“Snake Oil” patents in XIX century USA and XXI century Russia

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Does more patenting mean more innovation? And, if not, what is the historical evidence of incentives, imposed on patentees, to engage in transaction costs of establishing of property rights on the intellectual property objects?

New Institutional economics traditionally puts an emphasis on the importance of property rights (IPR) protection, including intellectual property rights on innovation and economic growth. D. North points out, that the creation of patent system in England contributed to the growth of specialization in systematic innovative activity. However, the positive effect of IPR protection is only evident for static analysis of innovation that disregards the possibility of further improvement. Moreover, it is based on the assumption, that every granted patent is immediately valid, and, if not, can be easily revoked.

However, the examples of intellectual property rights protection in XIX century United States, and in XX-XXI Russia suggests, that there are potential negative effects of IPR protection on innovation. We find that the adoption of IPR in both cases was accompanied by the multiple patent manipulations, resulting in perverse effects on innovative activity and demand for innovations.

The case of Russian patent system in XX-XXI century starkly resembles the situation in XIX century USA, when there was was a significant number of objects under intellectual property rights protection that later became known as “Snake Oil” patents or “Patent medicine”. As the presence of such protection boosted consumer confidence in the quality of medicines, that consumers couldn’t verify it prior to purchase, the patent (or other mechanism of intellectual property rights protection) became valuable for patentees in itself. That, in turn, led to growth of asymmetry of information in the market for medicines.

XXI century Russia provides another interesting case of patents that cover “technologies” that cannot be implemented – the chemical reactions that cannot run, or would cause massive destructions, if they were performed, etc. But innovative firms would not buy fake patents, as they perform their own expertise in order to lessen production risks. However, there is a potential “buyer” for fake patents: the government decides whether to finance innovative project with a grant or not based on the number of patents and publications of the researcher. Hence, due to the poor expertise of Russian patent office, fake patents are used not as a signal of quality of a

technology (which can be very low), but as a signal of qualification of a researcher (which is judged upon a number of patents, not their quality). This kind of manipulations in patent system creates information asymmetry at the market of Russian patents, where the innovative firm is a "buyer", thus lowering the demand for patents (as suggested by data).

It is easy to note, that in both cases intellectual property rights introduced a signaling problem, and created disruptive incentives that lower the quality of life of a consumer and reduce further demand for working innovation. Stricter patent expertise in Russia can become a solution to this problem, as it happened in USA after the provision of Pure Food and Drug Act in 1906. However, as in Russian case the proper patent expertise might be very costly, such measure can have a negative impact on sequential innovation.

Literature overview

The protection of intellectual property rights has been largely regarded as an important, if not the key, component of encouraging innovative activities. This point of view has a long history and many supporters.

In fact, as early as 1859, J. Bentam wrote:

"What one man has invented all the world could imitate. Without the assistance of laws, the inventor would almost always be driven out of the market by his rival, who, finding himself without any expense, in possession of a discovery which has cost the inventor much time and expense would be able to deprive him of all his deserved advantages, by selling at a lower price".

This argument reflects today's prevailing point of view rather well. However, modern argument in favor of IPR protection encompasses other points:

I. Patents create greater revenue for innovators and thus increase incentives for engaging in innovative process. The prospect of reward appears only with the notion that intellectual property rights are protected and enforced. By creating scarcity, patents allow innovators to internalize positive externalities of invention.

II. Patents help to "put inventions to use":

"Bringing an invention to market requires coordination among many complementary users of that technology, including capitalists, developers, managers, laborers, other

technologists, manufacturers, marketers, and distributors. Patents get inventions put to use broadly and rapidly and help new businesses enter and compete against established players"[1].

III. Patenting allows firms to enter new markets and to compete with "giants", and, thus, discourages monopolies.[2]

IV. Patents help to cover the fixed costs of inventing and producing a new product as well as protecting against new market entry. This may stimulate a creative dynamic environment as well as strengthen and broaden continuous innovation. Patents on inventions attract the needed investment to develop and commercialize them.

V. Patenting requires disclosure of invention, and, thus, is socially beneficial. The exclusive right granted to the inventor by patent is balanced by the disclosure to the public of all the knowledge of the inventor. This disclosure is often referred to as more critical for the industries of a community than the property rights for invention. "Disclosure of information is a source of inspiration for other inventors. As all patent applications and patents granted are published, they are a source of information about innovative developments and a unique source of inspiration for alternative solutions"[3] .

VI. A national system of IPR protection diminishes regional differences in IPR legislation. That makes it possible to promote cross-country trade in intellectual property rights and international integration of science, technology and creative efforts.

VII. Patents decrease information asymmetry between firms, which undertake R&D, and potential investors. As noted by Clarissa Long, "Based on the information contained in the patent, observers may conclude that the invention will increase the expected value of the firm—even if it is not the existence of patent protection that makes the invention valuable—and invest accordingly" .

This point of view emphasizes the importance of property rights and the incentives they generate. It assumes that costs imposed on society are lower than the losses that would occur if invention would not be created or commercialized.

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[1] Haber, Stephen H., Kieff, F. Scott and Paredes, Troy A.,On the Importance to Economic Success of Property Rights in Finance and Innovation(July 2008). Stanford Law and Economics Olin Working Paper No. 359; Washington U. School of Law Working Paper No. 08-08-01. Available at SSRN: http://ssrn.com/abstract=1160291

[2] Kieff, F. Scott,Property Rights and Property Rules for Commercializing Inventions. Minnesota Law Review, Vol. 85, Pp. 697-754, 2001. Available at SSRN: http://ssrn.com/abstract=229981 or DOI: 10.2139/ssrn.229981,p 729-731

[3] WIPO-IFIA International Symposium on Inventors and Information Technology, Budapest, March 16 -19, 1998 www.inventor.hu/iwm98/Cummer2.html

But there is another point of view that claims that IPR protection does not have any positive effect on innovative activity, and might actually threaten it.

This view rests upon the notion of inefficiency of monopolistic behavior and its harm to society. This point of view is well described by F. Hayek:

"Application [to intellectual property] of the concept of property as it has been developed for material things has done a great deal to foster the growth of monopoly and that here drastic reforms may be required if competition is to be made to work….In the field of industrial patents in particular we shall have seriously to examine whether the award of a monopoly privilege is really the most appropriate and effective form of reward for the kind of risk-bearing which investment in scientific research involves"[4].

Condorset outlined that ideas are not the creation of a single mind or a gift from God, but are created in society and therefore "are equally and simultaneously accessible to all"[5]. From this point of view, ideas are intrinsically social: they are not produced by individuals alone; they are the fruit of a collective process of experience. M. Boldrin and D. Levine in their work "Against intellectual monopoly"[6] show that incentives to create might be provided without building of monopolies. Thus, they challenge the main rationale for patenting. The short summary of the main points against IPR protection is presented below.

I. Patenting creates monopolies. Monopolies, in turn, decrease the efficiency of allocation of resources.

II. Patenting increases the cost of innovative activity, as inventor has to buy out the patent for previous technology, or to wait until patent expires. The development of new technologies can infringe existing patents.

III. Patents might not create the incentives to innovate, as they grant monopoly power to the inventions that were already made and provide their authors with permanent income in the form of royalty.

D. Levine and M. Boldrin provide an example of this effect created by copyright in case of Guiseppe Verdi, "who was the first important composer to experience the new Italian copyright regime and devise strategies to derive maximum advantage, it is clear that copyright

[4] F. A. von Hayek, "Individualism and economic Order", 114 (1948)
[5]" The rise of intellectual property, 700 B.C.-A.D. 2000: An idea in the balance", - Carla Hesse, 2002
[6] Boldrin Michele, Levine David K.: "Against Intellectual Monopoly", Cambridge University Press (United States), 2008

could make a substantial difference. In the case of Verdi, greater remuneration through full exploitation of the copyright system led perceptibly to a lessening of composing effort".

