**Anticommons and Increasing Returns** Draft

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1. Introduction

The two items, anticommons and increasing returns, in the paper’s title are unrelated topic-wise. But they are related Buchanan-wise. These topics in economic theory Buchanan had been interested in. Note that these are outside the neoclassical research agenda. Buchanan was much discontented with neoclassical economics. In this paper, I will first discuss increasing returns. This will be brief. Then, I will discuss anticommons, a survey of which is the main topic of the paper.

Buchanan’s interest in ‘increasing returns’ comes from Adam Smith. Adam Smith’s theory of economic progress is based on increasing returns made possible by the division of labor and specialization in society. Buchanan used to complain that the pin factory example was unnecessarily misleading. The example demonstrates that increasing returns emerge from the division of labor arranged to serve a bigger market. It can be an unfortunate example if we believe that we can plan the division of labor in society much as we manage a pin factory. The proper interpretation is that Smith’s idea of spontaneous order applies to the division of labor in society, which we usually call specializations. Buchanan and I published several articles and an edited volume on this topic. We had a book project on increasing returns, which is still an unfinished work. Our last discussion on this project was sometime in 2012. The idea of the book is to elaborate fully the insight we obtained in “Two logics of trade” in which we compare the trade theory by Smith and by Ricardo. The policy implications from the two theories can be very different. Smith allows spontaneous order through substitutions, while Ricardo did not consider substitutability.

Now I can move on to anticommons. Adam Smith’s story on navigation on Danube river could motivate the anticommons idea. See Section II. Our anticommons paper has been cited since it was published in the *Journal of Law and Economics*, April 2000. But it was quoted mostly in law journals rather than in economic journals. Around year 2000, Buchanan and I were working on fiscal commons. Then Michael Heller’s (1998) law article came to our attention. Heller was introducing another kind of tragedy, a symmetric one to the tragedy of the commons. I could learn the law and economics of anticommons from legal scholars (Heller, Epstein, Lemley, Manager among others) and economists (especially, Choi and Shapiro.) This survey covers their work.

First, terminology. Let me give you a working definition of anticommons. Anticommons is a circumstance in which multiple persons have to agree before an idea is realized. (Epstein thinks this term is sufficient for debates on related issues.) This concept of anticommons is general enough and applicable to many intuitively related situations. On the other hand, anticommons in property right framework means that multiple persons have exclusion rights of a resource without usage right. For use of the resource a unanimous agreement is required. Anticommons causes inefficient underutilization of a resource, which we call the tragedy of the anticommons, much as the inefficient overutilization causes the tragedy of the commons. Hardin (1968)

Anticommons analyzes three main areas of study, though other applications can be added. Heller initiated anticommons for real property and patents in biotechnology and pharmaceutical industry. These are two major areas of application. A piece of land can be divided and sold by the owner of the land. This process of voluntary exchange is efficient by definition. Heller notes that assembling the fragmented pieces back is inefficient because of the transactions costs from holdout behavior by the owners. This is Heller’s paradigm for anticommons. Too many patent input holders make new drugs too costly and innovations will be discouraged. Too many overlapping regulators will allow too few permits.

However, it is important to note that anticommons is a dynamic problem. Fragmented land ownership was not inefficient until an innovator discovered a profit opportunity by assembling the pieces of land. Likewise, two patented technologies are not complements until an innovator discovers a method of making a new drug by combining the existing technologies. Furthermore, the future of innovations is at best uncertain. Heller discusses anticommons in a static environment.

The rest of the paper is a survey of the emerging theory of anticommons. Section II includes a discussion anticommons as a special form of property right. I will do this by invoking different kinds of property right regimes. Applied topics of anticommons are discussed in section III. Section IV discusses formal models for anticommons. Section V concludes the survey

II. the Concept of Anticommons

In this section, I will elaborate on different property right regimes that will help characterize anticommons. Property, as a bundle of rights, includes the right to use (usage right) and the right to exclude (exclusion right), along with the right to possess and the right to alienate. For our purpose, we focus on the usage rights and the exclusion rights. Four categories of property regimes can be distinguished, as Ancient Roman lawyers did (Cole and Grossman 2012):

(i). Private property (Res Private)

(ii). Public property (Res Publicae)

(iii). Common property (Res Communes)

(iv). Open access or no property (Res Nullius)

Consider the common property which is owned by a group of individuals. For instance, a fishery is owned by fishers who make collective decisions regarding the management of the fishing resource. The decision makers are the resource users and they are the co-owners. These owners have both usage and exclusion rights. In anticommons multiple persons have exclusion (veto) rights without usage right. They exercise their exclusion rights in making collective decisions. Thus they are the owners of the resource or property. Note that anticommons does not belong to any of these regimes. The anticommons introduces a new property regime, or we can say it is a variation on the common property.

