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The Impact of Trade Secret Laws on the Innovation Activity

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Abstract
The aim of this paper is to analyze the impact of the Unfair Competition Prevention Law on the Japanese innovation activity and, in particular, on the R&D expenditure-patent dynamic. Considering the patent statistics as a good proxy of the innovation processes, we outline the historical series of the patents granted in the manufacturing Japanese industries (the sectors we are interested in examining). We proceed by studying the effects of the R&D expenditures on the patent trend and we try to define the optimal lag between the funding and its productivity effect. Subsequently, we inquire on the impact that the trade secret law might have had on the model. A Chow breaking test is applied in order to see if there was a significant difference in the estimated equation after the promulgation date.

Keywords: Industrial Espionage; Trade Secret Law; R&D Expenditure; Patents
JEL Classification: K4, L5; O3

1. Introduction

In the context of a global weightless economy (Quah, 1999) where volatile resources become constantly dominant, the incentive to engage in a creative activity depends to a greater extent on the security of intellectual property rights.

Examining the factors that enforce or attenuate entry barriers, Agarwal and Gort (2000) denote that "the rate of initial competitive entry in new markets has been rising rapidly and steadily over the last century", mainly due to forces of rapid information dissemination and reverse engineering and to the dramatic increase of "the speed at which imitators gain access to the innovation related information"[1] (p. 17). The weakening of entry barriers does not necessarily insinuate a relapse in the incentive to innovate, but may reflect the influence of other factors, such as a change in the appropriability mechanisms.

In the main, the objective of unfair competition policies is to enhance economic welfare by avoiding torts that cause economic injuries to businesses, such as antitrust procedures, trademark infringements, misappropriation of trade secrets, trade libel and tortious interference. The first part of the article delves into the contradicting theoretical foundations of the effects of unfair competition on incentives to innovate.

Introducing in the basic Schumpeterian model of Aghion and Howitt (1992) the option for researchers of appropriating the ideas produced by other inventors, Cozzi (2002) finds that that a large intensity of aggregate spying activity reduces the appropriability of individual innovations and therefore unbalances the economic incentives to the detriment of the inventive activity, proving to be harmful for both innovation and growth. However,

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[1] The authors illustrate that the duration of the average interval between an innovation and its first competitive imitation has steadily decreased over the last century from a mean of 32.75 years in the period 1887 – 1906 to 3.40 years between 1967 and 1986.

tolerating some degree of wasteful espionage may be efficiency improving, but only if there are no other means of addressing the Schumpeterian overinvestment problem.

Grossman (2006) also reaches the conclusion that industrial espionage deters research, discourages the innovation activity and, therefore, can be harmful for economic growth. He argues that the better the environment for pirating is, the smaller is the net value per capita of ideas created. This situation occurs because guarding ideas from pirating includes costly activities[2] that require "either the direct use of an inventor's time and effort or the spending of part of an inventor's gross income on hiring other people, such as lawyers" (p. 2).

Contradicting Cozzi's and Grossman's view, Gilson (1999) and Hyde (2001) define the trade secret protection as a legal impediment to endogenous growth, by emphasizing the side effects of an inaccurately applied legislation: high velocity employment and, hence, rapid information diffusion. Using the Silicon Valley case, the two legal scholars argue that the lack of enforcement of the law explains the high labor turnover in the high-tech hub: "California law «in action» (as opposed to «on the books») efficiently promoted the endogenous economic growth described by Paul Romer […]. It promised property in information and therefore seemed to offer incentives to firms to invest in its production. Yet, by not impeding employee mobility, it fostered the information spillovers that are essential to economic growth" (Hyde, 2001).

Although in the last decades public awareness has been intensifying and legislation has undergone substantial adjustments, the legal protection of trade secrets is far from being complete. Choate et al. (1987), Budden (1996) and Merges (1998) notice that the US Uniform Trade Secrets Act provides less effective protection than it may at first appear[3]. Examining the anti-industrial espionage legislation in Europe, Cozzi and Pietrosanti (2006) observes that no country has a law comparable to the US Economic Espionage Act. Moreover, the degree of protection of R&D from spies is very heterogeneous within the EU, suggesting a serious potential weakness of the European environment for ambitious R&D projects. As far as the Japanese legislation is concerned, Limpert and Iatsyk (2001) focus on the shortcomings of the 1993 law.

