



IPRs Protection Measure and Regional Differences in China

Limin Yao (Corresponding author)

College of Business Administration, Zhejiang University of Technology

288, Liuhe Road, Hangzhou, 310023, China

Tel: 86-571-8529-0043 E-mail: ylm@zjut.edu.cn

Yan Rao

Hangzhou Administration Office of Harbor and Shipping

667, Yaolin Road, Tonglu County, Hangzhou, 311501, China

Tel: 86-571-6422-2700 E-mail: happyrao@126.com

Abstract

This paper studies the regional differences of intellectual property rights (IPRs), revealing IPRs protection's regional difference in China. By introducing "implementation effect" to adjust G-P Index, it can be realized that China's IPRs protection have been steadily improved, and there has been obvious and steady differences in IPRs. Developed districts have higher protection level of IPRs than the undeveloped districts. Some correlation analyses indicate that the protection level of IPRs has great correlation with the per capita GDP, and even a greater outward. China's economic unbalance determines regional differences in the protection of IPRs. However, having the poor correlation with R&D investment shows that IPRs protection doesn't influenced the technology improvement a lot. What's more, the positive function of IPRs will be hardly recognized in these undeveloped districts.

Keywords: Intellectual property rights (IPRs), Adjusted GPI, Regional differences, Implementation effect, Economic development

1. Introduction

Since the 1980s, the protection of intellectual property rights (IPRs) has been the negotiating focus between China and United States. U.S. complains that it's China's poor protection of IPRs that causes serious infringement (Note 1). To China, revealing the regional difference of the China's IPRs protection can not only help analyze the objective factors of China's protection of IPRs, but is also favorable for China government to nail down China's position in the negotiation between China and the United States. Economically, it's of great importance to reveal the function of the IPRs protection in China's economic development and technological innovation. It's also significant for the central and local government to formulate policies. However, the precondition to reveal the difference of intellectual property protection is to construct a more scientific and reasonable measuring method.

It's hard to quantify the level of each country's intellectual property protection (Maskus, 2000). It was until the 1990s that someone had made research in this realm. The earliest would be Rapp and Rozek (1990). Later, Ginarte and Park put forward a more integrated measurement on Rapp-Rozek's basis, which is now called G-P index. They categorize the index used to measure the level of protection into 5 sorts: (1) the coverage of the protection; (2) the member of international treaty;(3)the protection of forfeited rights; (4)enforcement; (5) the duration of protection. Each classification includes several measure indexes. Ginarte and Park regulate that each measure index accounts for 1score. The summation of each index's score divided by the number of indicators is the score of this category. The accumulation of the 5 categories is the level of quantized protection of intellectual property. However, such a method only evaluates whether a country has constituted the relative law of IPRs protection, without the consideration of its implementation effect. For some developed countries, these indexes are more effective in judging the law's implement effect. But it's not appropriate for some countries with unbalanced development in transition. In allusion to Ginarte-Park's method, Han Yuxiong and Li Huaizu put forth some improvement. But their improvement still hasn't considered China's regional unbalance in economic development and is difficult to analyze the regional difference in IPRs protection. Therefore, to judge the level of IPRs protection on Ginarte-Park Index's basis (hereinafter referred to as GPI), this paper induct the "implementation effect" to modify GPI. By modifying the index, this article measured the

IPRs protection of each province in 5 years, and discloses the obvious regional difference in China's IPRs protection.

The following text makes use of GPI to measure the IPRs protection. Then, inducing "implementation effect" can measure each province's protection level, analyzing the regional difference and relative factors in each area. And finally we can get the conclusion.

