot observe the differences between companies, he may design a range of alternatives that can discriminate between firms of different quality. In this way, the problems typically associated with asymmetric information—the ability of the regulated firm to extract more of the social surplus than desirable and the necessity of suboptimal incentive schemes—can be alleviated.

In two recent papers, the manner in which features of the patent system may play a similar role have been explored. Cornelli and Schankerman [1999] and Scotchmer [1999] highlight how information asymmetries between inventors and patent officials can be overcome through the use of patent renewal schemes. In particular, the government can improve welfare by offering a menu of patents of different lengths: the potential for a

greater reward will motivate firms with a greater ability to undertake high-quality R&D to undertake more research projects. Under certain conditions, the authors show that a renewal fee mechanism—whereby patentees must pay to periodically renew their patent awards—can induce the optimal (or close to the optimal) level of investment in innovation. Simulations by Cornelli and Schankerman suggest that as the dispersion in company types rises (and hence the information gap between the firm and the government increases), the menu of patent lives that firms can choose from should increase.

#### B. *Discretion Granted the Patent Office*

A second body of work has focused on the challenge of managing government officials who interact frequently with industry. Political scientists (beginning with Wildavsky [1964]) and economists have highlighted the deleterious consequences that can result from information asymmetries between agency officials and their political overseers.

As discussed by Noll [1989], government officials can exploit these information gaps in several ways. This may take the form of the “shirking” frequently modeled in agency theory: the failure to fulfill the agency’s mandate as aggressively as possible. Alternatively, bureaucrats may pursue an agenda at odds with policymakers’ intentions. Officials may choose actions that expand the scope and resources of the agency in question, or that curry favor with prospective private sector employers.

In a variety of works, political scientists and economists have argued that the institutional features of government agencies can be seen as responses to these problems. In this discussion—as in the empirical analysis below—I focus on two classes of responses to the information problems between agency officials and policymakers.

One response is to limit the discretion of the bureaucrats. Political scientists have long pointed out that the degree of discretion allocated to different agencies varies dramatically. (See the discussion in McCubbins [1985].) Many of the key aspects of congressional oversight of regulatory bodies—for instance, the Administrative Procedures Act of 1946 (McCubbins, Noll, and Weingast [1987])—have been interpreted as responses to information problems. This insight has been recently developed in a variety of theoretical economic treatments. In a number of settings, these works (summarized in Laffont and Tirole [1993] and Laffont [1994]) have shown that legislators respond to information asymmetries which would allow agency officials to collude with firms by limiting the discretion of agencies. Even if the agency has private information that would allow it to effectively discriminate between firms, the need to limit collusion may lead policymakers to restrict its use of that information. This suggests examining how the discretion granted patent office officials varies with the information environment.<sup>1</sup>

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<sup>1</sup>One difference between a patent office and a regulatory body, of course, is that each patent examiner works with multiple firms. This may limit the possibility of collusion. But there appear to still be significant opportunities for such distortions. The case of the contemporary United States patent office is illustrative. While each patent examiner (who specializes in a given technology) examines applications by a large number of firms, a few companies (and law firms) are likely to account for the bulk of the filings. These patent examiners frequently leave after a few years for much more lucrative



A second response by policymakers may be to divide the responsibility for a single regulatory function between agencies, or even across branches of government. By having multiple regulators, each of whom has information that is only partially known by the others, the ability of regulators to collude with firms may be greatly reduced. In settings with substantial information asymmetries, the cost of separating regulators (the loss of shared information from the different monitoring approaches) is outweighed by the benefit of avoiding the distortions engendered by collusion with firms. This concept has been developed in the political science analyses (e.g., Moe [1990]), in the law-and-economics literature (Landes and Posner [1975]), and most recently in the new regulatory economics framework, which most fully endogenizes the institutional setting (Laffont and Martimort [1999]).<sup>2</sup>

In the case of patent systems around the world, there is invariably a judicial procedure to determine if a given party is infringing and, if so, the damages that should be paid to patentee. Where nations differ is in the extent to which the determination of patent validity is left in the hands of the courts. In countries with patent registration systems, all patent applications following proper administrative procedures are granted, regardless of whether they make original contributions or not. The determination of whether the patent is novel is left entirely to the courts. In nations with examination

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positions at the same private sector firms with whom they work with as government employees: annual turnover in some groups exceeds 20%.

<sup>2</sup>There are a variety of other rationales for the separation of administrative functions, such as addressing the inability of government officials to make long-term commitments (Tirole [1994]).

systems, the initial determination of novelty is made by the patent office. While the courts in almost all cases can still find the patent invalid (at least for litigation commenced within a certain date of the patent award), there is a typically a presumption in favor of the patent's validity in these cases. This suggests that the desirability of analyzing how the process of determining patent validity varies with the extent of informational asymmetries.

### **3. The Construction of the Data Set**

I employed as my sample the sixty countries listed in the International Monetary Fund's *International Financial Statistics* as having the highest gross domestic product (GDP) in 1997. If the country was missing GDP data for 1997, I used the GDP and exchange rate for the most recent year for which such data were available, inflation-adjusting the result to insure comparability.<sup>3</sup>

I then determined the features of the patent system at 25-year intervals. I sought to determine this information as of mid-year 1850, 1875, 1900, 1925, 1950, 1975, and 1999. I only determined the status of the country's patent system if it was an independent political entity as of that date. My rationale for this approach was that most colonies did not have independent patent policies. Most did not grant patents at all, simply registered patents granted by their colonial overseer without any formal review, or had patent

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<sup>3</sup>In one case (Iraq), the volume had no data for the past five years. In this case, a consensus estimate from press accounts was used. In the second case (Taiwan), a country was not listed due to questions about its political status. In this case, data were obtained from government publications.

systems that closely mirrored those of their colonizer. As a result of these omissions, this was not a balanced sample: the number of observations increased over time, as more nations became independent.

Determining what constituted an independent country was not always a simple matter. In some cases, colonies underwent prolonged independence struggles, and the exact date at which an independent government was established was difficult to determine (e.g., Saudi Arabia and Indonesia). In other cases, countries enjoyed a great deal of independence while under the official control or informal influence of another nation (e.g., Norway and Korea in the nineteenth century, Egypt in the 1930s and 1940s). In general, I sought to include a nation from the date that its independence was declared (conditional on it eventually emerging as a widely recognized country).<sup>4</sup>

In order to undertake this analysis, I relied on guidebooks to the world patent systems. These handbooks—typically prepared for the use of inventors by patent agents or lawyers—have been frequently published since the early nineteenth century. In each case, I was able to identify at least five information sources published within five years of the seven dates at which I sought to characterize the patent system. These are listed in Appendix A. While not all information was available in all years for all nations

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<sup>4</sup>Two complications should be briefly discussed. First, an exception to the algorithm above was made for formerly independent countries that were the final stages of military occupation (e.g., West Germany in 1950). In many instances, independent patent systems had been adopted as a prelude to the relinquishment of military oversight. Second, in cases where a country was divided into several political entities, I used the patent policy (and other characteristics discussed below) from the most economically significant portion. For instance, in the case of Germany, I used Prussia's patent policy prior to German unification, and that of West Germany after World War II.

(particularly data on patent fees), I was able to construct a variety of reasonably comprehensive measures.

Using a variety of sources summarized in Appendix B, I at least crudely characterized the nations' economic and social conditions. In each case, I sought measures that could be collected on a reasonably comprehensive basis. While most of the data sources noted in the appendix are familiar to economists, one exception is the Cross-National Time Series database, the primary source of the historical demographic variables. Originally compiled by the Council on Foreign Relations in 1927, this database has been maintained by the Center for Comparative Political Research at the State University of New York-Binghamton for the past three decades. Available in electronic form from the Inter-University Consortium for Political Science Research, the database has been extensively used in political science research.

I sought measures that might capture the degree of information asymmetries in the economy. By necessity, I was forced to rely on proxies that imperfectly captured these information problems:

- The size of the economy, as measured by its population (available for 99% of the 298 country-year observations).
  - The complexity of the economy, as measured by its per capita gross domestic product. The variable was converted into current U.S. dollars using, if possible, a purchasing power parity-based deflator. It was then converted into 1998 dollars using the U.S. GDP deflator (back to 1889) or the U.S. consumer price index (for earlier years). (This was available for 91% of the observations).
  - The extent to which the economy was self-contained, or shaped by interactions with foreign markets. In the case of economies where foreign manufacturers or customers
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played an important role, I presumed that information problems would be greater, all else being equal. To compute this, I used the ratio of the sum of exports and imports to gross domestic product (92%).

Two other measures were less widely available, and probably captured the presence of information problems less exactly. I hypothesized that information problems about new inventions might be greater, all else being equal, in nations where the population was less agrarian and better educated:

- Percentage of population employed in agriculture, calculated where possible using data on the civilian workforce only (81%).
- Percentage of population with basic literacy skills, defined by the *United Nations Demographic Yearbook* (the original source of most of the post-World War II data) as the “the ability both to read and to write.” This measure was likely to be quite imprecise, particularly during older periods and in developing nations (71%).