Another adverse hypothesis concerning the efficiency of the trade secret laws is sustained by Bessen and Maskin (2000) who believe that, in a static model, imitation invariably discourages innovation, but "in a dynamic world, imitators can provide benefit to both the original innovator and to society as a whole" (p. 20). Although it reduces the firm's current profit, imitation facilitates knowledge transfer, raising the probability of further innovation and increasing the speed at which new products are developed. The intellectual property protection should, therefore, favor a balanced approach which allows lawful interim imitation and potentially valuable complementary contributions[4].

The remainder of the paper is organized as follows. Sections 2 and 3 describe the databases utilized and set up the model that best reflects the temporal lag between an R&D investment and its productive effects (proxied by the number of granted patents). Section 4 applies to the previous framework a stability test that verifies the existence of a structural break in the promulgation year of the Japanese trade secret law and derives the main results. Section 5 concludes the paper with a few remarks and introduces future research agenda.

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[2] Usher (1987) develops a similar model in which producers also decide how much time and effort to put into guarding against predators.

[3] Merges (1998) states with respect to this concern that: "while trade secret law protects pure information in theory, in practice trade secret law actions by ex-employers are rarely successful when the former employee(s) take nothing tangible with them".

[4] We must underline, though, that the analysis conducted by Bessen and Maskin (2000) is confined to the high-tech industries, where innovation is both sequential and complementary.

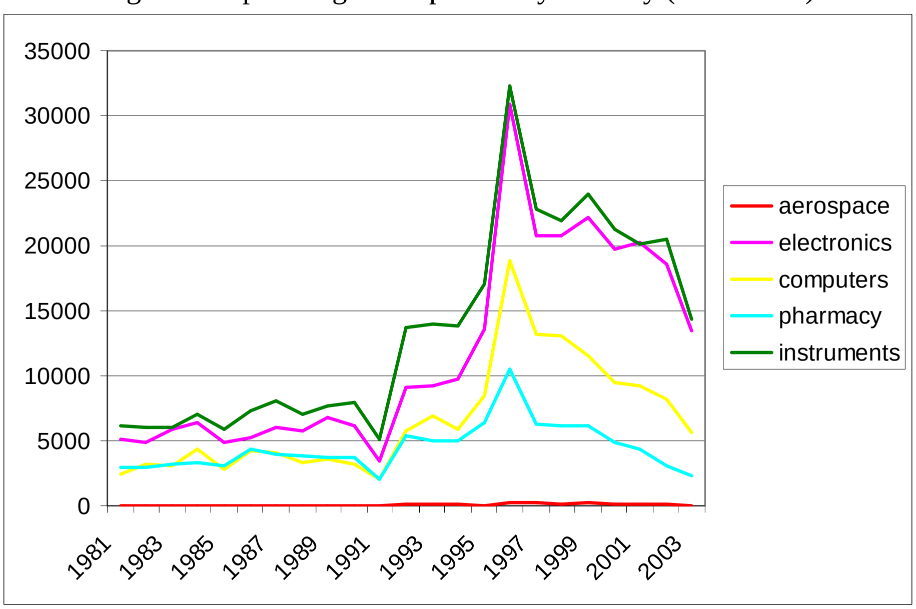
2. Data description

In its efforts to ensure fair competition among entrepreneurs and thereby to contribute to the wholesome development of the national economy, Japan adopted in 1993 the Unfair Competition Prevention Law ("UCPL", Law No. 47, promulgated on May 19, 1993) and, consequently, addressed the recently encountered problems of dissemination of technical information and know-how developed within the country. According to its penal provisions, any person who falls under its is sentenced to imprisonment for a term not exceeding three years or fined an amount not exceeding ¥3,000,000. Through the 2005 amendments, the protection of trade secrets is reinforced and the penalties are enhanced[5].