2. The measure of China's IPRs protection level: Ginart-Park

Since the 1980s, China's intellectual property law has experienced several momentous modifications. In 1985, China's patent law took effect and acceded to Paris Convention. Since the mid 1980s, the United States has promoted the link between IPRs protection and the international trade in the negotiation with Uruguay. The United States has exerted great pressure on many countries and regions about IPRs protection, such as Taiwan and Korea (Note 2). Meanwhile, China government has reinforced its legislation on IPRs. In 1992, China amended its Patent Law, bringing food, beverage, condiment, medicine and synthetics into the extent of the patent protection, (Before the Patent Law amended, and it only protected the method of producing synthetics rather than synthetics.) And also patent's duration has been extended from 15 years to 20 years. What's more, the procedure changed into dissent after authorized, which greatly cut down the time of applications for an authorized patent and strictly restricted the compulsory import of technique. A series of laws and statutes have been issued during this stage, as the Regulations on Computer Software, the Regulation on Executive Protection for the Agricultural Chemical Products, Implementation of the Regulations on the Administrative protection of Pharmaceuticals. The GPI Index has risen from 1.512 in 1991 to 2.857 in 1992. Before the accession to the WTO, China has perfected its laws to meet the standard of WTO, modifying its Patent Law for the second time. It also adds the prohibition of promising the power of sale augments the ban and the preservation of property before litigation and abolishes the Patent Reexamination Board's final decision for utility model or design. Besides, the Patent Cooperation Treaty and the Convention the protection of plant varieties have also been added, which made the GPI Index reach to 4.19. Therefore, from the perspective of law to follow, China has a perfect legal system on intellectual property protection at present.

Table 1 concludes the changes in the Intellectual Property Protection Index (IPP Index) according to GPI. From 1984 to 2001, each sub index and IPP Index have a step change (Years are discontinuous). Table 2 presents some countries' level of Intellectual Property Protection in Asia, Europe and the United States. According to China's IPP Index change, its Intellectual Property Protection had exceeded some developed countries. Until 2001, China has surpassed most developed and developing countries protection level in 1990(only 4.52 lower than the United States). This result is inconsistent with our intuition, which provides us foundation to revise index.

3. China's improved measure of Intellectual Property Protection: using implementation effect to modify GPI

According to Ginarte-Park's method, Han Yuxiong and Li Huaizu put forth some improvement. They believe that now China is in the transition period of development while the static rules like laws and statutes are progressing rapidly. Whereas, it needs a long time to put the static rules into effect in deed. Since the localization of Intellectual Property Law need an adaptive phase, there is an imprecise synchronism between legislation and justice. Further more, people can't change their ideas on Intellectual Property Protection overnight. In addition, empirical work shows there exists a great gap between the GPI in China and our intuition. so they construct the index of enforcement effect to modify GPI. Enforcement effect consisted of average of four sub-index Grande-2 indexes. The four Grande-2 indexes include as the proportion of lawyers to scale the degree of the social legalization, as the legislative time to measure the complete degree of the social legal system, as per-capita GDP to scale the level of economic development, as the member of WTO to measure the mechanisms of international society's checks and supervision. The essay insists that it's reasonable to use these four indexes to constitute enforcement regulation. But it seems inappropriate to distinguish each province's enforcement effect caused by different economic development. So we can bring forward the enforcement effect to modify the GPI on the basis of Han Yuxiong's improved thinking of GPI.

The specific measure of enforcement effect is reviewed from the next four aspects :(1) social legalization; (2) the government's attitude of enforcement; (3) facilities of relative services agency; (4) the consciousness of social intellectual property protection. The enforcement effect of the intellectual property protection system is indirectly reflected by the following indexes. Obviously, the index of enforcement effect differs greatly from the enforcement efforts. But our enforcement effect index can differentiate the level of intellectual property protection from each province.

The enforcement effect can affect the variable of intellectual property protection's actual effect. This is between 0 and 1. 0 indicates that the clauses of intellectual property protection haven't been put into effect. 1 indicates that the clauses have been put into effect perfectly. To assume $F(t)$ represents a country's enforcement effect at the time of t , $P^G(t)$ represents the level of intellectual property protection calculated by Ginarte-Park, so the modified level of intellectual property protection $P^A(t)$ can be expressed as follows:

$$P^A(t)=F(t) \times P^G(t) \dots \dots (1)$$

In form (1), $P^G(t)$ indicates the protection level the law stated, $F(t)$ represents the proportion of the protection level that has been actually carried out. (Note 3)

3.1 *The degree of social legalization and its measurement*

The degree of social legalization is an important factor that affects the intellectual property law's actual effect. Here, the measurement is the same as Han Yuxiong's (2005). The proportion of lawyers is the index to measure the social legalization. When the lawyers' proportion is or over 5/10000, the proportion of lawyers is 1. When the lawyers' proportion is or less than 5/10000, the proportion of lawyers is equal to the actual proportion divided by 5/10000. (Note 4).