Finally, I added as a control variable the family into which the nation’s commercial laws fell. As discussed in the companion paper to this one (Lerner [1999]), a substantial body of literature emphasizes the role of economic and political institutions in shaping economic development. These works highlight the importance of “path dependence”: the far-reaching implications of the initial design of a society’s institutions. I employed the classification in La Porta, Lopez-de-Silanes, Shleifer, and Vishny [1999].<sup>5</sup>

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<sup>5</sup>I made two adjustments that reflected the panel nature of my data set. First, many countries classified by these authors as communist previously were based in another legal tradition (e.g., Hungary and Poland). In the observations before the communist take-over, the countries were so classified. Second, some countries originally had legal systems that were quite distinct from any of the major families identified by these authors (e.g., Japan before 1889, Korea before 1910, and Russia before 1917). These cases were lumped together as an “other” category.

Many of the variables, especially the demographic ones, must be approached with caution. Definitions were unlikely to be consistent across countries and time, and nations may have been tempted to give an excessively positive view of their progress. Despite these substantial limitations, these variables can provide a general sense of the nations' development.

I sought to match the date of these measures as closely as possible to that of the patent policy observation, using the same month or calendar year. For the nineteenth century, however, I relaxed these requirements: I employed an observation as long as it was within five years of the period at which patent policy was recorded. This was particularly true of the estimates of GDP, which were only periodically available.

#### **4. Empirical Analysis**

##### *A. Summary Statistics*

The first four tables provide an overview of the measures of patent policy used in the analysis. The first two tables focus on the discretion delegated to patent applicants; the third examines flexibility provided patent office officials; and the fourth looks at the extent to which the determination of patent validity was left to the courts, or divided between judges and patent officials.

The first table focuses on one of the most important forms of discretion granted the patentee in many countries, the right to renew patents. As Schankerman and Pakes [1986] and Pakes [1986] argue, allowing patentees to pay for only the first year (or years)

of patent protection and then to renew the awards if commercially important provides them with a potentially valuable option. Because there were often a series of renewal fees of different magnitudes, summarizing the option-like nature of patent awards was complex. The table presents one way to do so: it presents the ratio of fees due in the second half of the patent's life to that of the first half. The calculation can be seen as approximating the ratio of the exercise price to the purchase price of the option. In making this calculation, I assumed that the patent was held for the longest period regularly granted, without any provision for discretionary extensions due to extraordinary circumstances.<sup>6</sup>

The second table examines other forms of discretion provided to the patentee. The number in each cell is the years from the application date that an applicant could delay having one of his patents examined. In recent years, many countries have allowed innovators to file patent applications that remain unexamined until requested. This provided a potentially important option, as firms could cheaply file large numbers of applications for technologies that might ultimately prove to be of strategic importance.

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<sup>6</sup>The period used was the time from the original application date to the end of the award. One complication was introduced by the practice of some countries of calculating the duration of patents from the date of the award or publication, rather than the date of the application. In these instances, I made some broad assumptions based on practitioner discussions. In particular, I assumed that that in 1850 and 1875, there was virtually no gap between the application and the award. In 1900 and 1925, I assumed that patents were awarded (and published) one year after the application date. In 1950 and thereafter, I assumed that patents were published one year after and awarded two years after the application date. In making the calculation, I counted payments happening on the mid-point date as being in the second half. Thus, in a country that awarded patents for twenty years from the application date, I divided the renewal fees paid from the tenth anniversary of the application onwards by the application, award, and renewal fees paid beforehand.

(For a discussion of how firms in Japan exploited this option, see U.S. General Accounting Office [1993].) The footnotes to the table denote a variety of other forms of discretion granted applicants. These included whether there was any provision for patents of addition (typically low-cost awards designed to supplement existing patent awards which expire with the original award), preliminary patent applications (which enabled an inventor to establish priority rights, even if he had not yet prepared a full-fledged patent application), and minor patent awards. These awards, variously known as “utility model” or miniature patents, were frequently for a reduced duration and involved a narrower scope of protection.<sup>7</sup>

The third table summarizes a variety of ways in which the government officials exercised discretion over patent awards. The table tabulates the number of years that patent office officials could extend the length of a patent. (Since the structure of patent awards was in almost all cases a consequence of legislative statute or royal decree rather than a constitutional mandate, I did not include cases where the duration of the patent could only be extended through legislation or royal grant.) The footnotes indicate whether patent officials had any of five forms of discretion. These included the right to choose which patents to examine, to vary the fee charged the patentee, to license or revoke all or some of awards (only included when licensing or revocation was possible for reasons other than non-working, that is the failure to put the patent into practice in a

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<sup>7</sup>I did not include countries that only had provisions for registering ornamental designs. Even though these were sometimes referred to (as in the United States) as design “patents,” they much more closely resembled trademark and copyright registrations than patent awards.



specified time),<sup>8</sup> to determine the original inventor (rather than being constrained to award the patent to the first applicant), and to alter the period in which the patent had to be worked.

The final set of measures, summarized in Table 4, focus on the examination process. The table notes whether the patents were examined for novelty in all, some, or no cases. It also indicates whether patent officials adjudicated objections to the validity of the proposed patent (termed oppositions) filed by rivals prior to patent awards. The table also denotes two other variants. First, in some cases, government officials could initiate disputes between rival firms regarding patent priority, often termed interferences. Second, in some places patents were published prior to the award. Even if there was no formal opposition procedure, in many instances practitioner accounts suggest that an informal opposition procedure took place: rivals communicated their concerns to patent office officials, who informally assessed the merits of complaints. The table does not include instances when an examination was only undertaken at the request of the applicant, rather than at the discretion of the patent office officials.

Tabulations of how patent policy varied with characteristics of the economy are presented in Panel A of Table 5, with significance tests presented in Panel B. Wealthier and larger economies were more likely to provide the patentees with greater flexibility, as seen in the steeply rising renewal fee schedules, more frequent renewals, and provisions

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<sup>8</sup>The coding of this variable was challenging, due to the great deal of variation across countries. I ignored cases where the government's right was confined to licensing the patent for national defense on an emergency basis.

to delay patent examinations for longer periods. Large, complex economies might be thought to be the settings where information asymmetries between government officials and patent applicants were greatest. Meanwhile, the flexibility of the patent office to extend patent awards was significantly lower in these instances.<sup>9</sup> In addition, the patent office was more likely to conduct novelty examinations in wealthier economies. These results were again consistent with the theoretical predictions discussed above. The patterns held true as well—though in some cases, to a less dramatic extent—when other proxies for information asymmetries were examined: an important role for foreign trade, a non-agrarian society, and a population with a high literacy rate.

### *B. Regression Analyses*

I then examined patent office practice in a regression framework, beginning with the nature of the renewal fee schedule. As in Table 1, I examined the ratio of the fees paid in the second half of the patent's life to those paid in the first half. I also examined the number of renewal fees due over the patent's life. Because the former measure was bounded below by zero, I employed a Tobit specification in addition to an ordinary least squares specification. (This correction, however, made little difference.) Reflecting the ordinal, non-negative character of the latter variable, I employed a Poisson specification. As independent variables in each regression, I used the five measures included in the cross-tabulations in Table 5. In each regression, I employed as well dummies for each

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<sup>9</sup>One complication was introduced by cases where the patent officials' discretion to extend patents was not limited to a set number of years. In this table, I assumed that the awards in these cases could be extended by a period equal to the longest period that was statutorily specified for patent extensions in any country (twenty years).

legal family (the coefficients are not reported). The one exception was the third regression, where I used dummies for each nation.

As Table 6 reports, patentees faced a more steeply sloped fee schedule and more frequent renewal fees as the national economies became more complex. Larger populations and more trade-intensive economies were consistently associated with the provision of greater discretion to the patentee. In two of the five regressions, this was true for higher per capita GDP as well at least at the five percent confidence level. These effects were significant economically as well as statistically. For instance, in the leftmost regression a one standard deviation increase in the national population led to the fee ratio increasing by 51%; a one standard deviation increase in the ratio of exports and imports to GDP led to an increase of 29%. These were both substantial relative to the mean ratio in the sample, 209%.

The usage of other mechanisms to provide the patentee with discretion presented a more mixed pattern. In Table 7, I examined two measures of discretion granted patent applicants. The first of these was the extent the applicants could delay the examination of a patent. As discussed above, these provisions allowed innovators to file large number of low-cost applications, which then could be activated if the technologies subsequently proved to be valuable (due to the “post-patent learning” discussed by Cornelli and Schankerman [1999]). The second measure was the count of alternative patent structures—patents of addition, preliminary patents, and utility models—that the nation offered. Again, these allowed the patent applicant to choose across a menu of possible

forms of protection. In the former case, I employed a Tobit specification (in many nations, no extensions are granted), while in the latter, I used an ordered logit approach.

The results of the first analysis were very consistent with the patent renewal regressions discussed above. As Table 7 reports, greater discretion was granted the patent applicant as the economy became more complex and information asymmetries more problematic. Delayed examinations were more frequent in countries with larger populations, more foreign trade, a smaller agricultural workforce, and greater literacy. (Per capita GDP was significant only in one regression.)

The measure of alternative patent schemes, however, displayed a somewhat more complex pattern. Alternative schemes were more frequent in poorer countries and (in one regression) less trade-intensive ones. The infrequent use of these alternatives in countries with a substantial civilian employment in agriculture, though, was consistent with the earlier results. This pattern was driven, as an examination of Table 2 suggests, by the abandonment of patents of addition by many wealthy nations. Thus, to a certain extent nations have moved away from allowing patentees one form of discretion in favor of several approaches that assured them greater flexibility and choice.

I then considered the discretion granted to patent office officials. As in Table 3, I examined both the extent to which patent office officials could extend awards and five other forms of discretion sometimes granted these officials. In the former instance, I

employed a censored regression specification.<sup>10</sup> In the latter case, I employed an ordered logit specification.