IV. Patents can be used to block competition. One can note, that the patent is not the right to make, use, offer for sale, sell or import, but the right to exclude others from making, using, offering for sale, selling or importing the invention. Thus, patenting can cease production of inventions if the inventor doesn't produce it himself nor sells the patent. Companies can buy patents out so that their competitors would not produce technologically superior products. But, if the costs of investing in the new technology today are high, the company itself would not produce it either.

V. Possibility of misuse of patents: the case of "submarine patents" ("patent trolls") – "filing of a useless patent on a broad idea that might, one day, be useful. The existence of the filing is secret (hence the submarine), and the application process is extended until some actual innovator invests the time and effort to make the idea useful. At that time, the amendment filing stops, the patent is awarded, and the submarine surfaces to demand license fees"[7]. In some cases patents might be enforced to prevent others from commercialization of technology, even if the holder of the patent doesn't commercialize it himself.

All in all, this point of view emphasizes, that IPR protection imposes costs on society that cannot be covered by its benefits.

Both hypotheses have strong arguments in their favor. However, evaluation of which of them comes closer to reality demands some historical study of influence of development of IPR protection on creative activity.

The historical overview

The main focus of this paper lies in the examination of the consequences of emergence of patent protection in USA and Russia. While the historical frames of both periods are very different (XIX century in USA and XXI century in Russia), they have many common elements.

The term "patent medicine" or ("snake oil patents") reflects the medical compounds constituted from herbal components, laxatives, alcohol, and even drugs. This "remedies" claimed to cure numerous diseases from flu to cancer, often simultaneously. Originally, they were

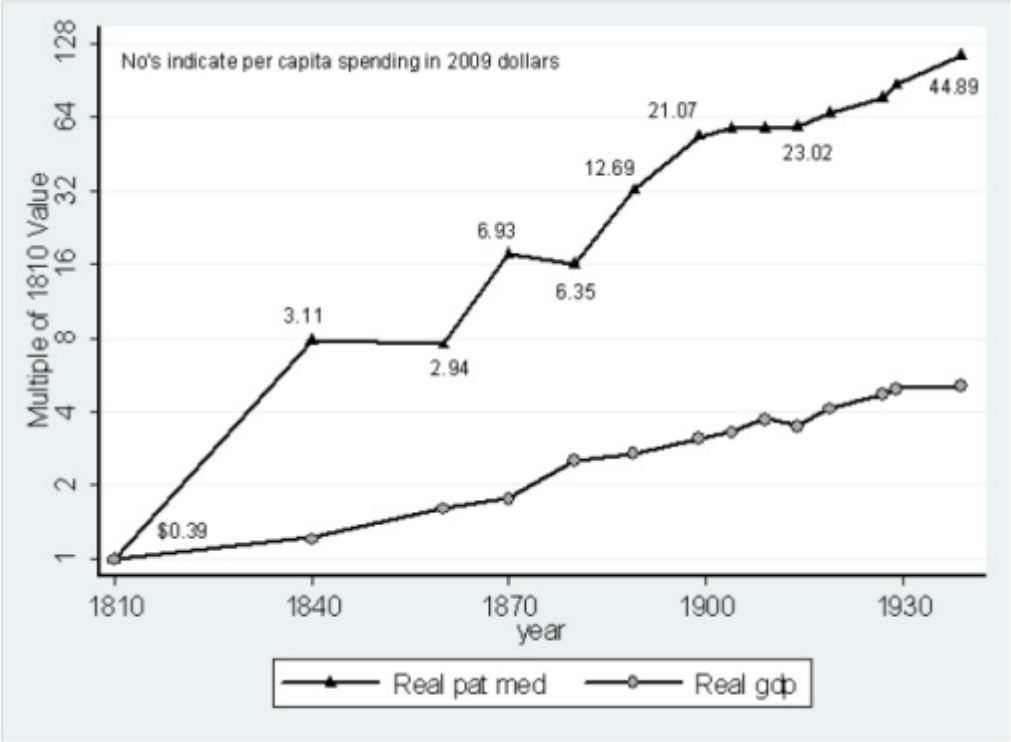
[7] Boldrin Michele, Levine David K.: "Against Intellectual Monopoly", Cambridge University Press (United States), 2008

patented (hence the name), yet later the makers shifted to obtaining a trademark, rather than patent, as it didn't require the revelation of ingredients.

The phenomena of patent medicine occurred only in one industry. Hence, it is inappropriate to assess its magnitude from the perspective of the total economy. However, the statistical evidence, provided by W.Troesken[8] suggests that it was substantial. As he points out, Figure 1 plots spending on patent medicines and GDP per capita from 1810 through 1939.1 Both series are in constant (US) dollars and are normalized to a value of 1 in 1810. Between 1810 and 1939, real per capita spending on patent medicines grew by a factor of 114; real per capita GDP by a factor of 5. Growing 22 times more than the economy as a whole over this period, individual spending on patent medicines rose from $0.39 per year in 1810, to $2.94 in 1860, to $12.69 in 1889, to $26.07 in 1919, and to $44.89 in 1939 (2009 dollars). This is not a low base effect. Spending grew relatively quickly over the entire nineteenth century; growth slowed only after 1900. Between 1810 and 1939, Americans spent a cumulative $158 billion (2009 dollars) on patent medicines. By 1909, out of 259 industries counted by the Census of Manufactures, the patent-medicine industry ranked 38th (85th percentile) based on the aggregate market value of its products. In this way, it rivaled industries such as lead refining, illuminating gas, fertilizers, agricultural implements, paint and varnish, and chemicals .

Figure 1. Growth in Spending on Patent Medicines and GDP per capita

[8] The Elasticity of Demand With Respect to Product Failures; or Why the Market for Quack Medicines Flourished for More Than 150 Years, - W. Troesken