3.2 *The attitude and measurement of the government's enforcement*

The government's attitude towards enforcement is the key factor that influences the actual fulfillment of a country's legislation on IPRs. Because IPRs are not like other rights, IPRs themselves possess a strong public character. Therefore, it's hard to protect the rights by the rights themselves.

The system of IPRs protection accrues a government's charter, needing the government's affirmance of the rights. So does the modern society. The patent must be applied for, the trademark must be registered, and the copyright must be checked in. After the rights are granted, the dispute of rights' validity and sanction of infringement all can be settled through the government's administrative measures. So the government's enforcement attitude is of paramount importance to a country's IPRs protection.

3.3 *The facilities and measurement of relative service institution.*

Through the investigation of United States' 100 international corporations, Mansfield (1994) found that these corporations were not only concerning whether the law for protection of a country's IPRs was strengthened, and whether the government enforced the laws strictly, they also emphasized the country should own enough social service agencies, such as the lawyers of intellectual property, patent agencies and so on. In terms of TRIPS, these proceedings cannot apply to national treatment (Note 5). That is to say, these proceedings should be transacted by the host country. Generally speaking, the host country stipulates that the foreign intellectual property items should be accomplished through the agency. There are some relevant provisions in China's trademark law and patent law. So, whether a country owns advanced social service agencies applied with IPRs protection can greatly influence this country's level of intellectual property protection.

Many proceedings relevant with intellectual property are undertaken by law offices. Forasmuch, this text chooses the index presents the proportion of the law offices that can handle the procedures of intellectual property to measure the social service agencies. The number of the law offices that can handle the procedures of intellectual property divided by the total offices is the result. If all the law offices can handle the procedures, the index is 1.

3.4 *Awareness and measurement of intellectual property protection*

Since intellectual property has the character of public, it's easy to infringe the intellectual property. If a country doesn't have a healthy social environment of respecting work, knowledge, competent people and creation, people have poor understanding of intellectual property, and the laws don't punish people well, the IPRs are defective even the country have a complete legal system, strict enforcement methods, abundant related social service agencies. Therefore, promoting public awareness of IPRs has long been the focus of relevant governments' efforts. The promotion of public awareness of IPRs includes: knowing what the IPRs is; realizing that pirating others' products of intellectual property is illegal as hooking others' property. In the strategy of IPRs, China proposes that we will bring about a general improvement in IPRs and initially form a cultural atmosphere of the whole society especially the market entities in 5 years. (Note 6) In the draft of strategy of IPRs, Jiang Su province had taken the aim of making 50% of inhabitants know what the IPRs is in 2004. (Note 7)

We use per capita patent applications as the index to protect IPRs. Because only when people's protection awareness of IPRs is heightened, they will believe that the justice system can protect their innovations. In the past, there are many scholars using this index to measure the technological level, which was not scientific. Application is the party's own judgment, while authorization really matches the conditions of IPRs. So we think patent applications rather than patent authorizations are more reasonable to measure people's awareness of IPRs. Considering China's actual conditions, we suppose that when ten thousand of people in one area own ten patent applications or more, the index value of per capita patent applications is 1; when ten thousand people own less than 10 patent applications, the index value equals to the actual amount of patent applications divided by 10.