The results were again consistent with the theoretical suggestions above. In more complex economies, where the difficulty of the legislative and executive officials in monitoring the activities of the patent office were presumably greater, the discretion of patent officials was considerably reduced. The GDP, population, and trade measures were all significantly negative in at least one of the patent life extension regressions. In the regression explaining other forms of patent office discretion, only the foreign trade measure was significantly negative, though all variables took on the expected negative sign.

Finally, I analyzed the patent examination process. As discussed above, in many economies the determination of patent validity was left solely in the hands of the judicial system; elsewhere, it was divided between the patent office and the judiciary. This pattern suggested the hypothesis that policymakers divided the responsibility for determining patent validity in settings where monitoring was more difficult.

In the regressions reported in Table 9, I employed two qualitative dependent variables. The first noted whether the patent office had no role in determining patent novelty (coded as zero), whether it had some role (one), or whether it provided full-

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<sup>10</sup>These extensions could not be less than zero, and in some cases, the maximum extension that could be granted was left ambiguous in the patent law. In the latter instances, the patent office officials were treated as having the right to extend awards for twenty years or more.

fledged novelty examinations for all patent applications (two). In the middle category, I included cases where the patent office examined some but not all applications, as well as those instances where the office did not examine applications for novelty but reviewed oppositions brought by rivals of the patent applicant.<sup>11</sup> I also ran the analysis with a dummy variable coded as one if the patent office examined all applications for novelty.

The results were again consistent with theoretical suggestions. Larger and wealthier nations, as well as those with a higher literacy rate, were more likely to have both patent officials and judges involved in determining patent novelty. This pattern was consistent with theoretical suggestions about the desirability of separating bureaucratic control in settings with considerable information asymmetries between policymakers and agency officials.

## **5. Conclusions**

A substantial economics literature over the past fifteen years has examined the relationship between the information environment and government operations. The presence of patent offices for an extended period in a wide variety of countries, as well as the recent theoretical work on patent office practice, suggests that this is an attractive arena in which to empirically examine these issues. While such a study must of necessity be on a higher level of aggregation than those of a single agency in a particular country, the heterogeneity across time and place should provide valuable insights.

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<sup>11</sup>In unreported regressions, I also included in this category those countries where patent applications were published prior to being issued, but where there was no formal opposition or examination procedure. This modification had little effect on the results reported in Table 9.

The evidence presented in this paper was broadly consistent with the theoretical suggestions discussed in Section 2. In nations with more complex economies, where information asymmetries between patent office officials and applicants and between policymakers and the patent office were likely to be the most problematic, the workings of the patent system differed substantially. Patentees were more likely to face steeply sloped renewal fee schedules and to pay multiple renewal fees. They were also more often granted the flexibility to delay the examination of patent applications. Meanwhile, patent officials were less likely to be granted discretion to extend and otherwise modify awards in these settings. Responsibility for determining patent validity was increasingly divided between the patent office and the judicial system.

The analysis suggests a variety of topics for further investigation. Certainly one of the most interesting set of issues is how the nature of patent office practice affects the behavior of firms. The benefits which Cornelli and Schankerman and Scotchmer argue that revelation schemes such as patent renewal schedules provide only occur if these schemes affect firm behavior. Have firms adjusted their patenting behavior in response to the incentive schemes offered in each country? What has been the impact of policy shifts, such as the introduction of renewal fees in the United States in 1984 and the efforts to harmonize world patent practice discussed in the introduction? Even more intriguingly, has patent office policy affected the innovative behavior of firms (as, for instance, the clinical research of Gomez-Casseres [1990] suggests)? These are questions that are likely to be answerable only through painstaking micro-level studies. But they

suggest that much more can be learned from this arena which will be more generally relevant to the study of the design of government agencies.



## References

- Baron, David P., and Roger B. Myerson, 1982, "Regulating a Monopolist with Unknown Costs," *Econometrica*. 50, 911-930.
- Cornelli, Francesca, and Mark Schankerman, 1999, "Patent Renewals and R&D Incentives," *Rand Journal of Economics*. 30, 197-213.
- Gomez-Casseres, Benjamin, 1990, "Fusion Systems Corp. in Japan (A)," Case No. 9-390-021, Graduate School of Business Administration, Harvard University.
- Kremer, Michael, 1998, "Patent Buyouts: A Mechanism for Encouraging Innovation," *Quarterly Journal of Economics*. 113, 1137-1167.
- La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny, 1999, "The Quality of Government," *Journal of Law, Economics and Organization*. 15, 222-279.
- Laffont, Jean-Jacques, 1994, "The New Economics of Regulation Ten Years After," *Econometrica*. 62, 507-537.
- Laffont, Jean-Jacques, and David Martimort, 1999, "Separation of Regulators Against Collusive Behavior," *Rand Journal of Economics*. 30, 232-262.
- Laffont, Jean-Jacques, and Jean Tirole, 1986, "Using Cost Observation to Regulate Firms," *Journal of Political Economy*. 64, 614-641.
- Laffont, Jean-Jacques, and Jean Tirole, 1993, *A Theory of Incentives in Procurement and Regulation*. Cambridge: MIT Press.
- Landes, Willam M., and Richard A. Posner, 1975, "The Independent Judiciary in an Interest-Group Perspective," *Journal of Law and Economics*. 18, 875-901.
- Lerner, Josh, 1999, "150 Years of Patent Protection," Unpublished working paper, Harvard University.
- Lewis, Tracy R., and David E.M. Sappington, 1989, "Regulatory Options and Price-Cap Regulation," *Rand Journal of Economics*. 20, 405-417.
- Loeb, Martin, and Wesley A. Magat, 1979, "A Decentralized Method of Utility Regulation," *Journal of Law and Economics*. 22, 399-404.
- McCubbins, Matthew D., 1985, "The Legislative Design of Regulatory Structure," *American Journal of Political Science*. 29, 721-748.

McCubbins, Matthew D., Roger G. Noll, and Barry R. Weingast, 1987, "Administrative Procedures as Instruments of Political Control," *Journal of Law, Economics and Organization*. 3, 243-277.

Moe, Terry, 1990, "The Politics of Structural Choice: Towards a Theory of Public Bureaucracy," in Oliver Williamson, editor, *Organizational Theory: From Chester Bernard to the Present and Beyond*. New York: Oxford University Press.

Noll, Roger G., 1989, "Economic Perspectives on the Politics of Regulation," in Richard Schmalensee and Robert D. Willig, editors, *Handbook of Industrial Organization*. New York: Elsevier Science Publishers, volume II, pp. 1253-1287.

Pakes, Ariel, 1986, "Patents as Options: Some Estimates of the Value of Holding European Patent Stock," *Econometrica*. 54, 755-784.

Scotchmer, Suzanne, 1999, "On the Optimality of the Patent Renewal System," *Rand Journal of Economics*. 30, 181-196.

Scotchmer, Suzanne, and Jerry Green, 1990, "Novelty and Disclosure in Patent Law," *Rand Journal of Economics*. 21, 131-146.

Schankerman, Mark, and Ariel Pakes, 1986, "Estimates of the Value of Patent Rights in European Countries During the Post-1950 Period," *Economic Journal*. 96, 1052-1077.

Shavell, Steven, and Tanguy van Ypersele, 1999, "Rewards versus Intellectual Property Rights," Working Paper No. 6956, National Bureau of Economic Research.

Spulber, Daniel F., 1989, *Regulation and Markets*. Cambridge: MIT Press.

Tirole, Jean, 1994, "The Internal Organization of Government," *Oxford Economic Papers*. 46, 1-29.

U.S. General Accounting Office, 1993, *Intellectual Property Rights: U.S. Companies' Patent Experiences in Japan: Report to the Honorable John D. Rockefeller IV and the Honorable Dennis DeConcini, U.S. Senate*. Washington: U.S. General Accounting Office.

Wildavsky, Aaron B., 1964, *The Politics of the Budgetary Process*. Boston: Little, Brown.

Wright, Brian D., 1983, "The Economics of Invention Incentives: Patents, Prizes, and Research Contracts," *American Economic Review*. 73, 691-707.

## Appendix A: Information Sources on Patent Policy

### Patent Policy in 1850:

Coryton, John, 1855, *A Treatise on the Law of Letters-Patent; For the Sole Use of Inventions in the United Kingdom of Great Britain and Ireland; Including the Practice Associated with the Grant; To Which is Added a Summary of the Patent Laws in Force in the Principal Foreign States*. Philadelphia: T. & J.W. Johnson.

Hancock, W. Nielson, 1850, *On the Cost of Patents of Invention in Different Countries*. Dublin: Hodges and Smith for the Dublin Statistical Society.

Kingsley, John L., and Joseph F. Pirsson, 1848, *Law and Practice of All Nations and Governments Relating to Patents for Inventions, with Tables of Fees and Forms*. New York: Kingsley and Pirsson.

Loosey, Charles F., 1845, *Collection of the Laws of Patent Privileges of All the Countries of Europe, the United States of N. America and the Dutch West-Indies*. Vienna: Charles F. Loosey.

Tolhausen, Alexandre, 1857, *A Synopsis of the Patent Laws of Various Countries*. London: Taylor and Francis.

Urling, R.W., 1845, *The Law of Patents in Foreign Countries, Translated, with Notes, &c. for the Information of Inventors and Patentees*. London: Simpkin, Marshall.