As the working definition suggests, anticommons is related to holdout. (For holdout, see Bloch and Epstein (2005) and Collins and Isaac (2012)). Behavior under anticommons environment includes holdout possibilities. However, see Section IV for formal models which analyzes simultaneous Nash equilibrium rather than the strategy to become the last person to deal with the buyer.

Here is a story of anticommons. Like many things in economics, we can find the origin of anticommons in Adam Smith:

“The navigation of the Danube is of very little use to the differtent states of Bavaria, Austria, and Hungary, in comparison of what it would be if any of them possessed the whole of its course till it falls into the Black Sea.” (Adam Smith, The Wealth of Nartions (1776), bk. 1, ch. 3)

Heller did not quote this, but he coined the term anticommons and his 1998 paper and the paper with Eisenberg (1998) had a lot of influence on the policy discussions and debates on property law in the legal profession. You can notice this from the fact that the term anticommons appears in FTC proceedings (reference to be provided.)   
Heller (1998) considers the example of the empty stores in Moscow during the transition period from Socialist to free market economy. His story is that, as the soviet collapsed, the stores in the Gum (shopping mall) were allowed to be run by the previous workers there. These workers had equal veto rights, and an anticommons problem arose when multiple exclusion (veto) rights were simultaneously exercised.

Demesetz also discusses the Russian experience of shifting from socialism to the market economy. Demsetz notes that the high transactions costs are caused by poorly structured property rights. He also notes that the slow recovery of Japan from the Kobe earthquake resulted from the complex ownership structure in Japan. The slow recovery was noticeable when compared to the swift recovery of Los Angeles which had an earthquake at about the same time. West and Morris (2003), however, report that the recovery has been satisfactory. These discussions fall into the anticommons problem, but he does not distinguish them from the commons problem of urban freeways. This practice might be possible by extending the concept of the commons problem further. However, we gain insights from the refinement of the tragedies of inefficient resource utilization as commons and anticommons.

III. Applied topics and informal models

I collected a list applications and informal models below. Each item is discussed briefly except ‘biotech and pharmaceutical industry.’ Each of them deserve a fuller discussion which I hope to develop later.

a.. Real property: a problem of assembling fragmented lands, for instance, to build a new airport.

b. The Danube river runs through several countries before it enters the sea. A cargo flowing from the upstream to the ocean has to pay passage fees to several countries, and each country charges independently. Economists and legal scholars use this mental picture in discussing the anticommons. A formal model for this is discussed in Section IV.

c. biotech and pharmaceutical industry: discussed at the end of the list.

d. overlapping regulators.

e. global curriculum. Several universities in America provides curriculum in Asian or Middle East countries. The idea is similar to assembling fragmented units.

Anticommons provides applications to policy issues in intellectual property rights in IT (information technology) especially bioengineering and pharmaceutical industry. Heller and Eisenberg (1998) note the anticommons problem in the development of a new drug. To produce a new drug involves many, say 50, upstream research tools. These research tools used to be in the commons or public domain. Since 1978 law, these research tools could be patented. As more complementary inputs are required, the drug becomes more costly to develop and the result is fewer drugs will be developed, as predicted by the tragedy of the anticommons. Though Heller and Eisenberg offered a useful framework to address the question, their prediction has been criticized by empirically and theoretically. Walsh, Arora, and Cohen (2003) report that the industry is not affected by many patented research tools. They handle this problem by “licensing, inventing around patents, going offshore, the development and use of public databases and research tools, court challenges, and simply using the technology without a license (i.e., infringement).”

