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SOME CURRENT ECONOMICS BASICS

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1 The Market

The notion of the market has been used for centuries in a whole host of manifold senses and contexts. One theme, however, above all, is recurrent: the mutually beneficial voluntary transaction, stemming from two most basic human traits, the striving for survival, that is, the desire to satisfy certain basic and higher level needs, and the ability to form beliefs about rights and wrongs, and to judge one's own performance from an impartial perspective, impacting on individuals' behaviour in a social context. The former gives rise to transactions, and the latter creates a sense of reciprocity accompanying those transactions, rendering them mutually beneficial.¹

The Oxford English Dictionary traces the use of the word back to the 12th century, however, it was not until Adam Smith's "The Wealth of Nations" that the notion was forcefully introduced into theoretical economic thinking.

The great Scottish philosopher never gave a precise definition of the market, effectively leaving the issue open to interpretation,² but made a strong statement in favour of the market as an institutional mechanism, which under conditions of 'free competition' or 'perfect liberty' resulted in maximised overall social welfare. His rhetorics were principally aimed at policymakers at the time, in view of a general indifference towards social welfare as a desirable goal of policy, and a widespread scepticism towards trade as a means of increasing welfare.³ Implicit and important to his argument is the recognition that transactions are of a voluntary nature and economic actors are opportunistic, hence all the parties to a transaction should be better off after the transaction.⁴ To him the decen-

¹See Gouldner (1960) who argues that reciprocity as a 'universal norm' contributes substantially to the 'stability of social systems', a notion that has been reinforced by the game-theoretic approach and its implications (Axelrod 1984).

²Cairnes (1888, p. 100) criticised him because "it is not quite clear ... in which sense he [Smith] uses the word 'market'."

³In the 18th century commerce was regarded as highly suspicious in the Christian and civic republican tradition, both of which were based largely on ancient Greek thought. Recall that Aristotle considered 'trafficking in goods' as hazardous to the moral well-being of individuals.

⁴As he put it forcefully:

[M]an has almost constant occasion for the help of his brethren, and it is in vain for him to expect it from their benevolence only. He will be more likely to prevail if he can interest their self-love in his favour, and show them that it is for their own advantage to do for him what he requires of them. ... It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own interest. We address ourselves, not their

tralised market mechanism was in many instances vastly superior to any type of centralised administrative system.⁵

However, he was also aware that “from the point of view of the individual producer or group of producers it was most beneficial to circumvent the competitive market with its attendant risks, and use all available means to prevent competition, in order to obtain the highest possible price for their wares”, as Muller (1993, p. 77) points out. Therefore, the market had to be designed in a way that encourages “self-control and the channeling of the passions in socially beneficent directions” (p. 131).

humanity but to their self-love, and never talk to them of our own necessities but of their advantages. (Smith 1910, p. 13)

⁵He puts it:

He generally, indeed, neither intends to promote the public interest, nor knows how much he is promoting it. . . . [H]e intends only his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention. . . . The statesman who should attempt to direct private people in what manner they ought to employ their capitals would not only load himself with a most unnecessary attention, but assume an authority which could safely be trusted, not only to no single person, but to no council or senate whatever, and which would nowhere be so dangerous as in the hands of a man who had folly and presumption enough to fancy himself fit to exercise it. (Smith 1910, pp. 400–01)

Incidentally, he only used the notion of the “invisible hand” once in his work, and there is, in fact, nothing mystical to it.

Most neoclassical writers have anxiously defended and elaborated this market notion, and reject outright any state intervention going beyond the legal recognition and enforcement of private property rights (Friedman 1962; Becker 1962; Liebowitz and Margolis 1999). An exemplary statement by Liebowitz and Margolis (1999) reads:

An inefficiency is a profit opportunity. By definition, an inefficiency means that there is some feasible change for which the benefits outweigh the costs. That is to say, there exists a possible surplus. The person who can figure out a way to bring about the necessary reallocation and capture some of the net benefit will enjoy a profit. Where property rights are clear and freedom of contract is broad and secure, inefficiencies will face assault from profit-seeking entrepreneurs. . . . The abstract possibility of market failure is an inadequate basis for the making of real-world policy. (pp. 239–40)

For a summary of critical accounts of a market-based and voluntaristic society see Shearmur and Klein (1997). See also Copp (2000) for an interesting treatment of the inherent conflict between capitalism and freedom, stemming from inequalities in economic power.