### Patent Policy in 1875:

Agnew, William F., 1874, *The Law and Practice Relating to Letters Patent for Inventions: Together with Notices of the Patent Laws in Force in the Principal Foreign States and in the Colonies*. London: Wildy and Sons.

Bougon, Joseph, 1870, *The Inventor's Vade Mecum: Memorandum on the Laws Effecting the Patents in Every Country*. London: Reeves & Turner.

E.W. Anderson & Co., 1880, *International Patent Guide and Inventor's Handbook for All Countries*. Washington: Globe Printing and Publishing House.

Great Britain Patent Office, 1854-1883, *Commissioners of Patents' Journal*. London: Great Britain Patent Office.

Newton, Alfred V., 1879, *Patent Law and Practice: Showing the Mode of Obtaining and Opposing Grants, Disclaimers, Confirmations, and Extensions of Patents*. London: Trubner.

Whitman, Charles S., 1875, *Patent Laws and Practice of Obtaining Letters Patent for Inventions in the United States and Foreign Countries*. Second edition. Washington: W.H. & O.H. Morrison.

### Patent Policy in 1900:

Boult, Alfred J., 1899, *Digest of British and Foreign Patent Laws*. Second edition. London: Boult, Wade, & Kilburn.

Greeley, Arthur P., 1899, *Foreign Patent and Trademark Laws: A Comparative Study with Tabular Statements of Essential Features of Such Laws*. Washington: J. Byrne.

Haddan, Reginald, 1898, *The Inventor's Adviser and Manufacturer's Handbook to Patents, Designs and Trade Marks*. Fourth Edition. London: Harrison and Sons.

Marks and Clerk, 1904, *British and Foreign Patent Laws and Practice for American and Canadian Patent Attorneys Only*. London: Marks and Clerk.

Philadelphia Commercial Museum, Bureau of Information, Compiling Department, 1899, *Patent Laws and Trademarks of Leading Countries of the World*. Philadelphia: Philadelphia Commercial Museum.

Thompson, William P., 1899, *Handbook of Patent Law of All Countries*. Eleventh Edition. London: Stephens.

#### Patent Policy in 1925:

Baraclough, W.H., 1928, *Every Inventor His Own Patent Agent; A Handy Book of the Principles of the Patent Law, with Appendices of the Patent Forms and Fees, Forms of Patent Specifications, Statutory Declarations, Patent Documents, Designs, Copyrights, Contracts, Partnerships, Medicine Stamp Act and an Abridged Index on Legal Points*. London: Effingham Wilson.

Haddan, Reginald, 1924, *The Inventor's Adviser and Manufacturer's Handbook to Patents, Designs and Trade Marks*. Twelfth Edition. London: Harrison and Sons.

Singer, Bethold, 1924, *Patent Laws of the World*. Chicago: privately printed.

Thompson, William P., 1920, *Handbook of Patent Law of All Countries*. Eighteenth Edition. London: Stevens.

White, William W., and Wallace White, 1923, *Patents Throughout the World*. New York: Trade Mark Law Publishing Co.

#### Patent Policy in 1950:

Bucknam, Ralph E., 1954, "How to Save on Foreign Patent Taxes," *Journal of the Patent Office Society*. 36, 677-682.

Federico, Pasquale J., 1954, "Renewal Fees and Other Patent Fees in Foreign Countries," *Journal of the Patent Office Society*. 36, 827-861.

Langner, Parry, Card & Langner, 1951, *Foreign Patents: Foreign Digest*. Fourth Edition. New York: Langner, Parry, Card & Langner.

Michael, Aloys J., 1945, *The World's Patent Laws, Digested and Annotated by Aloys John Michael*. New York: unpublished manuscript.

Millenet, Max, 1951, *Millinet's Patent-Tabelle: Bestimmungen über Verfahren und Gebühren für Patente und Gebrauchsmuster in 30 Ländern*. Munich: C. Heymann.

Singer, Stern and Carlberg, 1953, *Foreign Patent and Trade Mark Requirements*. Chicago: Singer, Stern and Carlberg.

Vojáček, Jan, 1951, *A Survey of the Principal National Patent Systems*. First Addendum. London: privately printed.

White, William W., and Byfleet G. Ravenscroft, 1952, *Patents Throughout the World*. New York: Trade Activities, Inc.

#### Patent Policy in 1975:

Baxter, J.W., 1975, *World Patent Law and Practice*. Second Cumulative Supplement to the Second Edition. London: Sweet & Maxwell.

Durham, Hobart N., editor, 1977, *World Patent Litigation: Treatise on Systems and Procedures of Principal Countries of the World Regarding Protection and Infringement of Patents*. Washington: Bureau of National Affairs.

Schade, Hans, 1971, *Patents at a Glance: A Survey of Substantive Law and Formalities in 46 Countries*. Munich: Heymann.

World Intellectual Property Organization, 1974, *The Principal Provisions of Patent Legislation in Eighty-Five Countries, Presented in the Form of Summary Tables*. Geneva: World Intellectual Property Organization.

#### Patent Policy in 1999:

Jacobs, Alan J., editor, 1999, *Patents Throughout the World*. Fourth Edition. Deerfield, Ill.: Clark Boardman Callaghan.

Manual Intellectual Property, 1998, *Manual for the Handling of Applications for Patents, Designs and Trademarks Throughout the World*. Utrecht, the Netherlands: Manual Industrial Property, BV.

Nelson, Lester, editor, 1999, *Digest of Commercial Laws of the World: Digest of Intellectual Property Laws of the World*. Dobbs Ferry, NY: Oceana Publications.

Sinnott, John P., 1999, *World Patent Law and Practice: Patent Statutes, Regulations, and Treaties*. New York: M. Bender.

World Intellectual Property Organization, 1995, *Duration of Patents; Maintenance Fees; Provisional Protection of Applicant; Prior Users' Rights*. WIPO Document HL/CE/IV/INF/2, Revision 1. Geneva: World Intellectual Property Organization.

World Intellectual Property Organization, 1999, *Industrial Property Laws and Treaties*. Geneva: World Intellectual Property Organization.

World Intellectual Property Organization, 1999, *PCT Applicant's Guide: General Information for Users of the Patent Cooperation Treaty*. Geneva: World Intellectual Property Organization.

#### Patent Policy in Multiple Periods—Comparative:

Bent, Stephen A., et al., 1987, *Intellectual Property Rights in Biotechnology Worldwide*. New York: Stockton Press.

Dietz, Alfred, 1995, *Protection of Intellectual Property in Central and Eastern European Countries: The Legal Situation in Bulgaria, CSFR, Hungary, Poland and Romania*. Paris: Organisation for Economic Cooperation and Development.

Erbisch, Frederic H. and Karim M. Maredia, editors, 1998, *Intellectual Property Rights in Agricultural Biotechnology*. New York: CAB International.

Federico, Pasquale J., 1948, "Compulsory Licensing In Other Countries," *Law and Contemporary Problems*. 13, 295-309.

International Bureau of the American Republics, 1904, *Patent and Trade-Mark Laws of the Spanish-American Republics, Brazil, and the Republic of Haiti*. U.S. House of Representatives, 58<sup>th</sup> Congress, 3<sup>rd</sup> Session, Document No. 145, Part 7. Washington: Government Printing Office.

Kaufers, Erich, 1989, *The Economics of the Patent System*. Chur, Switzerland: Harwood Academic Publishers.

Llewelyn, Margaret, 1996, *Utility Models/Second Tier Protection: A Report on the Proposals of the European Commission*. London: Intellectual Property Institute.

Montgomery, Royal E., 1923, "The International Aspects of Patent Legislation," *Journal of Political Economy*. 31, 90-113.

Neumeyer, Fredrik, 1959, *Compulsory Licensing of Patents Under Some Non-American Systems*. U.S. Senate, Committee on the Judiciary, Subcommittee on Patents, Trademarks and Copyrights, 85<sup>th</sup> Congress, 2<sup>nd</sup> Session, Study No. 19. Washington: Government Printing Office.

Organisation for Economic Cooperation and Development, 1972, *Restrictive Business Practices Relating to Patents and Licenses: Report of the Committee of Experts on Restrictive Business Practices*. Paris: Organisation for Economic Cooperation and Development.

Pontius, Alfred W., 1909, *Protection Extended to Patents, Designs, Trade-Marks and Copyrights in China, Japan and Korea*. Washington: Government Printing Office.

Reik, Richard, 1946, "Compulsory Licensing of Patents," *American Economic Review*. 36, 813-832.

Roberts, Herbert B., 1979, "First to Invent—A Fading Concept," *Journal of the Patent Office Society*. 61, 350-372.

U.S. Congress, Office of Technology Assessment, 1989, *Patenting Life*. New Developments in Biotechnology series, #5. Washington: Government Printing Office.

Wegner, Harold C., 1993, *Patent Harmonization*. London: Sweet & Maxwell.

World Intellectual Property Organization, International Bureau, 1978, *Situation of Industrial Property in the Arab States*. WIPO Publication No. 872(AEF). Geneva: World Intellectual Property Organization.

Patent Policy in Multiple Periods—Country Specific:

Aer, Anneli, 1995, *Patents in Imperial Russia: A History of the Russian Institution of Invention Privileges Under the Old Regime*. Annales Academiae Scientiarum Fennicae Dissertationes Humanarum Litterarum, no. 76. Helsinki: Suomalainen Tiedekatemia.

Alford, William P., 1995, *To Steal a Book is an Elegant Offence: Intellectual Property Law in Chinese Civilization*. Stanford: Stanford University Press.