Epstein (2007) criticizes the simplistic model of Heller and Eisenberg by noting the dynamic aspect of technology. If upstream research tools are patented, the knowledge is made public and the technology can be easily copied for developing new complements and substitutes for the patented technology. Thus, we cannot judge the anticommons will cause inefficiency. Epstein made valid points. Anticommons arises because of the new technology. The research tools did not cause inefficiency until new innovation for a new drug arose. The short term inefficiency should be compared with the long term expected benefit. In this respect, Heller and Eisenberg considered the short-run problem only. The practical solution is also much suggestive. Patents are not ironclad. The validity of patents are probabilistic (Lemley and Shapiro, 2005).

What should be noted is that there was no anticommons problem before the innovation (new drug) came into existence. It was rather an unexpected problem. Perhaps the particular patent was idle. Let’s assume that this patent/owner is A and the innovator for a new drug is Z. Usually, we assume that A is a monopolist and indeed A has the legal protection of monopoly for 20 years. But that does not mean A is a commercial monopolist. It is possible that Z is the only potential user of the patented technology A. Then, the relationship between A and Z is monopoly-monopsony problem. The price of A will be between the competitive price (marginal cost) and the monopoly price. The concern of A is imitations by others. A may use limiting pricing by pricing lower to send a negative signal to potential competitors. Competitors may invent a substitute technology, say A\*. Then a substitute product Z\* that will compete against Z. This is the situation of prescription medicine. When the patent expires, generic drugs appear and compete. What I am pointing out is that two unrelated technologies A and B can become complements to each other if some innovation uses A and B to produce a new good. It is hard to measure the inefficiency caused by the anticommons problem. If Heller-Eisenberg kind oa anticommons is a problem, it will be on discouraging new innovations. But the probability of new innovation is lower than substitution technologies of patented technology. This could be one argument that anticommon problem is a mixed one.

IV. Models for anticommons.

There are several formal models developed to address issues related to anticommons. Shapiro’s model for patent thickets and Choi’s model for patent pools are most interesting. These two models and Buchanan and Yoon model are based on Cournot’s (1995; 1838) model for input complements. His example is brass made by mixing complementary inputs copper and zinc.

I will discuss Buchanan-Yoon model in this section and show this. Suppose a resource or property is owned by multiple owners, and each owner has exclusion right without usage right. Then, any usage right of this resource requires unanimous agreement because each owner has the exclusion right. When multiple exclusion (veto) rights are exercised simultaneously, the resource is inefficiently underutilized. This is termed as the tragedy of the anticommons.

The analysis of the anticommons can be facilitated by a simple algebraic model suggested by Buchanan and Yoon (2000). Consider a large vacant lot in a town, which can be used for parking. The value of parking in this lot is decreasing in the number of users,

[1] P = a – bQ

where Q measures the quantity (usage) and P measures the average value product (of parking); and a and b are constants. There is a free parking a mile away from the town.

The local parking lot is owned by two (or multiple) persons.

[Footnote: The owners could collude and maximize the rent. This is what Choi analyzes in his patent pool paper. We assume that collusion is not possible because mutual trust is lacking.]

Persons, A and B, are assigned a right to exclude. The use of the parking lot requires permission tickets from the two separate owners. Each person exercises her exclusion right by setting the price of her tickets independent from the other owner’s practice. Person A issues green tickets at price P1 and person B issues red tickets at price P2 . The *total price* P1 + P2 is the price of usage. A user is willing to pay up to the average value of the convenient parking lot above that of the free parking a mile away. The total price P1 + P2 serves as the reservation price for users, and equation [1] can be interpreted as demand function. The quantity and total price are related accordingly,

[2] P1 + P2 = a - bQ

A Nash equilibrium can be obtained from the following game. We assume the production is costless. Given person B’s choice of price, **P2**, Person A chooses P1 so as to maximize her rent,

[3] Max P1 Q = P1 (a - P1 - **P2**)/b

The first order condition for maximization is

(a - P1 - **P2**)/b - P1/b = 0

and P1 can be expressed as a function of **P2**;

P1(**P2**) = a/2 - **P2**/2

Likewise, P2(P1 ) = a/2 - P1/2. The symmetric solution is characterized by

P1\* = P2\* = a/3

A customer pays a price of P\* = P1\* + P2\* = 2a/3, the quantity output is Q\* = (1/3)(a/b), and the total rent is (P1\* + P2\*)Q = (2/9)(a2/b).