The aim of this paper is to analyze the impact of the Unfair Competition Prevention Law (UCPL) on the Japanese innovation activity and, in particular, on the R&D expenditure-patent dynamic. In order to do that, we refer to two data files: the Japan Patent Office database (JPO Patent Database, hereafter) and the OECD Main Science and Technology Indicators (MSTI). Considering the patent statistics as a good proxy of the innovation processes, we start our approach by outlining the historical series of the patents granted between 1981 and 2003 in five manufacturing industries. We proceed by studying the effects of the R&D expenditures on the patent trend and we try to define the optimal lag between the funding and its productivity effect by using a least squares regression. Subsequently, we inquire on the impact that the trade secret law might have had on the model. A Chow forecast test is applied in order to see if there was a significant difference in the estimated equation after the promulgation date.

Since the JPO Patent Database uses the International Patent Classification (IPC) and the MSTI applies the International Standard Industrial Classification (ISIC Rev.2), we convert the IPC coding system into five aggregated ISIC categories: aerospace, electronics, computers and office machines, pharmacy and instruments. The substitution was possible due to the MERIT concordance table developed by Verspagen et al. (1994) and partially presented in Appendix I.

Figure 1. Japanese granted patents by industry (1981-2003)



[5] The 2005 Amendment increase the severity of the penalty to a period of five years and a fine of 5,000,000 yen. Both imprisonment and the fine can be sentenced at the same time (Article 21, paragraph 1).

As shown in Figure 1, although the discrepancies between the number of registered patents are sometimes significant across industries, the database illustrates homogenous trends for all the sectors. A deep collapse is registered in 1991, followed by a significant boost in 1996. The 1996 drastic growth of the granted patents may represent what Freeman and Perez (1988) name, in their innovation taxonomy, a “systematic innovation”, i.e. far-reaching changes in technology that lead to the proliferation of radical innovations which immediately diffuse into the economy and generate a large number of incremental innovations ("bandwagon effect").

3. The model

Using the R&D expenditure MSTI data (2008), we try to calculate the lag between the year of R&D investments made by private and public enterprises in each industry and the year of the patent registration in the respective sectors. Through the least squares method and the backward stepwise procedure, we have defined the optimal model that characterizes all the sectors, considering the number of registered patents as the dependent variable, autoregressive for n periods, and the R&D expenditure as the independent variable. We found that the fourth annual lag is significant at conventional levels and that its coefficient is the highest in absolute terms as far as R&D is concerned, confirming the results obtained by Ravenscraft et al. (1982) and Rouvinen (2002)[6]. Therefore, the estimated equation has the following form:

PATENTS = C(1) + C(2)*PATENTS(-1) + C(3)*INVESTMENTS(-4) (1)

and the substituted coefficients are:

PATENTS = 706.641650059 + 0.85375539362* PATENTS (-1) + 0.1924602872* INVESTMENTS(-4) (2)

However, if we are to deduce the model that best represents the productivity effects of R&D funding in each industrial sector, the lags differ, augmenting to five years in the aerospace and computer industries, while in the instruments sector the R&D funding defrayed by the public and private enterprises materializes in patents after a period of only one year.

4. Empirical results

Starting from the simple models previously identified and their corresponding lags, we precede our analysis by inquiring on the repercussions that the Unfair Competition Prevention Law might have had on the independent variables. In order to determine the existence of an impact, we apply the Chow forecast test for 1993, the promulgation date of the law. The output of the test (presented in Table 1) decisively rejects the null hypothesis of stability of the parameters. The most pronounced structural breaks occurred in the aerospace and electronics sectors, results confirmed by the CUSUM of squares test (see Appendix II).

[6] As Rouvinen (2002) remarks, in the perpetual inventory method, either the current or the one-year lagged values of the constructed R&D stocks are used as regressors. Investigating the U. S. manufacturing sector data during the 1970's, Hall et al. (1984) identify a significant effect of R&D on patenting predominantly within the first year. On a few occasions, the three-year lags are been assumed between changes in the R&D stock and their effects on total factor productivity (e.g. Englander et al., 1988; Park, 1995).