Australian Patent Office, 1969, *Patent Office Notes on the History of the British and Commonwealth Patent Acts and the Law Relating to Letters Patent of Invention in Australia*. Canberra: Australian Patent Office.

- Balz, Manfred W., 1975, *Invention and Innovation under Soviet Law: A Comparative Analysis*. Lexington, Mass.: Lexington Books.
- Boehm, Klaus, with Aubrey Silberston, 1967, *The British Patent System: I. Administration*. Cambridge: Cambridge University Press.
- Doi, Teruo, 1980, *The Intellectual Property Law of Japan*. Alphen aan den Rijn, the Netherlands: Sijthoff & Noordhoff.
- Doorman, Gerard, 1948a, "Patent Law in the Netherlands, Part I," *Journal of Patent Office Society*. 30, 225-241.
- Doorman, Gerard, 1948b, "Patent Law in the Netherlands, Part II," *Journal of Patent Office Society*. 30, 258-271.
- Doorman, Gerard, 1948c, "Patent Law in the Netherlands, Part III," *Journal of Patent Office Society*. 30, 347-367.
- Dutton, Harold I., 1984, *The Patent System and Inventive Activity During the Industrial Revolution, 1750-1852*. Manchester, England: Manchester University Press.
- Kim, Young, 1996, *Background Reading Material on the Intellectual Property System in the Republic of Korea*. WIPO Publication no. 686. Geneva: World Intellectual Property Organisation.
- Schiff, Eric, 1971, *Industrialization Without National Patents: The Netherlands, 1869-1912, Switzerland, 1850-1907*. Princeton: Princeton University Press.
- Skorodinskii, A., 1909, *Studien in der Praxis des Russischen Patentgesetzes*. St. Petersburg: Privately Printed.
- Skorodinskii, A., 1910, *Russian Patent Law and Practice*. London: Herbert Hadden & Co.
- U.S. Library of Congress, Legislative Reference Service, 1958, *Patent Office Fees—A Legislative History*. U.S. Senate, Committee on the Judiciary, Subcommittee on Patents, Trademarks, and Copyright, 85<sup>th</sup> Congress, 2<sup>nd</sup> Session, Study No. 13. Washington: Government Printing Office.
- Walterscheid, Edward C., 1998, *To Promote the Progress of Useful Arts: American Patent Law and Administration, 1787-1836*. Littleton, Col.: F.B. Rothman.

## Appendix B: Information Sources for Other Variables

### Discount Rates and Deflators:

Global Financial Data, 1999, *Global Financial Database* (computer database). Los Angeles: Global Financial Data.

U.S. Department of Commerce, Bureau of the Census, 1976, *Historical Statistics of the United States: Colonial Times to 1970*. Washington: Government Printing Office.

U.S. Council of Economic Advisors, 1999, *Economic Report of the President*. Washington: Government Printing Office.

### Exchange Rates:

Board of Governors of the Federal Reserve System, 1943, *Banking and Monetary Statistics*. Washington: Board of Governors of the Federal Reserve System.

Global Financial Data, 1999, *Global Financial Database* (computer database). Los Angeles: Global Financial Data.

International Monetary Fund, 1999 and earlier years, *International Financial Statistics*. Washington: International Monetary Fund.

Schneider, Jurgen, Oskar Schwarzer, and Friedrich Zellfelder, 1991-1997, *Wahrungen der Welt. Beitrage zur Wirtschafts- und Socialgeschichte*, Volumes 44-47, 49-50, 57, and 61. Stuttgart: F. Steiner.

### Gross Domestic Product and Trade Measures:

Banks, Arthur S., 1999, *Cross-National Time Series, 1815-1998* (computer database). Binghamton: Center for Comparative Political Research, State University of New York (Binghamton).

International Monetary Fund, 1999 and earlier years, *International Financial Statistics*. Washington: International Monetary Fund.

Maddison, Angus, *Monitoring the World Economy, 1820-1992*. Paris: Development Centre, Organisation for Economic Co-Operation and Development.

Mitchell, Brian R., 1998, *International Historical Statistics: Africa, Asia & Oceania, 1750-1993*. New York: Stockton Press.

Mitchell, Brian R., 1998, *International Historical Statistics: Europe, 1750-1993*. New York: Stockton Press.

Mitchell, Brian R., 1998, *International Historical Statistics: The Americas, 1750-1993*. New York: Stockton Press.

### Legal Families:

David, Rene, and John Brierley, 1985, *Major Legal Systems in the World Today*. London: Stevens and Sons.



La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny, 1999, "The Quality of Government," *Journal of Law, Economics and Organization*, 15, 222-279.

Reynolds, Thomas, and Arturo Flores, 1989, *Foreign Law: Current Sources of Basic Legislation in Jurisdictions of the World*. Littleton, Col.: Rothman & Co.

Population and Demographic Measures:

Banks, Arthur S., 1999, *Cross-National Time Series, 1815-1998* (computer database). Binghamton: Center for Comparative Political Research, State University of New York (Binghamton).

International Labor Office, 1998 and earlier years, *Yearbook of Labour Statistics*. Geneva: International Labour Organization.

Mitchell volumes [see references in "Gross Domestic Product and Trade Measures" above].

United Nations Educational, Scientific and Cultural Organization, 1998 and earlier years, *UNESCO Statistical Yearbook*. Paris: UNESCO Publishing.

United Nations Educational, Scientific and Cultural Organization, 1998, *World Culture Report*. Paris: UNESCO Publishing.

World Bank, 1999 and earlier years, *World Development Indicators*. Washington: World Bank.

**Table 1. Discretion granted the patentee: renewal fees.** The sample consists of the sixty largest countries (by gross domestic product) at the end of 1997, observed at 25-year intervals from 1850 to 1999. The table denotes the ratio of the costs incurred in the second half of the patent award carried to full term (not including any extension granted at the discretion of government officials) to the total cost in the first half (expressed in nominal dollars). The footnotes denote the number of renewal fees paid during this period. Observations where the country was not an independent entity are filled in; those where the country did not have a patent system are shaded.

	1850	1875	1900	1925	1950	1975	1999
Algeria						NA	145%****
Argentina		33%****	40%****	49%****	52%****	36%****	98%****
Australia				63%*	234%****	169%****	236%****
Austria	55%****	0%	544%****	881%****	552%****	769%****	466%****
Bangladesh						NA	370%****
Belgium	0%*	280%****	282%****	295%****	361%****	365%****	303%****
Brazil	0%	0%	286%****	222%****	89%****	0%**	192%****
Canada		50%**	50%**	0%	0%	0%	146%****
Chile	0%	0%	0%	0%	99%**	50%**	0%
China							510%****
Columbia	0%	0%	0%	0%	NA	NA	58%**
Czech Republic				544%****	529%****	70%****	330%****
Denmark		0%	493%****	436%****	331%****	230%****	195%****
Egypt						187%****	156%****
Finland				364%****	373%****	297%****	317%****
France	88%****	88%****	88%****	154%****	217%****	141%****	218%****
Germany	0%	0%	233%****	771%****	793%****	788%****	661%****
Greece				233%****	155%****	173%****	291%****
Hungary				507%****	748%****	281%****	194%****
India					404%****	327%****	818%****
Indonesia							344%****
Iran					NA	152%****	146%****
Iraq					NA	NA	141%****
Ireland					287%****	327%****	205%****
Israel					188%***	221%****	356%***
Italy	100%*	133%****	133%****	219%****	323%****	322%****	564%****
Japan			216%****	226%****	508%****	345%****	751%****
Kuwait						NA	0%
Libya						NA	0%
Malaysia							278%****
Mexico	0%	0%	109%***	109%****	106%****	106%****	103%****
Morocco						NA	151%****
Myanmar							
Netherlands	0%			188%****	189%****	151%****	231%****
New Zealand				0%**	135%***	146%***	162%***
Nigeria						NA	0%
Norway	0%	0%	205%****	395%****	305%****	267%****	246%****
Pakistan					385%****	385%****	375%****
Peru		0%	111%****	0%	NA	682%*	NA
Philippines					NA	150%****	150%****
Poland				461%****	378%****	183%****	232%****
Portugal	0%	88%****	0%	114%****	105%****	72%****	225%****
Romania				224%****	0%	193%****	174%****
Russia	0%	0%	357%****		327%****	109%****	296%****
Saudi Arabia							107%****
Singapore							153%****
South Africa				178%***	124%****	114%****	100%****

South Korea					NA	NA	841%****
Spain	0%	0%	282%****	341%****	446%****	351%****	353%****
Sweden	0%	0%	176%****	250%****	343%****	243%****	226%****
Switzerland			198%****	198%****	198%****	425%****	99%****
Syria					NA	NA	150%****
Taiwan					NA	NA	354%****
Thailand							884%****
Turkey			88%****	88%****	169%****	95%****	93%****
Ukraine							239%****
United Arab Emirates							NA
United Kingdom	0%	133%**	467%****	333%****	313%****	260%****	276%****
United States	0%	0%	0%	0%	0%	0%	60%***
Venezuela			0%	0%	NA	149%****	NA

Notes:

\* = One renewal fee.

\*\* = Two renewal fees.

\*\*\* = Three to five renewal fees

\*\*\*\* = Six or more renewal fees.

NA = No data on patent fees are available.