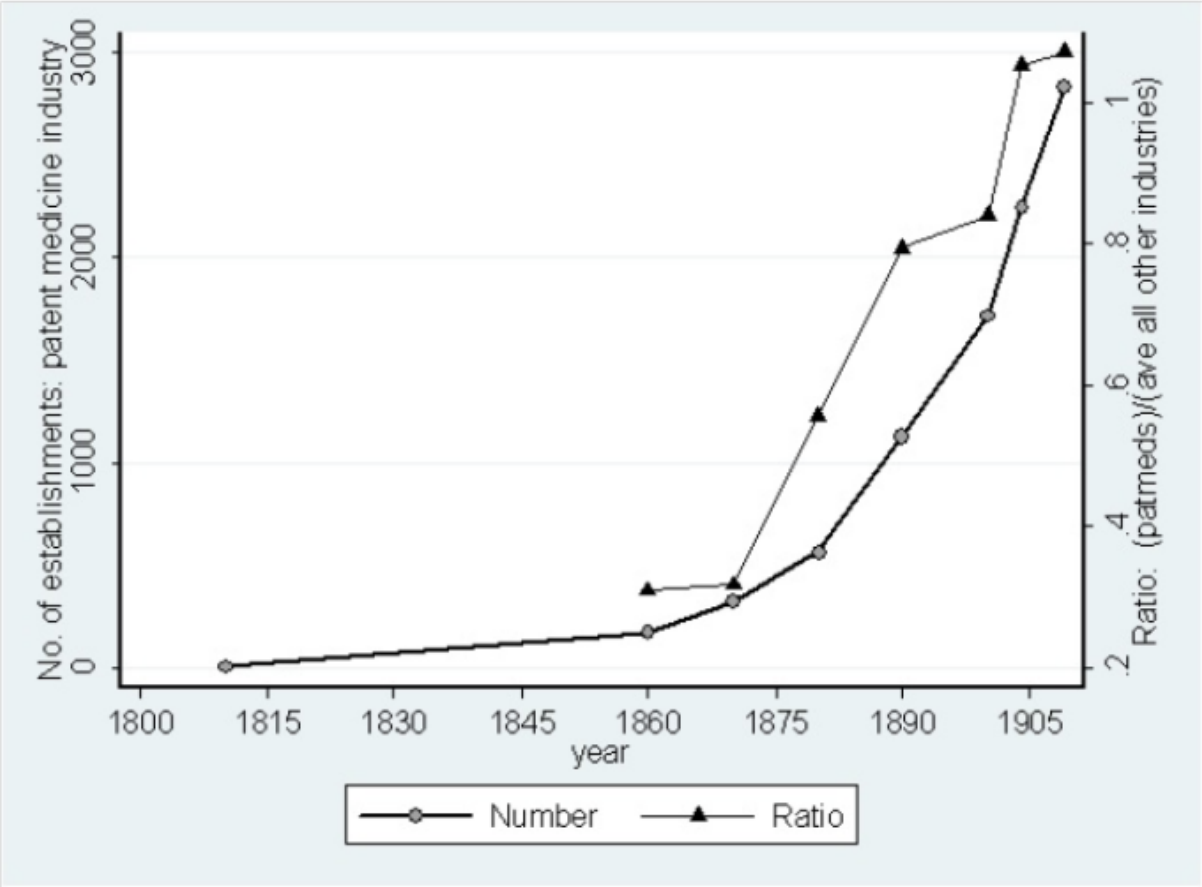
The striking feature of this growth is that it persisted even thought the drugs didn't work. The quality of the patent medicine couldn't be established by the buyer prior to purchase, thus creating the asymmetry of information. However, after the purchase was made, and the medicine failed to cure the patient, the demand for it didn't fall. In fact, most of these products were on the market for at least 50 years, and that several had life spans of 100 years of more. One of them - Peruna -- stayed at the market for nearly 300 years. That suggests very low elasticity of demand with respect to product failures. Moreover, the market for patent medicines was not destroyed by the advances of real medicine.

Product	First obs'd	Last obs'd	Min life	Main ingredients
Ayer's Sarsaparilla	1824	1906	82 yr's	sarsaparilla, yellow dock, May apple, sugar
Brandreth's Pills	1827	1920	93	aloe, colocynth, peppermint, cinnamon, alcohol
Hamlin's Wizard Oil	1864	1920	46	ammonia, chloroform, sassafras, turpentine, cloves
Holloway's Pills	1823	1920	97	aloe, rhubarb, capsicum (chili peppers), ginger, soap
Hood's Sarsaparilla	1884	1915	31	sarsaparilla, sassafras, sugar, maple syrup, alcohol
Hop Bitters	1873	1920	47	alcohol (16-20 percent)
Hostetter's Stomach Bitters	1853	1958	105	roots, Peruvian bark (quinine), orange peels, alcohol
Jayne's Vermifuge	1863	1920	57	sodium, turpentine, pink root, jalap (a cathartic plant)
Kilmer's Swamp Root	1880	1959	79	water, alcohol, willow bark, sugar
Moxie Nerve Food	1870s	1910s	≈45	oats, syrup, sassafras, wintergreen
Pinkham's Vegetable Comp.	1873	1958	85	alcohol, aloe, glycerin (a laxative), tansy, lovage (plants)
Peruna (later called Ka-tar-no)	1638	1927	289	whiskey, champagne, claret, beer
Old Hinkley's Bone Liniment	1856	1959	103	wormwood, hemlock, thyme, turpentine, capsicum
Perry Davis's Painkiller	1840	1958	118	opium, camphor, capsicum
Dr. Pierce's Golden Med. Disc.	1875	1958	83	opium, May apple, guaiacum (tree extract)
Dr. Sanford's Liver Invigorator	1858	1911	65	unknown
Swaim's Panacea	1820	1899	79	worm-seed, valerian, cloves, agaric, rhubarb, tansy
Wistar's Balsam of Wild Cherry	1843	1920	77	opium, cherries, syrup, sugar, alcohol

It is common knowledge, that patent medicine mostly included different herbs, alcohol, laxative and sometimes even drugs. Hence, one might suggest that part of the continuity of the demand could be explained by addiction or the desire to get drunk. However, they had cost several orders of magnitude more per unit of alcohol than beer or ordinary distilled spirits. Only 25% of them actually contained drugs, while in most states, opium and morphine could be purchased from a druggist without a prescription, and without the advertising expenses for much lower price.

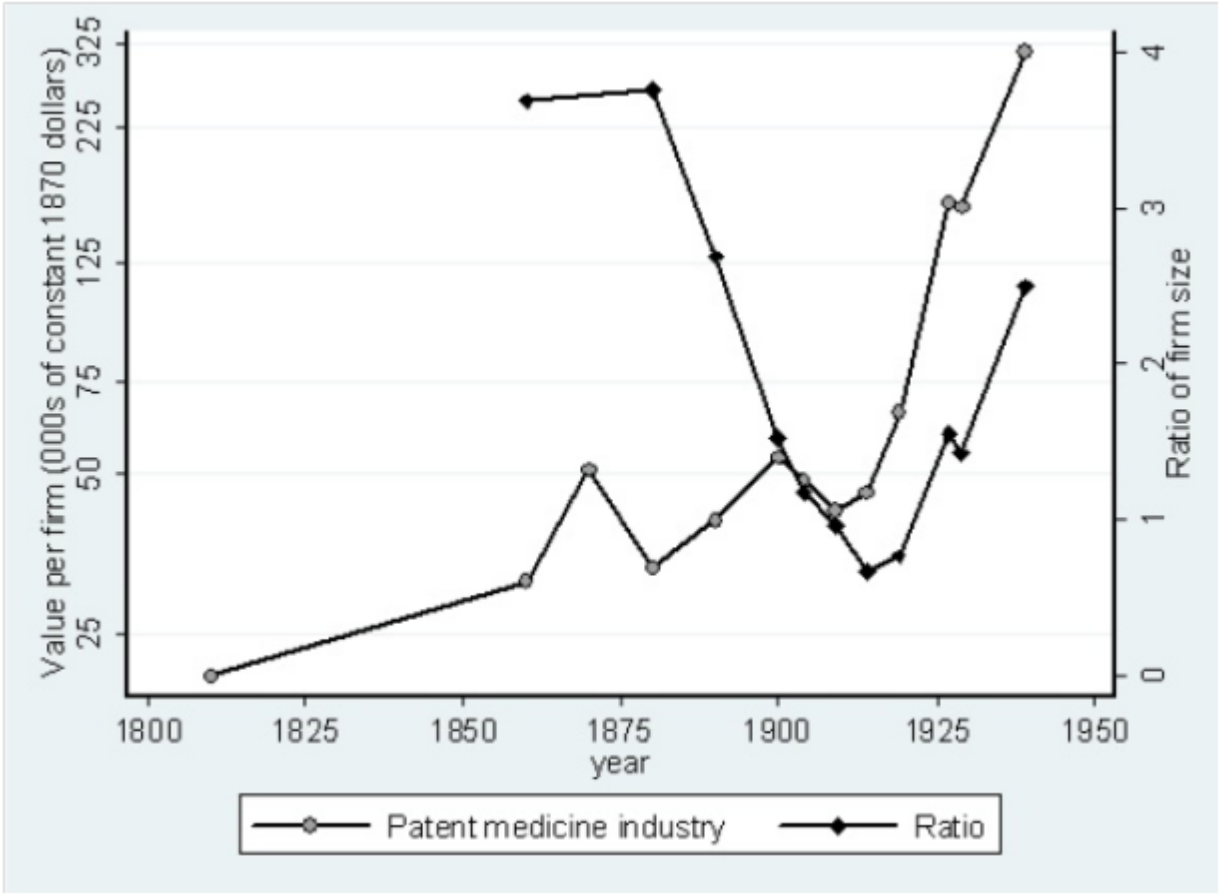
The industry had grown rapidly. The number of establishments producing patent medicines grew tenfold between 1860 and 1900 -- more than 2.5 times faster, that in other industries.