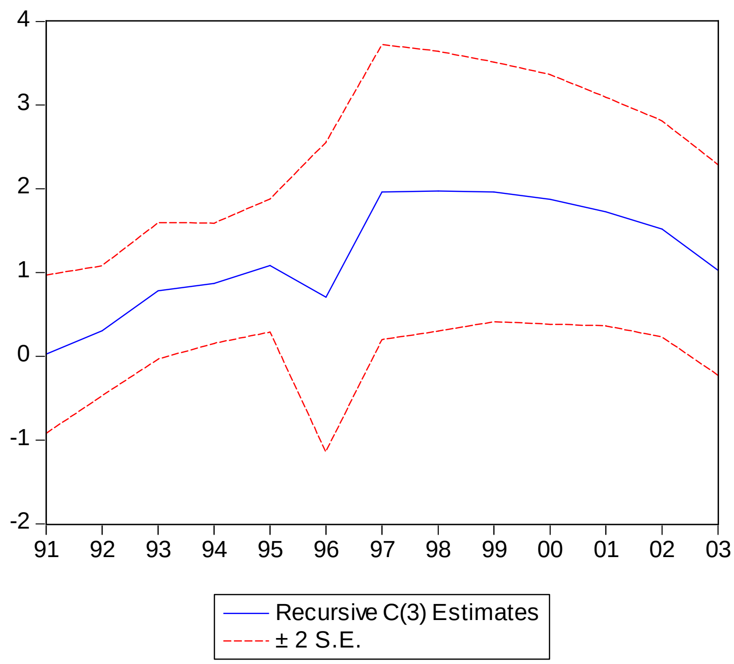
Table 1. Chow Forecast Test Output (1993)

Chow Forecast Test: Forecast from 1993 to 2003

Aerospace	F-statistic	31.34103	Prob. F(11,4)	0.0023
Computer	F-statistic	9.913519	Prob. F(11,4)	0.0201
Electronics	F-statistic	19.06900	Prob. F(11,5)	0.0022
Instruments	F-statistic	12.06910	Prob. F(11,8)	0.0008
Pharmacy	F-statistic	4.285834	Prob. F(11,5)	0.0602

In consequence, the test exhibits an alteration of the relation between funding and innovation in all the manufacturing sectors that were analyzed. In order to depict the change produced in the models in the aftermath of the UCPL promulgation, we use the recursive coefficients estimations and we notice a slight increase of the coefficient of the R&D expenditure in all the sectors, confirming Cozzi's (2001) assertion that industrial espionage inhibits the inventive activity and, consequently, that a reinforced intellectual protection might exert a positive effect on the trend of new findings in the years following the promulgation (as, for example, is illustrated in the electronics industry case in Figure 2).

Figure 2. Recursive Coefficients Estimates – Electronics Sector



5. Conclusion

Resuming the empirical observations, we have remarked that the trend of the historical series of the granted patents is similar for all the manufacturing sectors observed between 1981 and 2003. The dynamics of the R&D expenditure – patents is also homogenous across industries, since the temporal lag between the investments and the granted patents generally reaches a four to five year period. In the instruments sector, however, the productive effects of the funding can emerge immediately, even within a year's time.

Addressing the recently encountered problem of dissemination of technical information, Japan adopted a law preventing the improper acquisition of trade secrets and the transactions with imitated goods. Albeit the theoretical framework on the unfair competition law advances antithetical arguments on the impact that this legislation might exert on the incentives to innovate, according to the test output, the promulgation of the act affected the industries under observation (although in various degrees). The impact was reflected in an attenuated growth of the coefficient of the funding variable.

Our empirical approach is over simplified, and not without limits: the patents measure only a fraction of the output of R&D and the fraction may vary considerably over time. Also, several studies (Pakes, 1984; Schankerman and Pakes, 1984) have evidenced that a large fraction of the granted patents are "worthless" or become obsolete in a short period of time. Furthermore, the short period of time of the data available to us may have distorted the results of the test. Bearing these impediments in mind and in the attempt of correcting them, we also find challenge for further research in broadening our analysis to other developing countries.