I compute the ratio of the total cost incurred during the last half of the period from patent application to the expiration of the award (with no provisions for discretionary extensions) to the cost in the first half. For 1950 and afterwards, it is assumed that awards occur two years after the application date (one year after publication date). For 1900 and 1925, it is assumed awards occur one year after the application date (and publication date). For 1850 and 1875, it is assumed awards occur only a nominal period after application.

**Table 2. Discretion granted the patentee: administrative procedures.** The sample consists of the sixty largest countries (by gross domestic product) at the end of 1997, observed at 25-year intervals from 1850 to 1999. The table denotes the maximum length of time (in years from the application date) that a patentee can delay the examination of a patent application. The footnotes denote other major areas where patentees can exercise discretion during the patent approval process. Observations where the country was not an independent entity are filled in; those where the country did not have a patent system are shaded.

	1850	1875	1900	1925	1950	1975	1999
Algeria						0 <sup>A</sup>	0 <sup>A,U</sup>
Argentina		0 <sup>A,P</sup>	0 <sup>A,P</sup>	0 <sup>A,P</sup>	0 <sup>A,P</sup>	0 <sup>A,P</sup>	0 <sup>A,P</sup>
Australia				0 <sup>A,P</sup>	0 <sup>A,P</sup>	5 <sup>A,P</sup>	5 <sup>A,P,U</sup>
Austria	0	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>
Bangladesh						0 <sup>A,P</sup>	0 <sup>A,P</sup>
Belgium	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A,U</sup>	0 <sup>U</sup>
Brazil	0	0	0 <sup>A,P</sup>	0 <sup>A,P</sup>	0 <sup>A,U</sup>	3 <sup>U</sup>	3 <sup>U</sup>
Canada		0 <sup>P</sup>	0 <sup>P</sup>	0 <sup>P</sup>	0 <sup>P</sup>	0 <sup>P</sup>	0 <sup>P</sup>
Chile	0	0	0	0	0 <sup>P</sup>	0 <sup>P</sup>	0 <sup>A,P</sup>
China							3 <sup>U</sup>
Columbia	0	0	0	0	0	0 <sup>A</sup>	0 <sup>A,U</sup>
Czech Republic				0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	3 <sup>A,U</sup>
Denmark		0	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0
Egypt						0 <sup>A</sup>	0 <sup>A</sup>
Finland				0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0
France	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	3 <sup>A</sup>
Germany	0	0	0 <sup>A,U</sup>	0 <sup>A,U</sup>	0 <sup>A,U</sup>	7 <sup>A,U</sup>	7 <sup>U</sup>
Greece				0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A,U</sup>
Hungary				0 <sup>A</sup>	0 <sup>A</sup>	5	5 <sup>U</sup>
India					0 <sup>A,P</sup>	0 <sup>A,P</sup>	0 <sup>A,P</sup>
Indonesia							2.5 <sup>U</sup>
Iran					0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>
Iraq					0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>
Ireland					0 <sup>A,P</sup>	0 <sup>A,P</sup>	0 <sup>P,U</sup>
Israel					0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>
Italy	0	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A,U</sup>	0 <sup>A,U</sup>	0 <sup>U</sup>
Japan			0 <sup>A,P</sup>	0 <sup>A,U</sup>	0 <sup>A,U</sup>	7 <sup>A,U</sup>	7 <sup>U</sup>
Kuwait						0 <sup>A</sup>	0 <sup>A</sup>
Libya						0 <sup>A</sup>	0 <sup>A</sup>
Malaysia							Indef. <sup>U</sup>
Mexico	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A,U</sup>
Morocco						0 <sup>A</sup>	0 <sup>A</sup>
Myanmar							
Netherlands	0 <sup>A</sup>			0 <sup>A</sup>	0 <sup>A</sup>	7 <sup>A</sup>	7
New Zealand				0 <sup>A,P</sup>	0 <sup>A,P</sup>	0 <sup>A,P</sup>	0 <sup>A,P</sup>
Nigeria						0	0
Norway	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0
Pakistan					0 <sup>A,P</sup>	0 <sup>A,P</sup>	0 <sup>A,P</sup>
Peru		0	0	0 <sup>A</sup>	0 <sup>P</sup>	0 <sup>P</sup>	0 <sup>P,U</sup>
Philippines					0	0 <sup>U</sup>	0 <sup>U</sup>
Poland				0 <sup>A,U</sup>	0 <sup>A,U</sup>	0 <sup>A,U</sup>	0 <sup>A,U</sup>
Portugal	0 <sup>A,P</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A,U</sup>	0 <sup>A,U</sup>	0 <sup>U</sup>
Romania				0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	2.5 <sup>A,U</sup>
Russia	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>		0 <sup>A</sup>	0 <sup>A</sup>	3 <sup>U</sup>
Saudi Arabia							0 <sup>A</sup>
Singapore							1.875

South Africa			0 <sup>A,P</sup>	0 <sup>A,P</sup>	0 <sup>A,P</sup>	0 <sup>A,P</sup>
South Korea				0 <sup>U</sup>	0 <sup>U</sup>	5 <sup>A,U</sup>
Spain	0	0	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A,U</sup>	0 <sup>A,U</sup>
Sweden	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>
Switzerland			0 <sup>A,P</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>
Syria				0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>
Taiwan				0 <sup>A</sup>	0 <sup>A,U</sup>	0 <sup>A,U</sup>
Thailand						6
Turkey			0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>
Ukraine						7 <sup>A,U</sup>
United Arab Emirates						0 <sup>A</sup>
United Kingdom	0 <sup>A,P</sup>	0 <sup>P</sup>	0 <sup>P</sup>	0 <sup>A,P</sup>	0 <sup>A,P</sup>	0 <sup>A,P</sup>
United States	0 <sup>A,P</sup>	0 <sup>P</sup>	0 <sup>P</sup>	0	0	0
Venezuela			0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>	0 <sup>A</sup>
						0 <sup>U</sup>

Notes:

A = Patents of addition (or improvement) can be awarded.

P = Preliminary patent applications can be awarded.

U = Utility model (minor) patents can be awarded.

**Table 3. Discretion granted the government. The sample consists of the sixty largest countries (by gross domestic product) at the end of 1997, observed at 25-year intervals from 1850 to 1999. The table denotes the maximum period that government officials can extend a domestic patent award without legislative action. The footnotes denote other major areas where government officials can exercise discretion over the patent approval process. Observations where the country was not an independent entity are filled in; those where the country did not have a patent system are shaded.**

	1850	1875	1900	1925	1950	1975	1999
Algeria						0 <sup>L</sup>	0 <sup>L</sup>
Argentina		0	0	0	0	0 <sup>L</sup>	0 <sup>L</sup>
Australia				14 <sup>L</sup>	10 <sup>L</sup>	10 <sup>L</sup>	0 <sup>L</sup>
Austria	0	0	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0
Bangladesh						10 <sup>L</sup>	10 <sup>L</sup>
Belgium	0	0	0	0	0	0	0 <sup>L</sup>
Brazil	20	20	0 <sup>L</sup>	0 <sup>L</sup>	5 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Canada		0 <sup>Ls,P</sup>	0 <sup>Ls,P</sup>	0 <sup>Ls,P</sup>	0 <sup>L,P</sup>	0 <sup>L,P</sup>	0
Chile	Indef. <sup>W</sup>	Indef. <sup>W</sup>	10 <sup>W</sup>	10 <sup>F</sup>	5	5	0
China							0 <sup>L</sup>
Columbia	0 <sup>F</sup>	0 <sup>F</sup>	0 <sup>F</sup>	0 <sup>E,F</sup>	0 <sup>E</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Czech Republic				0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0
Denmark		10	0	0	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Egypt						5 <sup>L</sup>	5 <sup>L</sup>
Finland				0	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
France	0	0	0	0	0 <sup>Ls</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Germany	0	0	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Greece				0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Hungary				0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
India					10 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Indonesia							2
Iran					0	0 <sup>E</sup>	0
Iraq					0	0 <sup>L</sup>	0 <sup>L</sup>
Ireland					10 <sup>E,L</sup>	10 <sup>L</sup>	0 <sup>L</sup>
Israel					0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Italy	10	0	0	0	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Japan			0 <sup>L</sup>	10 <sup>L</sup>	10 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Kuwait						5 <sup>L</sup>	5 <sup>L</sup>
Libya						5	5 <sup>L</sup>
Malaysia							0
Mexico	Indef. <sup>F</sup>	Indef. <sup>F</sup>	5	5	0	0 <sup>L</sup>	0
Morocco						0	0
Myanmar							
Netherlands	0			0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
New Zealand				Indef. <sup>E,L</sup>	10 <sup>L</sup>	10 <sup>L</sup>	10 <sup>L</sup>
Nigeria						0 <sup>L</sup>	0 <sup>L</sup>
Norway	Indef.	12	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Pakistan					10	10 <sup>L</sup>	0 <sup>L</sup>
Peru		0	0	10	5	0 <sup>L</sup>	0 <sup>L</sup>
Philippines					0 <sup>L,P</sup>	0 <sup>L,P</sup>	0 <sup>L,P</sup>
Poland				0	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Portugal	0 <sup>L</sup>	5 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Romania				0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Russia	0	0	0		0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Saudi Arabia							0 <sup>F</sup>
Singapore							0 <sup>Ls</sup>
South Africa				14 <sup>L</sup>	14 <sup>Ls</sup>	10 <sup>L</sup>	5 <sup>L</sup>

South Korea					7	0	0 <sup>L</sup>
Spain	0	0	0	0	0	0	0 <sup>L</sup>
Sweden	Indef.	12	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Switzerland			0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>	0 <sup>L</sup>
Syria					0	0	0
Taiwan					0 <sup>E</sup>	0 <sup>E</sup>	0 <sup>L</sup>
Thailand							0 <sup>L</sup>
Turkey			0	0	0	0	0
Ukraine							0 <sup>E</sup>
United Arab Emirates							0
United Kingdom	14	14	14 <sup>L</sup>	10 <sup>L</sup>	10 <sup>L</sup>	10 <sup>L</sup>	0 <sup>L</sup>
United States	7 <sup>P</sup>	0 <sup>P</sup>	0 <sup>P</sup>	0 <sup>P</sup>	0 <sup>P</sup>	0 <sup>P</sup>	0 <sup>P</sup>
Venezuela			0	0	0	0	0

Notes:

Indef. = No legislative limits on the period for which the government can extend a patent award.