On Ginarte-Park's method, this paper presumed the four indexes have the same contribution to implement effect. In this way, the score of implement effect is the average of the four indexes' sum scores divided by 4. According to the measurement of the four indexes, we calculate the implement effect of the national IPRs during 1984 to 2005 in view of the data's acquirability. Besides we also figure up the implement effect of administrative regions of China at the

provincial level during the period of 2001 to 2005. Thereunto, three indexes include proportion of lawyers, proportion of law offices, and per capita patent applications of the country's implement effect are calculated from the data of Statistics Yearbook of China. The data of proportion of lawyers and proportion of law offices, at the provincial level during the period of 2001 to 2005, are got from Judicial Statistics Yearbook of China, while the index of per capita patent applications is calculated from IPRs Yearbook of China. Rate of patent infringement disputes is from the official figures released by State Intellectual Property Office of China. Chart 1 displays changes of the GPI, implement effect, and Adjusted GPI index of China's level of IPRs protection throughout years. (Note 8)

The statistical data shows that there is but a minor fluctuation in the implement effect of IPRs. Meanwhile, the implement effect has gradually improved year after year, with a steady range of increase. After and before 1992 and 2001, there were two rapid rise periods, which was consistent with the fact that China had largely amended the laws of IPRs protection in 1992 and 2001. Compared with the IPRs protection in developed countries in form 2, since 2001, static index of China's intellectual property protection has exceeded most developed countries level in 1990. That is to say, China has quite complete law clauses of IPRs protection. However, the enforcement is comparatively poor. The enforcement was only 0.5215 in 2005 while the level of adjusted GPI was 2.1854, which was far behind the protection level in developed countries. China got behind in Asian ranked list. This reality accounts for why the United States government still brings a lawsuit to WTO against China for its poor protection of IPRs in 2007 (Note 9) So, strengthening the enforcement is China government's pivotal step to improve the IPRs protection at the present stage.

So which part on earth causes the poor enforcement effect? We can analyze the four variables that constitute enforcement effect. Hereinto, the average of proportion of lawyers to weigh the degree of social legalization is 0.132, with an annual average growth rate of 12.29%. The average of rate of patent infringement disputes to weigh the government's enforcement attitude is 0.835, with an annual average growth rate of 0.51%. The average of the proportion of law offices to weigh the relevant service institutions' equipment is 0.159, with an annual average growth rate of 6.92%; the average value of average per capita patent applications to measure the public awareness of social IPRs protection, with an annual average growth rate of 16.77%. We can find that in these four indexes only the rate of patent infringement disputes is much higher. The proportion of lawyers and the proportion of law offices are both very low, with a lower annual average growth rate. Although the average per capita patent applications has increased rapidly, the level of average value is still low. Therefore, the main reasons that cause poor enforcement effect are the lack of professional personnel and organizations and underdeveloped awareness of IPRs protection.

4. Regional Difference in China's IPRs protection level

Though a country has same static laws, the awareness of IPR protection is different for different provinces' economic development. Therefore, each province has distinct enforcement effect. In consideration of this, the author calculates each province's enforcement effect index of IPRs protection except Hong Kong, Macao and Taiwan. From the measurement, we can know that there is a great difference of protection level of IPRs in each area. To sort the average protection value of each province during 2001-2005 period, we can find that Beijing has the highest IPR index of 3.93 while Tibet Autonomous Region has lowest of 1.1503, with a discrepancy of more than 3 times. The 8 provinces that have much higher level are: Beijing of 3.9305, Shanghai of 3.4077, Tientsin of 2.3966, Guangdong of 1.9419, Zhejiang of 1.9111, Chongqing of 1.8559, Jiangsu of 1.7536, and Heilongjiang of 1.7431. Three municipalities have the highest protection level. And most of these provinces are in the east coastal regions.