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Appendix I

The MERIT concordance table

Description aggregate sector	ISIC	IPC	Percentage of correspondence (%)
Aerospace	3845	B64B	100
		B64C	100
		B64D	100
		B64F	70
		B64G	100
Electronics	3832	G08C	100
		G09B	50
		H01C	100
		H01L	100
		H01P	100
		H01Q	100
		H03B	100
		H03C	100
		H03D	100
		H03F	100
		H03G	100
		H03H	100
		H03J	100
		H03K	100
		H03L	100
		H04A	100
		H04B	100
		H04G	100
		H04H	100
		H04J	100
		H04K	100
		H04L	100
		H04M	100
		H04N	100
		H04Q	100
		H04R	100
		H04S	100
		H05K	100
Computers & office machines	3825	B41J	100
		B41L	50
		G06C	100
		G06E	100
		G06F	100
		G06G	100
		G06J	100
		G06K	100
		G06M	100

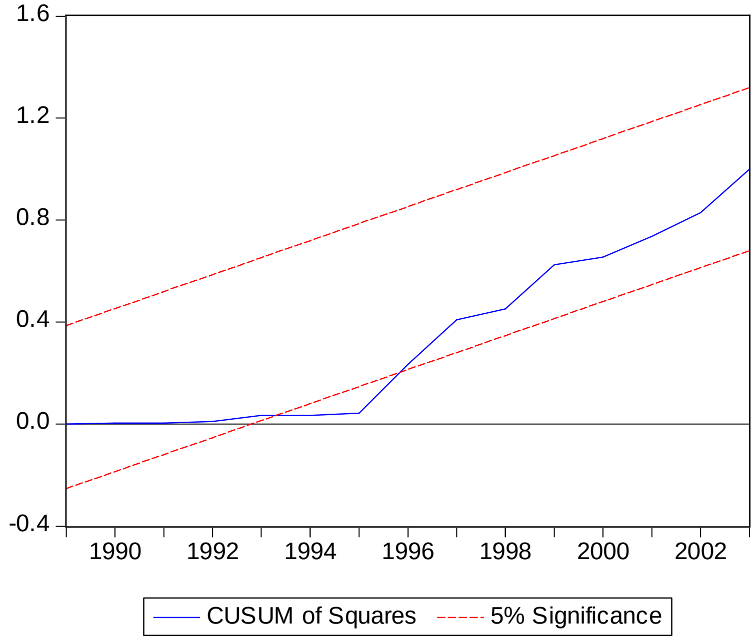
		G11B G11C	100 100
Pharmacy	3522	A61J A61K C07B C07C C07D C07F C07G C07H C07J C07K C12N C12P C12S	30 65 85 85 85 85 85 90 100 100 80 50 100
Instruments	3850	A61B A61C A61D A61F A61G A61H A61L A61M A61N A62B B01L B64F C12K C12Q F16P F22B F22D F22G F22X F23N F23Q F24F F41G G01B G01C G01D G01F G01H G01J G01K G01L G01M G01N G01P G01R	100 100 100 100 90 40 60 100 100 50 100 10 25 100 60 20 20 20 20 100 10 20 100 100 100 100 60 100 100 100 100 100 100 100 100

		G01S	100
		G01T	100
		G01V	100
		G01W	100
		G02B	100
		G02C	100
		G02F	100
		G03B	100
		G03C	100
		G03D	100
		G03G	100
		G03H	100
		G04B	100
		G04C	100
		G04F	100
		G04G	100
		G05B	100
		G05C	100
		G05D	100
		G05F	100
		G05G	100
		G06D	100
		G07B	100
		G07C	100
		G07D	100
		G07F	100
		G07G	100
		G09G	100
		G12B	100
		G21F	100
		G21G	100
		G21H	100
		G21K	100
		H05G	100

Source: Verspagen et al. (1994)

Appendix II

CUSUM Squares Test - Aerospace sector



CUSUM Squares Test - Electronics sector