Stable symmetric equilibrium can be obtained for a multiple excluder (n) setting. The price of each separately designed ticket Pn\*, quantity of users Q(n), and total rents TR(n) are

[4] Pn\* = a/(n+1)

Q(n) = (a/b)/(n+1)

TR(n) = n(a2/b)/(n+1)2

As n becomes large, the value of total rents, TR(n), approaches zero. This implies that the convenient local parking lot tends toward total abandonment. Its potential value will be wasted in idleness. This is the tragedy of the anticommons. Figure 1 and 2 demonstrates.

Stackelberg on Danube river. The river Danube runs through several countries before it enters the sea. A cargo flowing from the upstream to the ocean has to pay passage fees to several countries, and each country charges independently. Economists and legal scholars use this mental picture and consider the formal model developed by Buchanan and Yoon as formulating the situation. This is not quite right. In the story of Danube river, the price decisions are sequential, while in Buchanan and Yoon, the price decisions are simultaneous. There is a leader and followers by geographic imperative. A version of Stackelberg game is a better way to formulate this kind of anticommons. The equilibrium for the Stackelberg on Danube for two players will be,

[5] p1 = a/2

P2 = a/4

P = 3a/4 (total price)

Q = (a/b)/4.

V. concluding remarks

Buchanan believed that the legal profession was flourishing because of the rents created by poorly defined property rights. As the study in anticommons suggests, property rights cannot be fully specified. Even if property rights are specified fully in the static sense, technology change causes property rights to change - to take advantage of the new profit opportunities created by unexpected evolution of technology in new ways of doing the same thing and doing new things. I would say Buchanan would now accept that it is impossible to eliminate uncertainties in property rights. What about public choice for anticommons?

Public choice has been useful in understanding violations of property rights by political processes. Could public choice become useful for explaining the emergence of intellectual property that is excludable public good? A public choice approach in legislative and judicial interventions of property creations will become a research agenda for the economics of anticommons.

At the beginning of the paper, I mentioned that the two topics, anticommons and increasing returns, are unrelated. As I approach the end of the paper, I am not so sure if they are indeed unrelated. Adam Smith saw that economic progress is possible through the division of labor and specializations in society. Specialization can be facilitated by secure property rights. Anticommons, a study of new kinds of property right system, makes the intellectual connection to increasing returns.

References

Block, W. and R. Epstein. “ Debate on eminent domain,” *NYU journal of law and liberty* 2005

Buchanan and Yoon, “Symmetric Tragedies: Commons and Anti-commons”, *Journal of Law and Economics*, April 2000 XLIII (1):1-13

Buchanan and Yoon, “Globalization as Framed by the Two Logics of Trade” *The Independent Review*, winter 2002 (vol. 6, no. 3).

Buchanan and Yoon, “Majoritarian Exploitation of Fiscal Commons: General Taxes -Differential Transfers”, *European Journal of Political Economy, Vol. 20, Issue 1, March 2004, 73-90.*

Burk, Dan and Mark Lemley, *The Patent Crisis and how the courts can solve it*, University of Chicago Press 2009.

Choi, J. P. “patent pools and cross-licensing in the shadow of patent litigation” 2007

Collins, S. and M. Isaac. “Holdout: existence, information, and contingent contracting,” *J L E* 2012.

Cournot, Augustin, *Mathematical principle of the theory of wealth*, James and Gordon, 1995(1838)

Epstein, Richard 2004. “Is there a biomedical anticommons?” *Regulation*, Summer 2004.

Epstein, Richard 2004. “Steady the Course: Property Rights in Genetic Material” University of Chicago Law School Working paper, 2003.

Hardin, G. “The Tragedy of the Commons, “*Science,* 162 (3859): 1243–1248.

Heller, M. “The Tragedy of the anticommons: property in the transition from Marx to Markets” *Havard Law Review* 111, 1998.

Heller and Rebecca Eisenberg, 1998. “Can patents deter innovation? An anticommons in biomedical resrarch” *Scicen* Vol. 280.