Figure 2. The number of establishments in patent medicine industry



Source: The Elasticity of Demand With Respect to Product Failures; or Why the Market for Quack Medicines Flourished for More Than 150 Years, - W. Troesken

However, firm size in the patent medicine industry remained constant between 1810 and 1910. Patent medicine companies did not engage in extensive investment into their products. In fact, as suggested by Shrady ((American Medical Times, Dec. 14, 1861): The proprietor wants to make his medicine at less cost, and after a while puts in cheaper ingredients. The mixture which costs fifteen cents, and sells for a dollar, is finally made for five cents.



Source: Ibid

The sharp growth here is associated with the Pure Food and Drug Act.

Industry summary

We can draw the following picture of the patent medicine industry.

1. The consumers of patent medicine could not assess the quality of the good prior to purchase. The lack of consumer knowledge created the asymmetry of information, which could not be resolved ex ante.

2. Even ex post, the demand for patent medicine was strikingly inelastic with respect to failure. W.Troesken constructs a model, where consumer maximizes his expected utility

$$E(\cdot)_m = \gamma_m V - p_m$$

$$\gamma_m = \frac{1}{k+\varphi},$$

where γ_m is the consumers' perception of the probability to get cured by the drug m, V is the value of being cured in dollar terms, p is the price of the drug. Consumer competence is denoted by k, f is the frequency, with which he observes the drug to fail, ξ is the elasticity of demand with respect to failure. When it is very low, consumer cannot learn from experience of others (or even his own), and has to rely on his knowledge.

3. As the entry to the patent medicine was easy and no expertise on the quality of medicines was conducted, the number of the companies in it grew. However, their size did not increase until 1906, when the Pure Food and Drug Act was introduced.

4. In the absence of proper expertise, the producers kept the costs of medicine at the minimum level, not trying to invest in it in order to enhance its quality.

5. Patent medicines were consumption goods, they did not enter into the production function of real physicians. The development of the market for the actual medicine played only a small role in lowering the demand for patent medicine.

6. Despite the fact that most patent medicine were not actually patented, all of them obtained some intellectual property protection via the trademarks and copyrights. In all cases there was no need for the expertise, while obtained protection conveyed a signal of exclusive rights and legal approval to potential consumers. That, in turn, distorted the knowledge parameter k in favor of making a mistake. As the elasticity of demand with respect to product failure was very low, k was the only significant parameter in consumers' established probability of getting cured. Hence, the signal of approval, created by IPR protection, distorted the market for the patent medicine, but didn't spread to the market of working medicine, as the competence of the physicians was sufficient to reject the drug.

The role of Pure Food and Drug Act

The Pure Food and Drug Act for created for *"preventing the manufacture, sale, or transportation of adulterated or misbranded or poisonous or deleterious foods, drugs, medicines, and liquors, and for regulating traffic therein".* It played a huge role in reducing the market for "patent medicine", which by the beginning of XX century became a serious problem. The growing demand for "remedies" has not only led to the growth of the fraudulent industry, but also contributed to health problems of its customers, causing addictions to drugs and alcohol,

contained in them. At the same time, the substantial progress of real medicine created a better understanding by the educated citizens the difference between the actual treatments and "snake oil" ones. It helped to evaluate the effect of drugs on the grounds of the ingredients, contained in them.

The officials from Food and Drug Administration (FDA) were given the authority to regulate the industry according to the Law.

The Act provided penalties from violating the law: any violator should*," be fined not to exceed five hundred dollars or shall be sentenced to one year's imprisonment, or both such fine and imprisonment, in the discretion of the court, and for each subsequent offense and conviction thereof shall be fined not less than one thousand dollars or sentenced to one year's imprisonment, or both such fine and imprisonment, in the discretion of the court".*

The Act required the expertise procedure:

That the examinations of specimens of foods and drugs shall be made in the Bureau of Chemistry of the Department of Agriculture, or under the direction and supervision of such Bureau

In case of drugs:

First. If, when a drug is sold under or by a name recognized in the United States Pharmacopoeia or National Formulary, it differs from the standard of strength, quality, or purity, as determined by the test laid down in the United States Pharmacopoeia or National Formulary official at the time of investigation: Provided, That no drug defined in the United States Pharmacopoeia or National Formulary shall be deemed to be adulterated under this provision if the standard of strength, quality, or purity be plainly stated upon the bottle, box, or other container thereof although the standard may differ from that determined by the test laid down in the United States Pharmacopoeia or National Formulary.

Second. If its strength or purity fall below the professed standard or quality under which it is sold.

In the case of confectionery:

If it contain terra alba, barytes, talc, chrome yellow, or other mineral substance or poisonous color or flavor, or other ingredient deleterious or detrimental to health, or any vinous, malt or spirituous liquor or compound or narcotic drug.

Apparently, these measures were insufficient to prevent expansion of patent medicine industry; hence the influence of Food and Drug Act of 1906 was limited. It is after the provision of 1938, when the Congress enacted much stricter Food, Drug and Cosmetics Act the patent medicine industry started to contract. M. Law[9] suggests, that the success of the new law can be mostly explained by the alternative enforcement strategies that helped to achieve regulatory compliance. The small size of FDA could not enable the credible ex post punishment; hence, it sought to improve compliance ex ante. However, if such policy was feasible for the food products, it was much less so for patent medicine, as the level of expertise of FDA was insufficient to establish the quality of drugs.

Table 1. Enforcement of the Pure Food and Drugs Act 1919–38: Seizures and Prosecutions by General Category

Year	Food: Number of Prosecutions and Seizures	Percent of Total (%)	Drugs: Number of Prosecutions and Seizures	Percent of Total (%)	Stock Feeds: Number of Prosecutions and Seizures	Percent of Total (%)
1919	1,595	73	257	12	333	15
1920	946	43	1,001	45	278	12
1921	1,049	46	1,084	48	152	6
1922	1,065	63	471	28	157	9
1923	1,197	83	149	10	104	7
1924	1,100	73	167	11	231	16
1925	1,154	70	293	18	209	12
1926	935	70	265	20	144	10
1927	647	68	167	18	139	14
1928	669	66	234	23	112	11
1929	710	59	356	29	144	12
1930	634	57	363	33	108	10
1931	991	50	885	45	101	5
1932	1,647	64	799	31	121	5

[9] Marc T. Law How do Regulators Regulate? Enforcement of the Pure Food and Drugs Act, 1907–38 J. Law Econ. Organ. 2006 22: 459-489.

1933	1,833	66	869	31	75	3
1934	1,929	68	802	28	96	4
1935	2,409	79	555	18	76	3
1936	2,032	76	591	22	60	2
1937	1,651	72	613	27	25	1
1938	1,868	69	806	30	44	1

Source: Dunbar (1951).

However, the 1906 and 1938 Acts played a crucial role in the decline of patent medicine era. The series of publications in media, especially "The Great American Fraud" publication by S. Hopkins Adams raised the customers' awareness of the consequences of patent medicine use. The requirement for the physicians' mediation and prescriptions led to the sharp decline in the market for patent medicine in USA. The remnants of that industry, however, can be seen even now: they are marked as "nutritional supplements" and often promise weight loss "in your sleep" or similar miracles. Other products, such as 7-Up or Coca-Cola are no longer market as the patent medicine but still remain in the market.