E = Government has discretion over which patent applications to examine.

F = Government can vary fee charged patentee.

L = Government has power to license or revoke patents for reasons other than non-working.

Ls = Government has power to license or revoke some patents for reasons other than non-working (typically pharmaceutical patents).

P = Government can determine the original inventor (rather than being constrained to award patent to the first applicant).

W = Government has discretion over working period that is designated.

Table does not include cases where pharmaceutical patents are extended by a formula based on the duration of regulatory approval process. No data on licensing or revocation of patents is reported for Libya, South Korea, and Taiwan in 1975.

**Table 4. The nature of the patent examination. The sample consists of the sixty largest countries (by gross domestic product) at the end of 1997, observed at 25-year intervals from 1850 to 1999. The table denotes whether patents are examined for novelty by patent office officials and whether outside parties can oppose patent grants prior to their official issue. Observations where the country was not an independent entity are filled in; those where the country did not have a patent system are shaded.**

	1850	1875	1900	1925	1950	1975	1999
Algeria							
Argentina				Ex	Ex	Ex	Ex
Australia				Ex,Op	Ex,Op	Ex,Op	Ex,Op
Austria			Ex,Op	Ex,Op	Ex,Op	Ex,Op	Ex,Op
Bangladesh						Ex,Op	Ex,Op
Belgium							
Brazil	Ex	Ex	ExS <sup>a</sup>	ExS <sup>a</sup>	Ex,Op	Ex,Op	Ex,Op
Canada		Ex,OpInt	Ex,OpInt	Ex,OpInt	Ex,OpInt	Ex,OpInt	Ex,OpPub
Chile	Ex	Ex	Ex,Op	Ex,Op	Ex,Op	Ex,Op	Ex,Op
China							Ex,Op
Columbia				ExS,OpPub	ExS,Op	Ex,Op	Ex,Op
Czech Republic				Ex,Op	Ex,Op	Ex,Op	Ex,OpPub
Denmark		Ex	Ex,Op	Ex,Op	Ex,Op	Ex,Op	Ex,Op
Egypt						Op	Op
Finland				Ex,Op	Ex,Op	Ex,Op	Ex,Op
France						Ex,OpPub	Ex,Op
Germany	Ex	Ex	Ex,Op	Ex,Op	Op	Ex,Op	Ex,Op
Greece							Ex,OpPub
Hungary				Op	Op	Ex,Op	Ex,OpPub
India					Op	Ex,Op	Ex,Op
Indonesia							Op
Iran					Op	ExS,Op	Op
Iraq							
Ireland					ExS,Op	Ex,Op	Ex,Op
Israel					Op	Ex,Op	Ex,Op
Italy	Op	ExS <sup>b</sup>	ExS <sup>b</sup>				Op
Japan			Ex,OpInt	Ex,Op	Ex,Op	Ex,Op	Ex,Op
Kuwait						Op	Op
Libya						Op	Op
Malaysia							Ex,OpPub
Mexico	Op	Op	Op		Ex	Ex	Ex,OpPub
Morocco							
Myanmar							
Netherlands	Ex			Ex,Op	Ex,Op	Ex,Op	Ex,Op
New Zealand				ExS,Op	Ex,Op	Ex,Op	Ex,Op
Nigeria							
Norway	Op		Ex,Op	Ex,Op	Ex,Op	Ex,Op	Ex,Op
Pakistan					Op	Ex,Op	Ex,Op
Peru		Ex	Ex,	OpPub	Op	Op	Ex,Op
Philippines					Ex	Ex,OpInt	Ex,OpInt
Poland				Ex,Op		Ex,Op	Ex,Op
Portugal			Op	Op	Op	Op	Ex,Op
Romania						Ex	Ex,Op
Russia	Ex	Ex	Ex		Ex,Op	Ex	Ex,Op
Saudi Arabia							Ex,Op
Singapore							Ex,OpPub
South Africa				Op	Op	Op	Op
South Korea					Op	Ex,Op	Ex,Op



Spain							Ex,Op
Sweden	Op		Ex,Op	Ex,Op	Ex,Op	Ex,Op	Ex,Op
Switzerland						ExS <sup>c</sup> ,OpS <sup>c</sup>	ExS <sup>c</sup> ,OpS <sup>c</sup>
Syria							
Taiwan					ExS,Op	ExS,Op	Ex,Op
Thailand							Op
Turkey			ExS <sup>d</sup>				
Ukraine							ExS
United Arab Emirates							
United Kingdom		Op	Op	Ex,Op	Ex,Op	Ex,Op	Ex,Op
United States	Ex,OpInt	Ex,OpInt	Ex,OpInt	Ex,OpInt	Ex,OpInt	Ex,OpInt	Ex,OpInt
Venezuela				OpPub	Op	Op	Ex,Op

Notes:

Ex = All patent applications are examined prior to award.

ExS = Some patent applications are examined prior to award.

Op = Opposition procedure for all patent applications.

OpInt = No opposition procedure; pre-grant adversarial procedures can be initiated by patent office officials to resolve priority disputes.

OpPub = No opposition procedure; patent applications are published prior to award.

OpS = Opposition procure for some patent applications.

a = Food and pharmaceutical applications only.

b = Food applications only.

c = Time measurement and textile patent applications only.

d = Military applications only.

In some cases when there is no regular examination for novelty, the applicant can request that the patent office undertake such a search.

**Table 5. Cross-tabulation of national characteristics and patent policy.** The sample consists of the sixty largest countries (by gross domestic product) at the end of 1997, observed at 25-year intervals from 1850 to 1999. Countries with systems of registering patents granted in other nations or without an independent patent system are not included in any of the tabulations. Panel A indicates for each group the ratio of the costs incurred in the second half of a patent award carried to full term (not including any extension granted at the discretion of government officials) to the cost in the first half (expressed in nominal dollars), the number of renewal fees paid during the patent's life, the maximum length of time (in years from the application date) that a patentee can delay the examination of a patent application, the maximum period that the government officials can extend a domestic patent award without legislative action, and whether patent officials examine all patent applications for novelty. Observations are divided by the level of the country's per capita gross domestic product (in 1998 U.S. dollars), the country's population, the ratio of exports and imports to gross domestic product, the share of civilian employment in agriculture, and the literacy rate. Panel B presents the p-value of tests of the significance of these differences, based on either  $\chi^2$  (in the case of the novelty examination measure) or t-tests (in all other cases).

<b>Panel A: Mean of Different Groups</b>					
	<i>Delayed Fees</i>	<i>Number of Renewals</i>	<i>Delayed Examination</i>	<i>Patent Extensions</i>	<i>Novelty Exams</i>
<b>Per Capita Gross Domestic Product:</b>					
Top Quartile	265%	13.6	1.1	1.4	75.0%
Second Quartile	240%	12.1	0.4	2.0	66.7%
Third Quartile	192%	10.9	0.2	1.9	41.7%
Bottom Quartile	163%	8.5	0.2	4.0	30.0%
<b>Population:</b>					
Top Quartile	294%	12.0	1.0	2.1	72.6%
Second Quartile	170%	12.7	0.4	1.0	40.3%
Third Quartile	225%	11.3	0.4	2.8	48.4%
Bottom Quartile	139%	8.0	0.0	3.9	51.6%
<b>Trade Intensity:</b>					
Top Quartile	254%	14.6	0.8	1.2	59.6%
Second Quartile	219%	11.9	0.8	2.9	63.8%
Third Quartile	215%	10.3	0.2	2.6	45.6%
Bottom Quartile	204%	9.7	0.1	1.8	46.6%
<b>Agricultural Employment Share:</b>					
Top Quartile	225%	10.7	0.0	2.5	38.2%
Second Quartile	217%	11.0	0.4	1.3	50.0%
Third Quartile	199%	12.1	0.3	2.4	58.9%
Bottom Quartile	284%	13.7	1.3	1.6	76.8%
<b>Literacy Rate:</b>					
Top Quartile	280%	14.8	1.6	1.1	89.5%
Second Quartile	269%	12.2	0.5	2.2	71.2%
Third Quartile	186%	11.1	0.5	1.5	38.8%
Bottom Quartile	183%	11.6	0.0	2.2	22.4%
<b>Panel B: p-Values, Tests of Equality of Means</b>					
Above Median GDP vs. Below	0.005	0.001	0.006	0.046	0.000
Above Median Population vs. Below	0.044	0.004	0.013	0.006	0.309
Above Median Trade Intensity vs. Below	0.326	0.000	0.002	0.838	0.017
Above Median Agriculture Share vs. Below	0.453	0.024	0.006	0.809	0.000
Above Median Literacy Rate vs. Below	0.002	0.052	0.008	0.868	0.000

**Notes:**

The patent fee and renewal calculations do not include any provisions for extensions by the government due to extraordinary circumstances. In making the fee calculations, for 1950 and afterwards, it is assumed that awards occur two years after the application date (one year after publication date). For 1900 and 1925, it is assumed awards occur one year after the application date (and publication date). For 1850 and 1875, it is assumed awards occur only a nominal period after application. Cases where patents can be extended for indefinite periods are treated in this tabulation as being extendible for twenty years (the maximum statutorily stipulated period.)