Table 3 indicates the average value, standard deviation, and coefficient of variation of level of IPRs in China's 31 provinces during 2001-2005 periods. Average value used to indicate the central place that sample data relatively centralized in statistics. But its representativeness is influenced by the degree of each observation data's variation. Standard deviation and coefficient of variation are used to measure the degree of each observation data's variation, namely the difference of sample data. When making a comparison of two or more sample data's variation, we can directly utilize standard deviation if the unit of measurement is equal to average. If the unit is different from the average, we should use the ratio between the standard deviation and average to express it. The coefficient of variation can eliminate the different unit and average's influence towards the comparison between two or more variables' variation. The result in form 3 indicates that the average value has gradually increased during 2001-2005 period, which shows that the general level of IPRs has been improved with a stable rise. Then looking at the comparison of standard deviations, the deviations increased rapidly and steadily year after year, which increased from 0.505 in 2001 to 0.587 in 2005. Because the average values change at the same time, and the coefficient of variation is in the scope of 0.304 to 0.320. So the regional difference in China's IPRs protection is relatively stable.

The regional difference of China's IPRs protection depends on the imbalance of China's economic development. By giving an overview of many literatures about strengthening IPRs, economic growth, and technology transformation, Falvey and Foster (2006) got the conclusion that equilibrium of IPRs protection is influenced by many factors. From the perspective of developed countries, Chen and Puttitanun (2005) developed a developing country theoretical model with two industries (advantage and disadvantage) and two firms (innovative and imitative). They testified the relation

between equilibrium level of IPRs protection and per capita GDP, investment of innovation. Some scholars like Zhang Yabin, Wu Jiang, Yi Xian zhong (2007), Han Yuxiong, and Li Huaizu also make an analysis of the factors that influence the IPRs protection. This paper mainly makes a correlation analysis of the measurement of IPRs protection and per capita GDP in each area during 2001-2005 periods, and concludes an excellent correlation. The coefficient of correlation in 2001 was 0.8127, and reached to 0.9873 in 2005, with a tendency of rise. So we can infer that the imbalance in China's economic development is the key factor that affects regional difference of IPRs protection. Besides, economic openness is another important reason. But the relativity with technology R&D investment is relatively lower and fluctuating, which illustrates the imbalance of the regional development in developing countries like China will be one of dominants. As a result, the function of IPRs protection to technical innovation is not clear.

5. Conclusion

International GPI index never takes the factor of implement effect into consideration. Though Han Yuxiong, Li Huaizu (2005) propose some improvements considering the disadvantage of GPI, it's still hard to analyze and disclose the regional difference of China's economic development. By introducing implement effect to improve GPI, this paper aims to measure the improved GPI index of each province's IPRs, disclose the obvious regional difference in China's protection of IPRs. The 8 provinces that have much higher level are: Beijing, Shanghai, Tientsin, Guangdong, Zhejiang, Chongqing, Jiangsu, Heilongjiang, most of which are in the east coastal regions. Through the differentiate analysis, it can be indicated that the protection level of China's IPRs has steadily improved, and reflected that the variance of regional difference has been raised. Nevertheless, the coefficient variation is relatively stable. The relevant analyses indicate that the protection level of IPRs is related with the level of economic development, the openness of the market, and the local technology R&D investment. Per capita GDP is the vital factor that influences the regional difference of IPRs protection. The regional openness is another important factor, has a minor relevance with local technology R&D investment. So China's unbalance of developments in economic areas is the objective factor that causes the regional difference of the IPRs protection. What's more, the central government is unable to use the static laws to change the long-existing regional difference in short time.

By measuring the protection level of IPRs, this paper provides the elements to further analyze China's IPRs issues, which can help to disclose the regional difference and the objectivity of the protection level of IPRs, and can help to strengthen China's initiative in Sino-US' negotiation of IPRs protection.