The era of patent medicine ended with the end of the market, characterized by the inelastic demand with respect to product failure. As customers were no longer able to purchase drugs without prescription, the qualified intermediaries, able to access the quality of the drug, solved the problem of asymmetry of information.

Now let us have a closer look at IPR protection in Russia, and see, how it is similar to patent medicine in XIX century USA.

The emergence of IPR protection in Russia

Legislative changes

Intellectual property (as well as other forms of private property) was not developed in Soviet Russia. The institutional framework of IPR protection started forming in 1985-1991, but most significant reforms took place in 1991-2008. The period from 1917 to 1985 was characterized by lack of traditions of protecting IPR, as well as absence of legal framework of such protection and its enforcement.

In 1991, after the collapse of the Soviet Union, intellectual property in Russia still lacked all of these components: due to general negation of private property during the seven-decade Soviet era "Russia has a long and widespread tradition of disregarding intellectual property

rights.[10]" Prior to 1991 most intellectual activity products belonged to the public domain. Existing laws at that time didn't provide sufficient protection for inventions, and there was practically no chance to enforce them.

After the collapse in 1991, the Soviet Union had to develop a legal framework for private property, including intellectual property rights. The measures of protection involved not only development of law, but also the creation of the main executive body – Rospatent – and substantial changes in enforcement strategy. The most significant changes in IPR protection are listed below:

1991 – Development of IP legislation. Patenting became the single form of protection of inventions in USSR.

1991 – Government patent agency *Rospatent* was created

1992-1993 – IP legislation is adopted (See Appendix 1).

1994 – Projects of property rights reforms appeared.

First three parts of Civil Code were adopted.

1996 – Rospatent becomes a federal authority, bearing executive, regulatory and permitting functions.

1998 – The law of licensing became effective.

1999 – The law of *Control over intellectual activity results* became effective. Control of export of intellectual activity results was enacted.

2002 – Drafts of the forth part of Civil Code were developed.

2004 – Statute of inventions, discoveries and rationing procedures was adopted.

2006 – Forth part of Civil Code was adopted

2007 – By article 146 of Criminal Code copyright infringement now carries up to six years of imprisonment, making it a serious crime under Russian law.

2007 - Code of Administrative Offenses took effect on May 13, 2007 and expressly provides that unfair competition includes the misuse of intellectual property.

2008 – Forth book of Civil Code (devoted to IPR protection) became effective.

From this timeline, one may note, that prior to 1996 reforms were devoted to development of formal rules, yet during this period there were no tools of enforcement. In

[10] Andrew A. Baev, *Recent Changes in Russian Intellectual Property Law and Their Effect upon the Protection of Intellectual Property Rights in Russia*, 19 SUFFOLK TRANSNAT'L L. REV. 361, 363 (1996).

particular, from 1991 to1993 all of previously existing laws concerning IP were abolished, while the new ones hadn't come into effect. As a result, the system of IPR protection became highly chaotic, which led to decline of number of patents.

Since 1996, however, the Russian government took measures to facilitate enforcement of intellectual property rights. First, main executive body – Rospatent – became a federal authority, and could now bear executive, regulatory and permitting functions. In 1999 legal acts, that concerned not only definition of intellectual property, but also the means of its protection, were adopted. By 2004 it became obvious, that legal frame of intellectual property protection was too chaotic, and so the development of the fourth part of Civil Code began. Its final version was adopted in 2006, and came to power in 2008. Generally, forth part of the Civil code reflects the new stage of intellectual property protection. It unifies all of previously existed laws. Several completely new notions were carried out too (e.g. "unified technology"). Appendix A shows today's framework of IPR protection.

Meanwhile, the government made another effort to improve IPR enforcement by strengthening punishment for its infringement. Since 2007 violations of intellectual property became subjects to Code of Administrative Offenses and Criminal Code.

Thus, one might argue, that substantial changes in both codification of IPR and its enforcement took place during 1991-2008.

According to J. Lerner[11], the changes in the system of IPR protection yield positive shifts in innovative activity, if the previous scope of IPR protection was not extensive, and if the country is not lagging behind other countries in terms of GDP per capita. Clearly, the first condition is met in case of Russia, while the second is not.

What types of patents did emerge?

The article "On one Tendency in Domestic Patent Literature"[12] recognizes the problem of patent "dummies":

"Current state of Russian science, absence of design and experimental base, low interest of manufacturers in long-term investments to new technologies and non-transparency of many state and corporate sources of innovation financing generate a unique phenomenon of mass fabrication of patent "dummies" intended for the sole purpose of attraction of investments.

[11] 150 years of Patent protection, - J. Lerner,
[12] "On one tendency in Russian patenting", Arutyunov V.S., "Catalysis in Industry", April 2008

Obligatory and transparent examination of all innovative projects is necessary for struggle against this phenomenon".

The author presents several examples of "dangerous" patents. They include technologies that would undoubtedly lead to serious damages and even human losses. We also include patents that describe technologically impossible processes in this category.

Here are some examples:

1. Patent RU2062143: "A rigging for production of methanol". The application of this technology would lead to destructions of the surrounding area up to hundreds of square kilometers.

2. Patent RU 2265585: "Technology of production of methanol and other aliphatic spirits". Technologically the production of methanol and other aliphatic spirits with such method is proved impossible.

3. Patent RU 2181622 "A method of natural gas oxidation". The description of technology doesn't include any numbers or proportions. Essentially, patent claims only that there exists an unspecified method of natural gas oxidation.

4. Patent RU 2282612 implies a technological reaction that is impossible due to physical parameters of mentioned substances.

5. Patent RU 2205172 describes a technology that allows to achieve parameters, that are 5-7 times worse than mentioned in a patent.

Some patents include a remark, that the "use of this technology can lead to human losses".

There are several possible explanations of existence of such patents:

1. The authors of patents expect to attract investments from unprofessionals, who cannot evaluate technological value of a patent;

2. Authors expect to gain profits not from application of a technology, but from "next generation" of authors, who would develop technology so that it can be actually put to use.

We must note that the process of patenting requires a fair amount of time of the author and decent investment. The case of "dangerous" patents shows, that its authors expect to gain revenues from technologies, that can't be put to use with respect to modern science. Thus, one can conclude, that they expect to gain these revenues in future without further development of these "technologies".

Obviously, the case of "dangerous" patents raises a question of a better expertise for patent applications. But taking into account high specialization in various fields and in chemistry in particular, competent jury would impose higher costs of the procedures of patenting, and, thus, of patents themselves.

Note, that firms, that use "dangerous" patents differ from the notion of "patent trolls". The later are usually defined as firms, that

* Purchase a patent, often from a bankrupt firm, and then sue another company by claiming that one of its products infringes on the purchased patent;

* Enforce patents against purported infringers without itself intending to manufacture the patented product or supply the patented service;

* Enforce patents but has no manufacturing or research base; or

* Focus its efforts solely on enforcing patent rights.

In our case "dangerous" patents are not bought from another firm, as they do not actually work. Nor does the firm enforce them against the third party for the same reason. In future, however, it is possible if authors of such patents expect technologies that would make it possible to appear. The patent here works as a toll of attraction of investment, or as a part of investment into an equity capital of newly created firms.

This case makes us re-evaluate the notion that stronger IPR protection is a tool to increase innovative activity. In some circumstances it can only be a tool of extension of number of patents.

The example of "dangerous" patents represents a situation, where revenues from invention can't be gained, but firm is still willing to bear costs of patenting. However, if inventors expect that patents will be costly to obtain and ineffective in rents creation, we would not expect to see them to patent, unless patents have additional function. As suggested by Clarissa Long[13], this function is signaling.