Table 6. Discretion granted the patentee: renewal fees. The sample consists of the sixty largest countries (by gross domestic product) at the end of 1997, observed at 25-year intervals from 1850 to 1999. The dependent variable in the first four regressions is the ratio of the costs incurred in the second half of the patent award carried to full term (not including any extension granted at the discretion of government officials) to the cost in the first half (expressed in nominal dollars). The dependent variable in the fifth regression is the number of renewal fees paid during the patent's life. Countries with systems of registering patents granted in other nations or without an independent patent system are not included in any of the regressions. Independent variables are the level of the country's per capita gross domestic product (in thousands of 1998 U.S. dollars), the country's population (in millions), the ratio of exports plus imports to gross domestic product, the share of civilian employment in agriculture, the literacy rate (the last two are used in only some reported regressions due to the large number of missing observations), and dummy variables for the family of origin of the country's commercial legal code (not reported). The third regression employs dummy variables for each nation (not reported) instead of the legal family measures. The first through third regressions employ an ordinary least squares specification; the fourth, a Tobit specification; and the fifth, a Poisson specification. Standard errors in brackets.

	Dependent Variable:		
	Ratio of Fees in Second Half of Patent Award to Fees in First Half	Ratio of Fees in Second Half of Patent Award to Fees in First Half	Number of Renewal Fees
Per capita gross domestic product	0.01 [0.02]	0.0004 [0.02]	0.01 [0.003]***
National population	0.004 [0.001]***	0.04 [0.02]**	0.0004 [0.001]***
(Exports plus imports) / GDP	0.83 [0.43]**	0.005 [0.003]*	0.42 [0.06]***
Share of civilian employment in agriculture		-0.22 [0.68]	
National literacy rate		-0.02 [0.83]	
Legal family dummy variables	***	***	***
		0.68 [0.79]	
Number of observations	207	207	207
F-statistic/ $\chi^2$ -statistic	10.71	4.11	167
p-Value	0.000	0.000	65.19
Log Likelihood			0.000
Adjusted R <sup>2</sup> /Pseudo R <sup>2</sup>	0.27	0.25	-308.34
		0.47	0.10

Notes:

\* = Significant at the 10% confidence level; \*\* = 5% confidence level; \*\*\* = 1% confidence level.

NA = Not applicable.

I compute the ratio of the total cost incurred during the last half of the period from patent application to the expiration of the award (with no provisions for extensions granted at the discretion of government officials) to the cost in the first half. For 1950 and afterwards, it is assumed that awards occur two years after the application date (one year after publication date). For 1900 and 1925, it is assumed awards occur one year after the application date (and publication date). For 1850 and 1875, it is assumed awards occur only a nominal period after application.

Table 7. Discretion granted the patentees: administrative procedures. The sample consists of the sixty largest countries (by gross domestic product) at the end of 1997, observed at 25-year intervals from 1850 to 1999. The dependent variable in the first three regressions is the maximum length of time (in years from the application date) that a patentee can delay the examination of a patent application. The dependent variable in the fourth and fifth regressions is the count of how many of three commonly encountered alternative patent award schemes (patents of addition, preliminary patents, and utility models) are offered. Countries with systems of registering patents granted in other nations or without an independent patent system are not included in any of the regressions. Independent variables are the level of the country's per capita gross domestic product (in thousands of 1998 U.S. dollars), the country's population (in millions), the ratio of exports plus imports to gross domestic product, the share of civilian employment in agriculture, the literacy rate (the last two are used in only some reported regressions due to the large number of missing observations), and dummy variables for the family of origin of the country's commercial legal code (not reported). The first through third regressions employ a Tobit specification; the fourth and fifth, an ordered logit specification. Standard errors in brackets.

	Dependent Variable:		
	<i>Maximum Delay That Patentee Can Request</i>	<i>Count of Patent Alternatives</i>	
Per capita gross domestic product	0.30 [0.11]***	0.07 [0.14]	0.06 [0.11]
National population	0.010 [0.006]*	0.012 [0.006]**	0.012 [0.006]**
(Exports plus imports) / GDP	6.10 [2.45]**	4.83 [2.36]**	5.85 [2.31]**
Share of civilian employment in agriculture		-14.87 [7.43]**	
National literacy rate			20.48 [9.57]**
Legal family dummy variables	*		***
Number of observations	230	218	225
$\chi^2$ -statistic	30.28	33.29	29.07
p-Value	0.000	0.000	0.000
Log Likelihood	-120.96	-118.05	-200.92
Pseudo R <sup>2</sup>	0.11	0.12	0.07

Notes:

\* = Significant at the 10% confidence level; \*\* = 5% confidence level; \*\*\* = 1% confidence level.

**Table 8. Discretion granted to the patent office.** The sample consists of the sixty largest countries (by gross domestic product) at the end of 1997, observed at 25-year intervals from 1850 to 1999. The dependent variable in the first two regressions is the maximum period (in years) that the government officials can extend a domestic patent award without legislative action. Because in some cases the length of extension is discretionary, a censored regression is run with the maximum length being twenty years or greater. The dependent variable in the third regression is the count of how many of five commonly encountered forms of discretion granted to patent office officials (choosing which patents to examine, determining the working period, setting fees, ascertaining whether to license or revoke patents for reasons other than non-working, and determining the inventor based on criteria other than the filing date) are present. Countries with systems of registering patents granted in other nations or without an independent patent system are not included in any of the regressions. Independent variables are the level of the country's per capita gross domestic product (in thousands of 1998 U.S. dollars), the country's population (in millions), the ratio of exports plus imports to gross domestic product, the literacy rate (used in only some reported regressions due to the large number of missing observations), and dummy variables for the family of origin of the country's commercial legal code (not reported). The first and second regressions employ a censored regression specification; the third, an ordered logit specification. Standard errors in brackets.

	Dependent Variable:		
	<i>Maximum Patent Life Extension</i>		<i>Discretionary Provisions</i>
Per capita gross domestic product	-0.10 [0.04]**	-0.05 [0.04]	-0.03 [0.03]
National population	-0.005 [0.002]**	-0.004 [0.002]**	-0.001 [0.001]
(Exports plus imports) / GDP	-1.57 [0.97]	-1.55 [0.77]**	-1.78 [0.79]**
National literacy rate		-0.88 [1.18]	
Legal family dummy variables	***	***	**
Number of observations	230	190	227
$\chi^2$ -statistic	53.45	66.94	27.42
p-Value	0.000	0.000	0.001
Log Likelihood	-645.16	-488.27	-129.85
Pseudo R <sup>2</sup>	0.04	0.06	0.10

Notes:

\* = Significant at the 10% confidence level; \*\* = 5% confidence level; \*\*\* = 1% confidence level.

The patent life extension measure does not include cases where pharmaceutical patents are extended by a formula based on the duration of regulatory approval process.

**Table 9. The nature of the patent examination.** The sample consists of the sixty largest countries (by gross domestic product) at the end of 1997, observed at 25-year intervals from 1850 to 1999. The dependent variable in the first and second regression takes on the value zero if there is no examination for novelty, the value one if some patents are examined for novelty by the patent office officials and/or patent office officials rule on cases where outside parties oppose patent grants prior to their official issue, and the value two if all patent applications are examined for novelty by patent office officials. The dependent variable in the third regressions is a dummy that takes on the value one if all patent applications are examined for novelty by patent office officials, and zero otherwise. Countries with systems of registering patents granted in other nations or without an independent patent system are not included in any of the regressions. Independent variables are the level of the country's per capita gross domestic product (in thousands of 1998 U.S. dollars), the country's population (in millions), the ratio of exports plus imports to gross domestic product, the literacy rate (used in only some reported regressions due to the large number of missing observations), and dummy variables for the family of origin of the country's commercial legal code (not reported). The first and second regressions employ an ordered logit specification; the third, a logit specification. Standard errors in brackets.

	Dependent Variable:		
	<i>Measure of Patent Office Involvement In Assessing Patent Novelty</i>	<i>Dummy if All Examined</i>	
Per capita gross domestic product	0.10 [0.03]***	0.07 [0.03]**	0.10 [0.03]***
National population	0.008 [0.004]**	0.008 [0.004]**	0.008 [0.004]**
(Exports plus imports) / GDP	-0.67 [0.55]	-0.78 [0.57]	-0.55 [0.59]
National literacy rate		2.41 [0.74]***	
Legal family dummy variables	***	***	***
Number of observations	230	190	230
$\chi^2$ -statistic	73.42	79.23	64.99
p-Value	0.000	0.000	0.000
Log Likelihood	-195.18	-150.63	-126.22
Pseudo R <sup>2</sup>	0.16	0.21	0.20

Notes:

\* = Significant at the 10% confidence level; \*\* = 5% confidence level; \*\*\* = 1% confidence level.

In cases when there is no regular examination for novelty, but the applicant can request that the patent office undertake such a search, the patent office is not coded as having examination power.