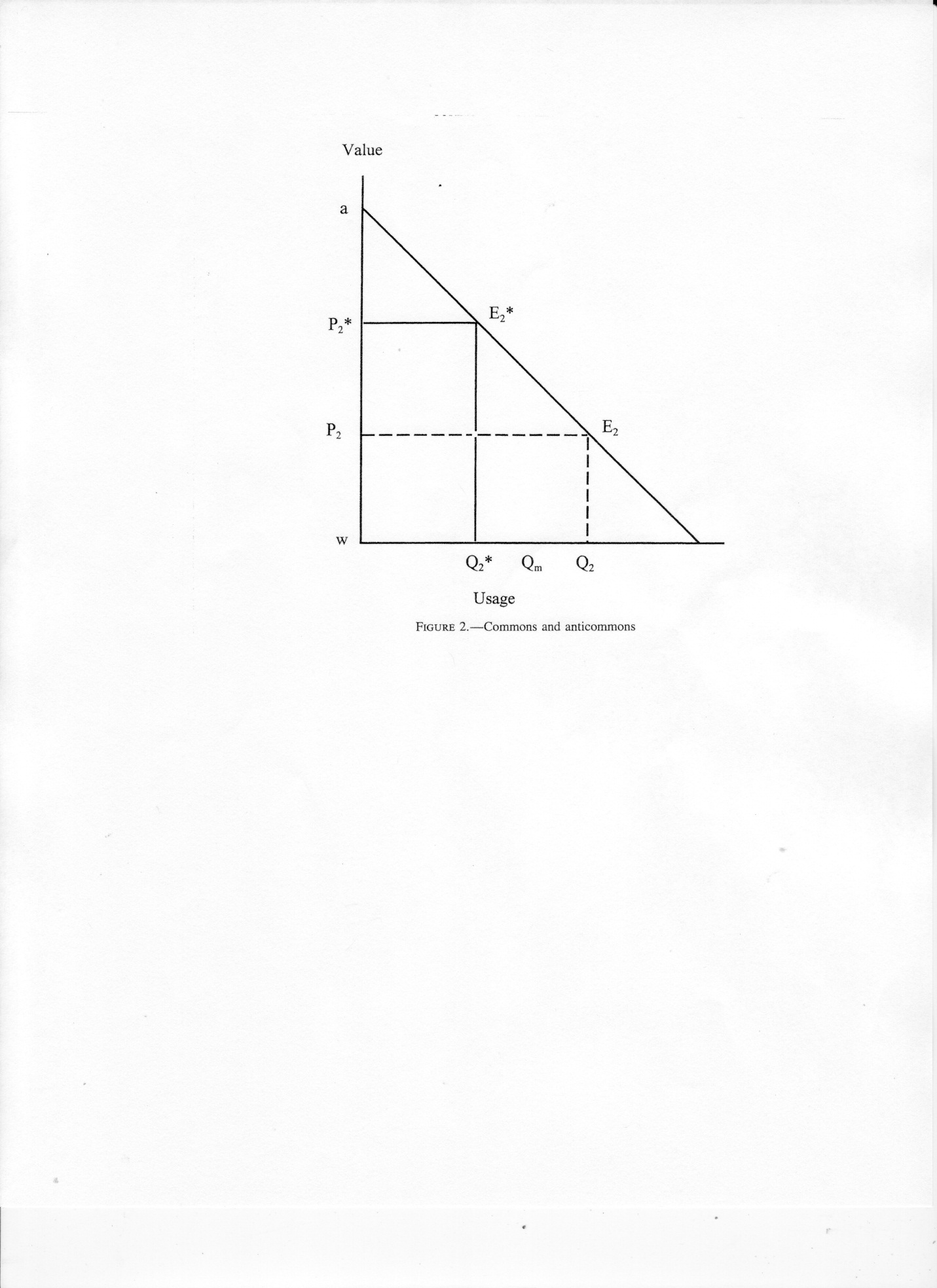
Heller, M. “The Tragedy of the Anticommons: a concise introduction and lexicon,” *The Modern Law Review*, 2013.