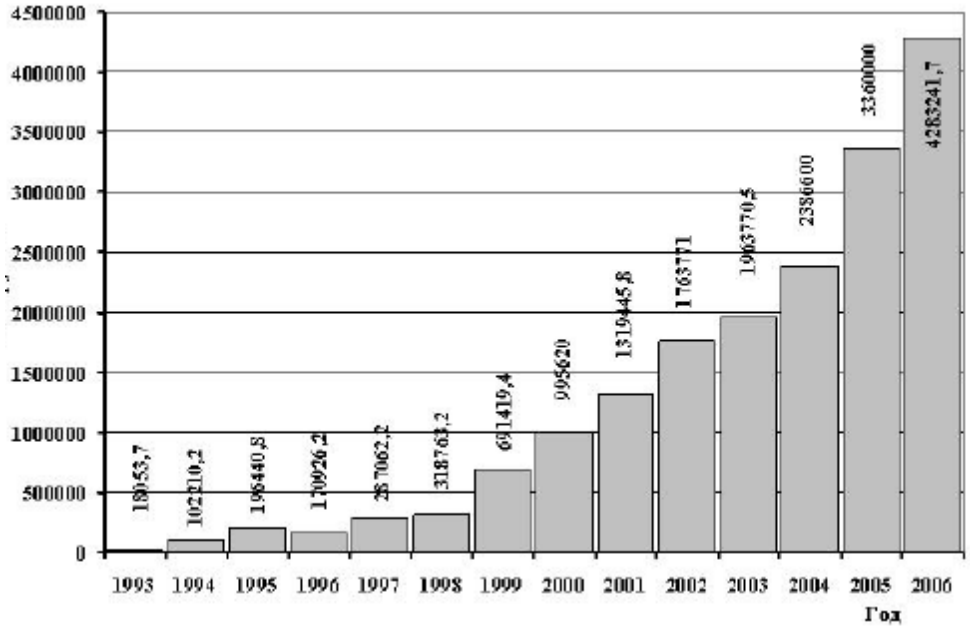
Signaling can lower information costs about invention, disclosing some information to potential investors. It also discloses information about professional skills of author of invention. Presumably, patents allow to count for higher investments in technology and higher rewards for the author.

[13] Clarissa Long, Patent Signals, 69 U. Chi. L. Rev. 625, 651–53 (2002)

However, in case of "dangerous" patents investment in technology by firms is unlikely, because technology can't be applied. What kind of signal does patent send in this case?

Here we assume that a signal, that agent receives, depends on the agent as well. We can regard two kinds of potential investors: firms and government. The former purchase patented technology or a product in order to apply it, while the latter invests in innovative activity through various programs. Unlike the firms, government does not seek the return on these investments. In this case it is not important what technology is financed, but rather what author receives a grant. As we've already noted, patents signal not only about the quality of a technology, but also about the professionalism of the author. This signal is used by the government that wants to allocate additional resources to more talented researchers.

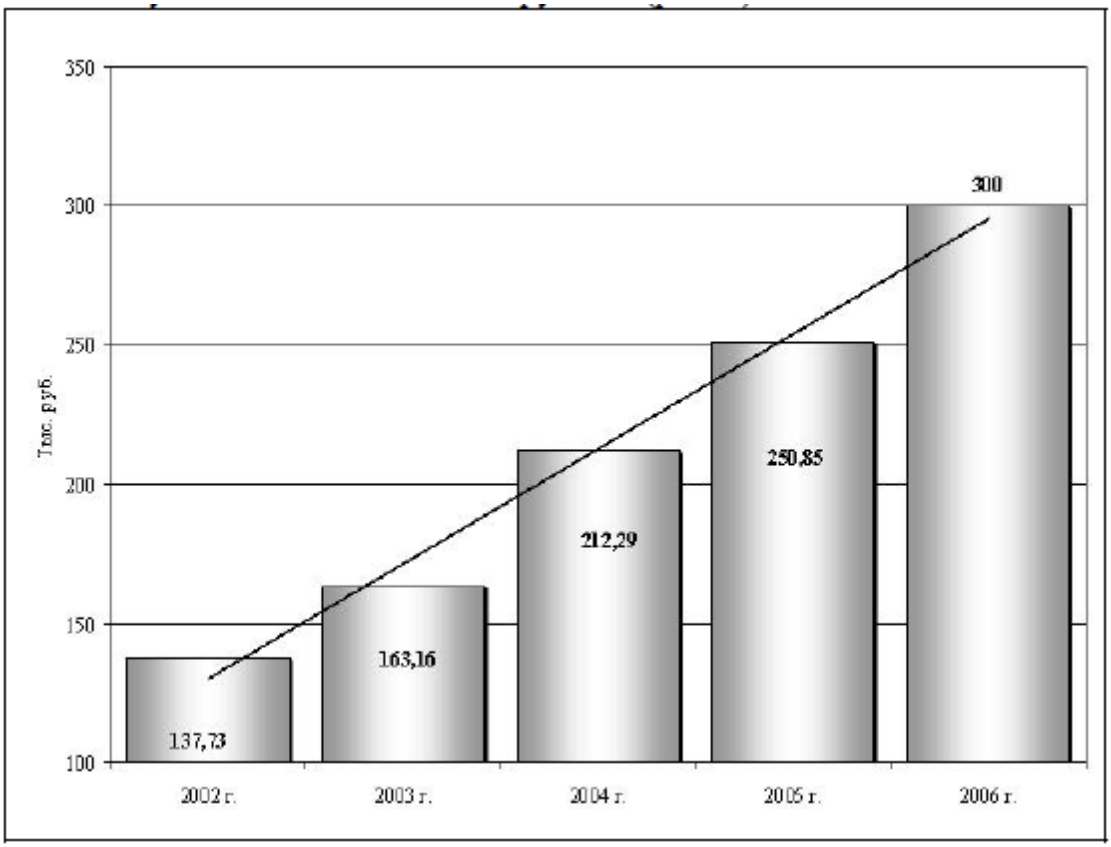
The table presents amounts of government investment into innovative activity in thousands of rubbles through 1993-2006.



Government investment through the Russian Fund of Fundamental Research (RFFI) has increased since 1993 from 3 to 6 percent of the federal budget. The expertise procedure for projects hasn't changed much since then. We also must emphasize that government does not seek revenues from these projects.

This creates a potential problem of investment in "dangerous" projects. And, in fact, as noticed by Aurtunov[14], the number of "dangerous" patents has increased dramatically since the 1990s.

We can also note that incentives to patent such technologies have increased too. The table below presents changes in the average amount of investment in one project (thousands of rubbles):



Comparing data from both tables we can conclude that total expenditures on grant programs rose 2.43 times in 2002-2006 period, while the size of an average grant rose in 2.18 times. That allows us to conclude that it is mainly the size of grants, that increased, but not the number of projects, which receive the grant.

But is patenting a sufficient signal for awarding a grant? To answer this question, we examine criteria that are used to evaluate grant applications in RFFI. Two of five of the criteria includes evaluation of author collective. They are presented below:

III[15]. Collective of authors.

[14] "Catalysis in Industry", Arutyunov V.S., April 2008

1. Evaluation of previous results of authors' research:
    - If authors achieved important and recognized results
    - If the results of previous research are original
    - If results are ordinary
    - If results of previous research can't be evaluated.
2. Evaluation of scientific methodology developed by the author of research :
    - Authors have significant achievement in this field
    - Authors have some achievements in this field
    - The achievements can't be evaluated.

IV. Realization of a project

- If the collective of authors is competent to realize a project.

As we can note, patents give a signal that authors have at least original results of previous research and at least some achievements in the field. As evaluation of author collective accounts for 30%-40% of probability of success, ability to give a positive signal about the authors becomes increasingly important. Some grants can only be obtained if author already has a patented technology.