References

- Chen, Y. and T. Puttitanun. (2005). "Intellectual Property Rights and Innovation in Developing Countries", *Journal of Development Economics*, 78, pp. 474-493.
- Ginarte, J. C. and W. G. Park. (1997). "Determinants of Patent Rights: A Cross-National Study", *Research Policy*, 26, pp. 283-301.
- Maskus, K. E. (2000). "Intellectual Property Rights in the Global Economy", August, 296 pp. ISBN paper 0-88132-282-2, 87-142.
- Rapp, R. T. and R. P. Rozek. (1990). "Benefits and Costs of Intellectual Property Protection in Developing Countries", *Journal of World Trade*, 24, pp. 75-102.
- Rod Falvey & Neil Foster. (2006). "The Role of Intellectual Property Rights in Technology Transfer and Economic Growth: Theory and Evidence", Working Papers of UNIDO, Strategic Research and Economics Branch.
- Han Yuxiong and Li Huaizu, (2003) "The Affection of Intellectual Property Rights to Social Welfare", *World Economy*, 9. (in Chinese).
- Han Yuxiong and Li Huaizu, (2005). "Quantitative analysis for intellectual property protection level of China", *Studies in Science of Science*, 6. (in Chinese).
- Zhang Yabin, Wu Jiang and Yi Xianzhong, (2007). "Intellectual Property Rights Protection and North-South Technology Diffusion", *World Economy Study*, 1. (in Chinese).

Notes

Note 1. On April 10th, 2007, United States appealed to the WTO (DS362) aiming at China's intellectual property rights and the market access of publication, See http://www.wto.org/english/tratop_e/dispu_e/cases_e/ds362_e.htm. The Chinese government expressed dissatisfaction, see http://news.xinhuanet.com/fortune/2007-04/10/content_5957643.htm. On September 19, 2007, the United States claimed to the Dispute Settlement Body of the WTO (DSB) to set up an expert panel, and China extremely regretted. See <http://news.tom.com/2007-09-27/OI27/46462640.html>. It's not until May 2008 that the experts panel's report has not been released.

Note 2. See Rod Falvey and Neil Foster: *The Role of Intellectual Property Rights in Technology Transfer and Economic Growth: Theory and Evidence*. Working Papers of UNIDO, Strategic Research and Economics Branch. 2006.

Note 3. The specific method to improve GPI is the same as Han Yuxiong's (2005)

Note 4. There are three usual methods used to ascertain the reference standard: (1), taking the country with the highest level as the standard (define the American value as 1), other values are adjusted according to the relative comparison. (2) Taking the province with the highest level as the standard (such as defining the Beijing value as 1). (3) Taking the developed countries and regions as the standard. This paper adopts the third way, defining the proportion of lawyers exceeded than 5/10000 as 1. According to the relevant data in Statistics Yearbook of China, and the Intellectual property rights Yearbook of China in 2002-2006 periods, the proportion of lawyers in Beijing has reached to 1 while Shanghai was 1 in 2005.

Note 5. TRIPS paragraph 2 of Article 3.

Note 6. See the outline of the national intellectual property rights. (in Chinese).

http://www.sipo.gov.cn/sipo2008/yw/2008/200806/t20080610_406106.html.

Note 7. See: <http://www.czipo.gov.cn/ReadNews.asp?NewsID=664>.

Note 8. For lack of space, the paper omits the specific datasheet of the GPI index, implement effect, and adjusted GPI index in China's protection of IPRs. If you need, please contact the author.

Note 9. The same to the note 1 see http://www.wto.org/english/tratop_e/dispu_e/cases_e/ds362_e.htm.

Table 1. China's Intellectual Property Protection Level based on G-P Index

Serial number	Factor	1984	1985	1992	1993	1999	2001
1	the coverage of the protection	0.43	0.43	0.86	0.86	0.86	0.86
2	member of international treaty	0	0.33	0.33	0.67	1	1
3	protection of forfeited rights	0	0	0.33	0.33	0.33	0.33
4	enforcement	0	0	0.33	0.33	0.33	1
5	duration of protection	0.75	0.75	1	1	1	1
	IPP Index(GPI)	1.18	1.51	2.86	3.19	3.52	4.19

Note: (1) For lack of space, the author omits all the second factors (sub index) and the years that have no change in table 1 on Han Yuxiong's paper (2005). (2) The specific scores are calculated from the relevant items on the IPRs Yearbook of China during 2000-2006 periods and the patent law that had been abolished (1984-1992 edition). Besides, December 31st will be the day of each index's marked standard day. (3) Based on the GPI method, we can get the IPP index by summing up the five items. So, the IPP index is equal to the GPI value.