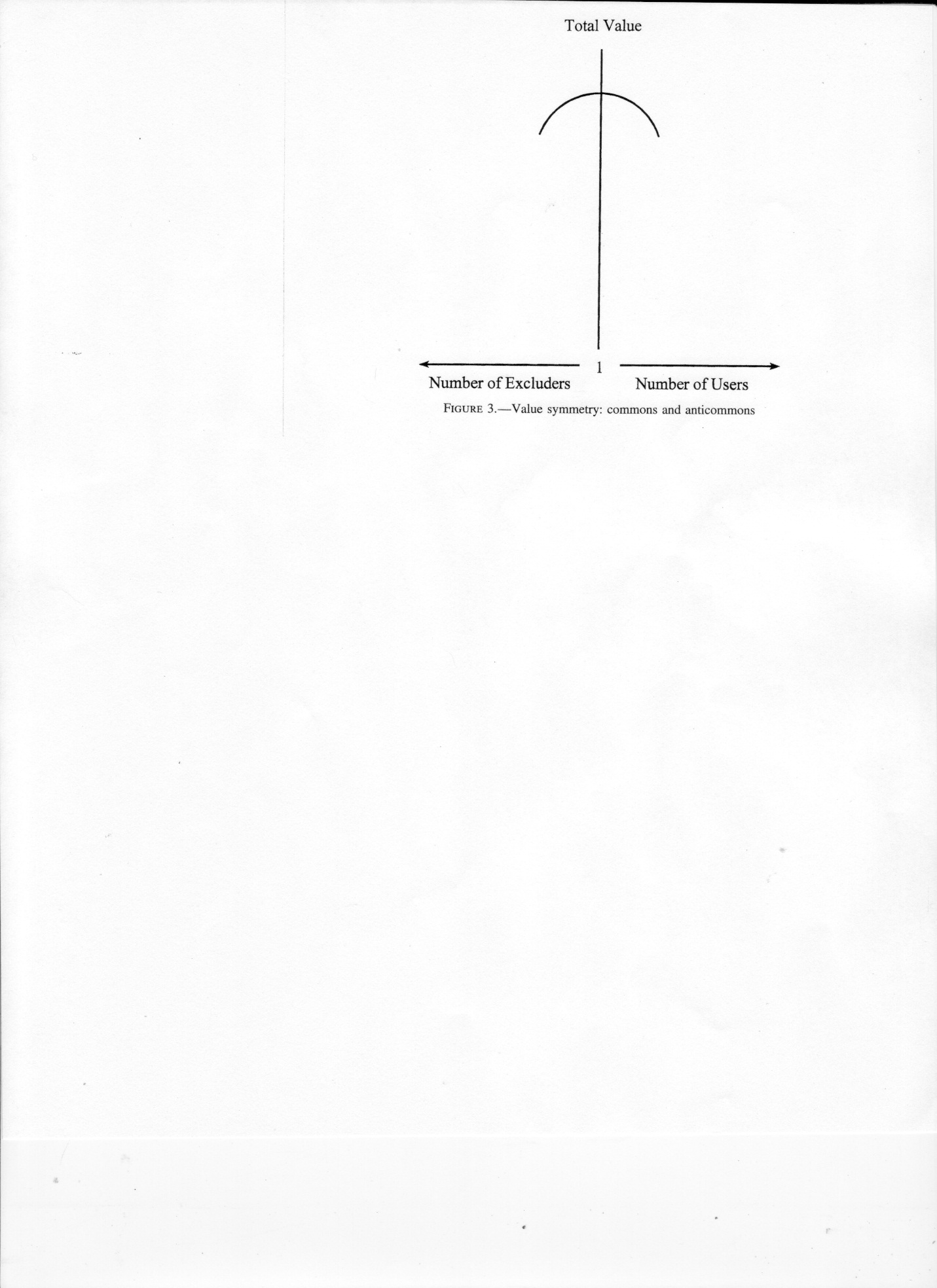
Landes, W. and R. Posner, *The economic structure of intellectual property law*, Harvard Univeristy Press, 2003.

Lemley, M. and Carl Shapiro, “Probabilistic Patents,” *Journal of Economic Perspectives* 2005

Shapiro, Carl, “Navigating the patent thicket: cross licenses, patent pools, and standard setting’, in Adam B. Jaffe et al (eds), Innovation Policy and then Economy 1, MIT Press 2001.

Walsh, Arora, and Cohen, “Working through the patent system” *Science* 14 Feb 2003.

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