With that, we may expect that a fraction of "dangerous" patents in the total quantity of patents will increase. And, in fact, it is so, according to Ayurtunov. In such circumstances the significance of a patent as a signal to firms will fall and agents will face a problem of "lemons". That diminishes incentives to patent in order to attract investment from companies, unless it is required as a "ticket".

Government stimulates innovative activity by strengthening IPR protection and investing via grant programs. The quality of expertise of projects remains low, however. These two factors generate the tendency of increasing number of "dangerous" patents and lowering the quality of the signal to firms and demand for patents falls. Hence, falling quality of patents can cause their fall in demand for patented technologies, and, thus, decreasing the supply of patents.

We construct the simple model to describe this situation.

The Model:

We construct the following model. Let n be the number of patents, ni – the number of patents of researcher i. There are two types of patents – patents of high quality H and patents of

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[15] Territorial Department of the Russian Government Statistics: http://www.rffi.ru/default.asp?section_id=170

low quality L. The researcher knows, what type of patent he sells, while the firm assumes, that it can buy a low quality patent with probability λ, and the high quality patent with probability (1-λ). We denote the reward the firm is willing to pay for the patent j as xj, given

(1) $xj = t * [(1 - \lambda)H + \lambda L]$,

where t is the firms' inverse of marginal utility of money. Following Akerlof and Wilson we set researcher's marginal utility of money to one.

G – the expected utility of grant for the researcher.

There are 2 types of researchers: with probability δ the researcher has the cost of C1 of obtaining the patent, and cost of C2 of obtaining a patent with probability (1-δ). The researcher has a budget constraint Y. C2>C1>0. C is the cost of filling application and is faced by each type of a researcher when patenting good or bad technology.

Then the costs of patenting a good technology equal $\delta C1 + (1 - \delta)C2 + C$,

The costs of obtaining a bad patent are C.

The gain of patenting a bad technology, thus, equals $G - C * ni$;

The gain of patenting a good technology for a researcher of type 1 equals:

$G' + xj * ni - (C1 + C) * ni$, where G'<G

The gain of patenting a good technology for a researcher of type 2 equals:

$xj * ni - (C2 + C) * ni$, and he obtains no grant.

Thus, good technologies are patented by any type of researcher if

(2) $xj * ni - (C2 + C) * ni > G - c * ni$

All researchers patent worthless technologies if

(3) $G - C * ni > xj * ni - (C1 + C) * ni$

Combining (2) and (3) and substituting xj with (1) we obtain the conditions, under which both types of patents can appear on the market, and, hence, where asymmetry of information exists:

(4) $t \in (\frac{g+C1}{(1-\lambda)H+\lambda L}; \frac{g+C2}{(1-\lambda)H+\lambda L})$,

Where $g = \frac{G}{ni}$

The equilibrium conditions for this market are:

(5) $p \leq t[(1 - \lambda)H + \lambda L]$ for the buyer,

(6) p≥H for the seller.

The resulting equilibrium condition is, therefore, (7) $t \geq \frac{H}{(1-\lambda)H+\lambda L}$

Combining (4) and (7) we find a condition, under which the high-quality patents are present in the market, and equilibrium condition holds:

(8) $t > \frac{g+C1}{(1-\lambda)H+\lambda L}$

(9) $t \geq \frac{H}{(1-\lambda)H+\lambda L}$

Combining those gives $t > \frac{(1-\delta)C2+C+g+(1+\delta)C1}{2[(1-\lambda)\delta C1+(1-\delta)(1-\lambda)C2+C]}$,

Hence, we can conclude, that the smaller is firm's marginal utility of money, and he smaller are government grants, the more likely it is that, in presence of asymmetry of information high-quality patents would be traded on the market. We can also see that higher proportion of high-quality patents, the larger is the potential for government support through grants. The larger is the proportion of mediocre researchers, the smaller is the potential for government support.

The other important result of this model is the role of the "brain drain" – the fewer talented researchers stay in the country, the smaller are the governments' opportunities to encourage innovation via grants. On the contrary, if the share of the good researchers increases, the economy is likely to see fewer bad patents.

To test our hypothesis we run a series of ECM regressions to see how the government expenditures on technological innovations affect the technological exchange between firms and researchers, and also the number of patent applications.

Empirical test:

Data:

In our research we use the data provided by Federal State Statistics Service . We collect the data on the number of license agreements of all types, the number of patent application by Russian residents, the amount of government and private financing of technological innovations in rubbles, the percentage of government and private financing of technological innovations, GDP in 2003 prices and the number of patents in force in 1996-2009 years. Based on these data, we construct a license per patent in force estimation.

Methodology:

In order to track the short-term and the long-term effects of government and private spending on the number of licenses per patent in force we construct an error-correction model (ECM):

D.LPP =L.LPP + D.GDP + L.GDP + D.FIRM + L.FIRM +D.GOV + L.GOV,

where LPP indicates the number of licenses per patent;

GDP – the measure of GDP in rubbles, 2003;

FIRM – the amount, spent by private firms on technological innovations;

GOV – the amount, spent by government on technological innovations.

The D. is the difference operator, L. is a lag operator.

Our regression shows the significance of L.LPP, L.GDP, L. FIRM, D.GOV, L.GOV coefficients, where L.GDP and L.FIRM enter with a positive sign, L.LPP, D.GOV, L.GOV enter with a negative sign, which is consistent with our theory that government financing of innovations leads to lower efficiency of patents, while firm investment in innovations contribute to the rise of such efficiency. We interpret the coefficients foe lag variables as long-run relationship, and the coefficients for the differenced variables as a short-run correction.

We also run separate regressions for the percentage of firm financing of innovations and government financing of innovations and obtain a similar result.

In order to track the firm behavior we run an ECM regression of the form:

D.FIRM_P = L.FIRM_P + D.GDP + L.GDP + D.FORCE +L.FORCE,

where FIRM_P represents the percentage of technological innovations, financed by private firms,

FORCE – the number of patents in force.

The D. is the difference operator, L. is a lag operator.

We obtain the following results: the L.FIRM_P and D.GDP enter the equation with significant coefficients, while the number of patents in force does not; implying that growth of the number of available patents does not stimulate the growth of firm investment in technological innovations.

Also, we run ECM regression to see, how government and private expenditures influence he number of patent applications. We can note, that D.GDP and L.GDP influence D.APPS positively, while we share of government expenditures in total expenditures on technological innovations L.APPS_P has negative effect, which is in line with other theory. We can also note

that the share of private expenditures in total expenditures on technological innovations has no significant effect.

Results:

The results are presented in tables 1 and 2.

Table 1. Error-Correction model: Patent applications

d.gdp	*l.gdp*	*d.gov*	*l.gov*	*d.firm*	*l.firm*
++	++		+		

Where ++ denotes statistical significance at 5% level, + - at 10% level.

As the coefficients of the ECM model are not interpretable, we report only the direction of influence of the statistically significant components.

Table 2. Error-Correction: Licenses per patent

d.gdp	*l.gdp*	*d.gov*	*l.gov*	*d.firm*	*l.firm*
	+	-	--		+

From these tables we can conclude that government support has positive influence on the number of patent applications, while the number of licenses per patent actually decreases in it. However, the former increase if the private firms expand R&D expenditures.