Table 2. The Intellectual Property Protection Level (GPI) in some countries

	1960	1965	1970	1975	1980	1985	1990
USA	3.86	3.86	3.86	3.86	4.19	4.52	4.52
Canada	2.76	2.76	2.76	2.76	2.76	2.76	2.76
Germany	2.33	2.66	3.09	3.09	3.86	3.71	3.71
France	2.76	3.1	3.24	3.24	3.9	3.9	3.9
Italian	2.99	3.32	3.32	3.46	3.71	4.05	4.05
Japan	2.85	3.18	3.32	3.61	3.94	3.94	3.94
Korea	2.8	2.8	2.94	2.94	3.28	3.61	3.94
Singapore	2.37	2.37	2.37	2.37	2.57	2.57	2.57
India	1.85	1.85	1.42	1.62	1.62	1.62	1.48
Malaysia	2.37	2.37	2.37	2.37	2.57	2.9	2.37

Data sources: Ginarte J C, Park W G, Determinants of Patent Rights: A Cross-national Study, Research Policy. 1997.26. 283-301

Table 3. The analysis for differential index of each province's IPRs protection

Index	2001	2002	2003	2004	2005
Average value	1.5788	1.6872	1.7750	1.8335	1.9272
Standard deviation	0.5050	0.5280	0.5653	0.5794	0.5867
Coefficient of variation	0.3198	0.3130	0.3185	0.3160	0.3044

Note: calculated by excel.

Table 4. The correlation between the IPRs protection level and other related index

Year	2001	2002	2003	2004	2005
LN per capita GDP	0.8127	0.9817	0.9805	0.9830	0.9873
LN ratio of dependence on foreign trade	0.7188	0.7030	0.7185	0.6998	0.7027
LN R&D	0.4272	0.4769	0.4318	0.4709	0.4424

Note: calculated by excel.

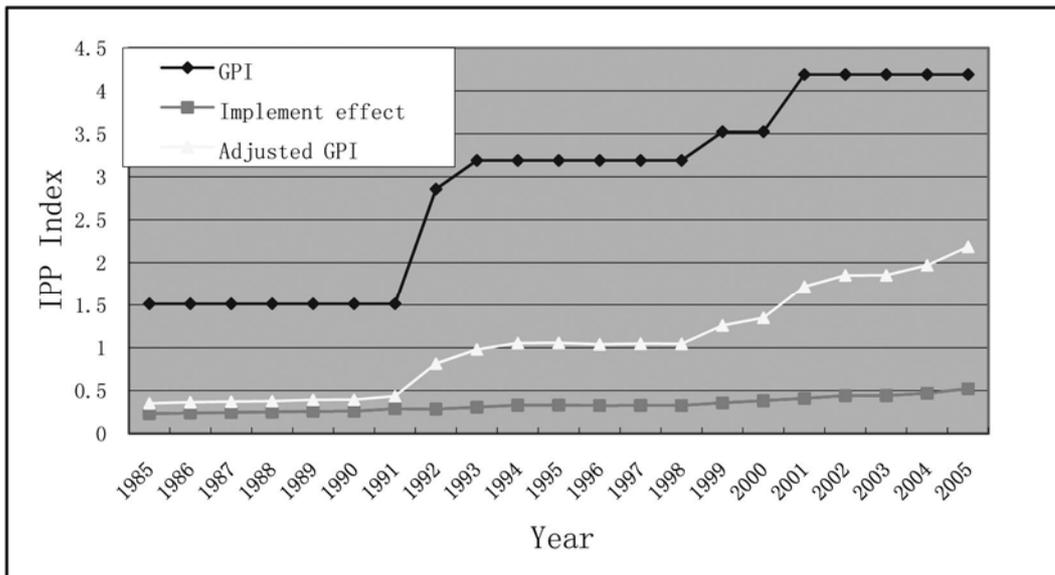


Figure 1. Improvement of GPI and adjusted GPI and implement effect