Further characteristics of Russian patents:

Figure 1

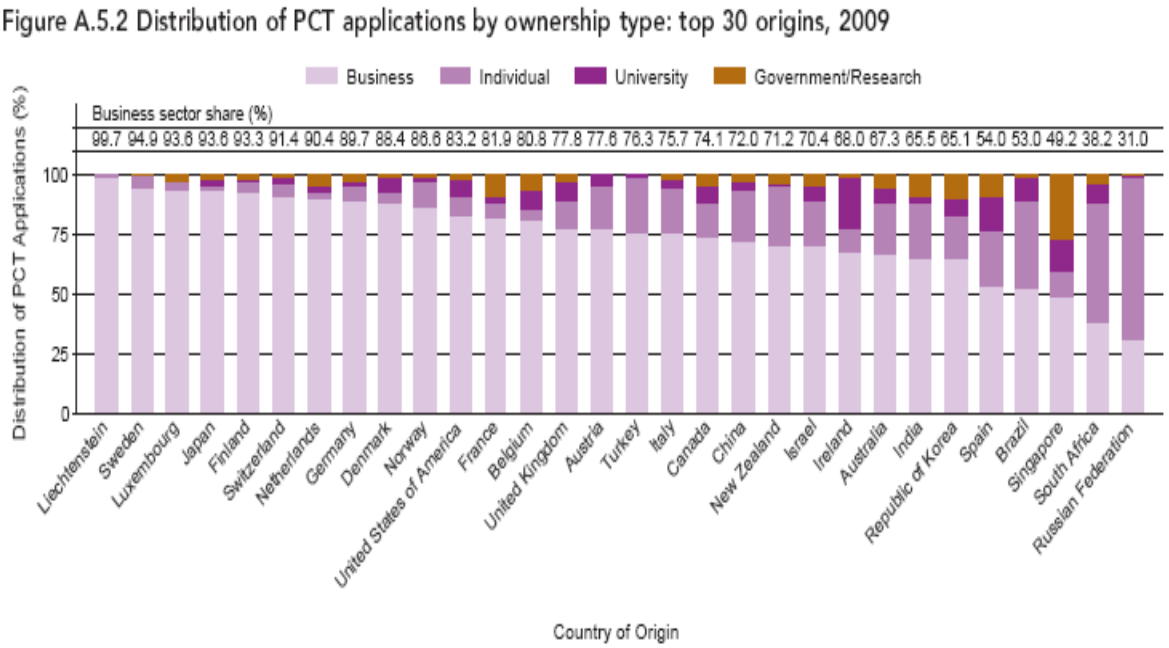
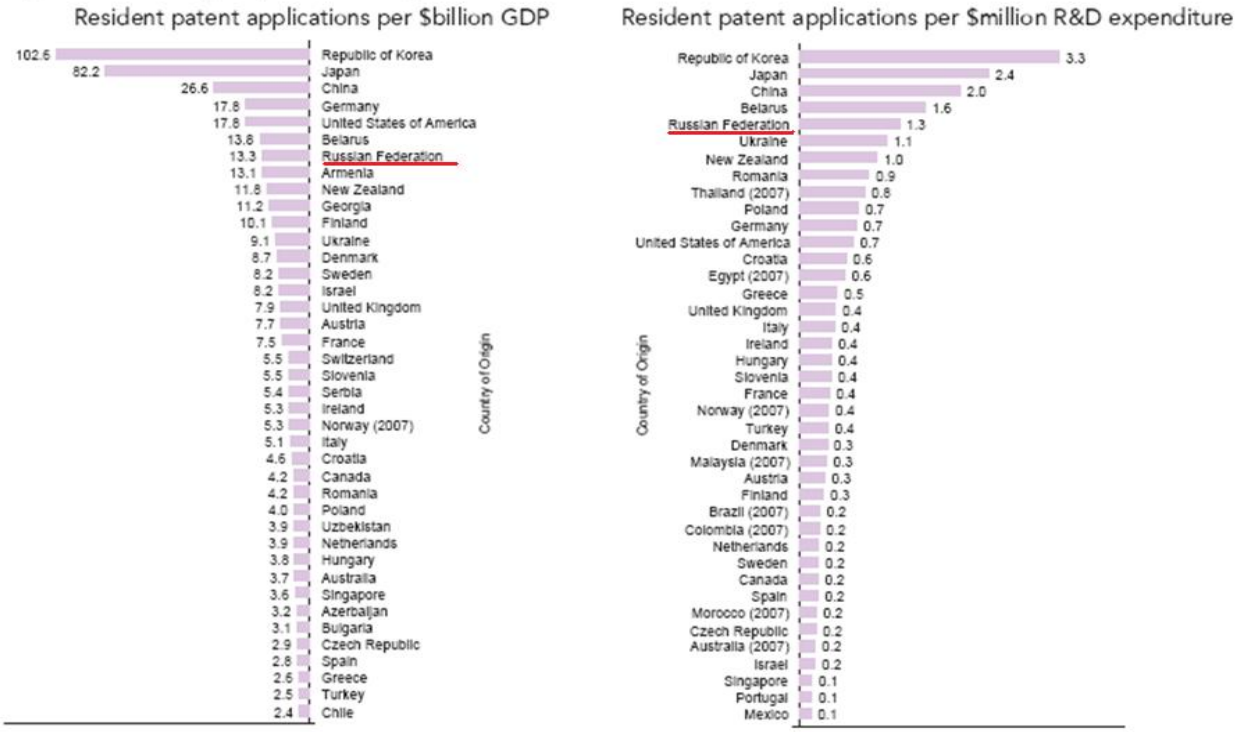


Figure 1 shows that patent in Russia are mainly held by individuals, with less than 30 percent belonging to companies. As individuals typically do not have enough equipment and capital to implement technologies, one can suggest that such patents are not used in production processes, and patenting in itself does not serve as an instrument of technological transfer.

Also, Russia is one of the countries, where patents are obtained for a really low cost, and the intensity of patenting is high. This is inconsistent with the low rate of technological exchange between researchers and innovative companies. We can suggest that the inconsistency can be solved if we regard a portion of Russian patents as a "snake oil medicine", aimed for the agent that has low elasticity of demand with respect to failures – the government.

Figure A.8 Intensity of patent activity, 2008



However, there are substantial differences between Russian and American empty patents.

In the case of the former, patented technologies were supposed to be an intermediary good and enter the production function of firms, while the former were designed as consumer goods. Even though there was a possibility that physicians would use them in their recopies (which did not happen because of their high expertise), the main market for "snake oil" patents were uneducated consumers. In case of Russia, the ignorant consumer with low elasticity of demand with respect to failure is the government. In both cases we observe the separation of the market for "snake oil" from the market for a proper remedy. In case of Russia, better educated

buyers – innovative firms – refrain from purchasing Russian patents and shift to purchasing technology from abroad. Physicians of XIX century USA did not have an external market to turn to, thus the domestic market for proper medicine did not fail.

The lesson from XIX century USA to XXI century Russia

The market for "snake oil" patents in USA has failed, but the market for "empty patents" persists. The American experience in war against patent medicine involved broad media attention, the provision of Pure Food and Drugs Acts of 1906 and 1938, and the efforts of FDA agency. However important, those measures turned to be not sufficient to solve the problem of patent medicine, while the market for such products, characterized by the inelastic demand with respect to failures, existed. The provisions, requiring prescription for purchasing drugs placed qualified intermediaries between drug producers and final consumer, and thus the problem of asymmetry of information was solved.

In modern Russia the intended buyers of patented technologies are firms. They are not characterized with inelastic demand with respect to failure, and, thus, they shift to external markets of technologies. The only agent that has the inelastic demand is the government. Our study shows, that as it increases government support of innovations by grants, the Russian market becomes fooled with "snake oil" patents. On one hand placing intermediaries between Russian researchers and innovative companies is not feasible. On the other hand, it is not needed, as the abandoning of the provision of government grants on the ground of number of patents, obtained by researchers, is likely to destroy the market, characterized by th inelastic demand with respect to failure, and, hence, lower the incentives of production of "snake oil" patents.

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