The notion of the market, it appears, is a crucial yet highly ambiguous concept at the very core of economics. It is often used in different contexts and its usual definition is relatively broad. A recent definition (Pearce 1986, p. 263) reads: “[G]enerally, any context in which the sale or purchase of goods or services take place. There need be no physical entity corresponding to a market”. A more narrow definition, linking the market explicitly to the exchange of goods, is the one by Hardwick, Khan, and Langmead (1999, p. 51): “The market for a good can be thought of as the area in which buyers and sellers of the good come in to contact with each other to transact their business”.

Understandably, sociologists feel generally uneasy about such definitions. Lie (1997, p. 342) remarks: “[T]he neoclassical market is shorn of social relations, institutions, or technology and is devoid of elementary sociological concerns such as power, norms, and networks”,⁶ and continues: “The very abstraction of the market – its ontological indeterminacy – allows for its universal applicability”.

The application of axiomatic propositions to economic modelling, and the dispensing with factors that apparently evade reliable abstraction may be justified as it facilitates a basic understanding of economic processes, yet the economic concept of the market is not universally applicable to a universe of human relations.⁷ As Schumacher (1973, p. 42) puts it: “There are boundaries to the applicability of the economic calculus”, and “[T]o undertake to measure the immeasurable is absurd and constitutes but an elaborate method of moving from preconceived notions to foregone conclusions” (p. 41).

Antitrust policy, in making normative considerations about social welfare, builds largely on economic considerations regarding efficiencies of markets. By virtue of the government’s coercive power it seeks to correct market inefficiencies by imposing remedies on corporations which are considered to abuse their market power and thereby lower social welfare.⁸

Whilst ‘the market’ in most economic considerations is generally a rather broad concept, the point of departure from an antitrust perspective is the product, and

⁶To be sure, these concerns are not entirely new. Marshall (1920, p. 182) wrote: “Everyone buys, and nearly everyone sells. . . in a ‘general’ market. . . . But nearly everyone has also some ‘particular’ markets; that is, some people or groups of people with whom he is in somewhat close touch: mutual knowledge and trust lead him to approach them. . . in preference to strangers”.

⁷See also Kindleberger (1986, pp. 1–3).

⁸Exploring the notion of antitrust or competition policy is beyond the scope of this paper. But see Carlton and Perloff (2000, ch. 19–20), Van Cayseele and Van den Bergh (2000), and Faull and Nikpay (1999).

“the interest is in market power” (Faull and Nikpay 1999, p. 44). Part of the legal test that is being applied in judging allegations of market power that prejudices consumers is the notion of the ‘relevant product market’, which “includes all the products and firms that in fact do or could easily offer reasonable substitutes to the customers if the firm in question were to raise prices or supply inferior products” (p. 45).⁹ The difficult issue in defining the market is that the boundaries usually cannot be decided satisfactorily precisely. Implementing antitrust guidelines in reality is far from straightforward and may pose many pitfalls. Assessing all relevant contingencies regarding demand and supply substitutes and potential competition is prone to misjudgements or may simply be infeasible,¹⁰ questioning the reasonable justification of any policy measures.

This tends to be an especially serious issue in industries undergoing a rapid pace of product and technological innovation, which is certainly the case in software markets, as Katz and Shapiro (1998, p. 13) note: “Market boundaries shift over time along with technology and marketing practices”.¹¹ The ongoing Microsoft lawsuit has shown that already the determination of what constitutes a product is notoriously difficult and depends on the standing. One may consider an operating system a distinct product.¹² Microsoft has been arguing that its Internet Explorer is an integral part of its Windows operating system.¹³ Whatever the standing, software products are strongly complementary and can be described as forming systems (Katz and Shapiro 1994), which tend to be subject to significant network effects, potentially creating both direct and indirect externalities.¹⁴ This complicates an appropriate determination of relevant markets considerably. Moreover, price discrimination between different consumer segments may further narrow the relevant market.¹⁵

Some authors have argued that the relevant market definition is too narrow

⁹This notion can be found in American and European legislation. See Faull and Nikpay (1999, pp. 45–6).

¹⁰For an elaboration see, for example, Froeb (1994) and his references.

¹¹The US DOJ and FTC Antitrust Guidelines for the Licensing of Intellectual Property (1995, available from <<http://www.usdoj.gov/atr/public/guidelines/ipguide.htm>>) take this to a certain extent into account. See especially § 3.2.3 which treats innovation markets.

¹²In 1993 upon receiving a complaint from Novell about Microsoft’s licensing practices, the European Commission made the finding that the three layers of software, operating system, graphical user interface (GUI), and software applications, constituted separate markets. (XXIVth Report on Competition Policy, 1994, Annex II at 364-5)

¹³See also the appeals court opinion, *infra* note ?? at 79.

¹⁴See section 4.

¹⁵This is explicitly recognised in the 1992 US DOJ/FTC Horizontal Merger Guidelines (available from <<http://www.antitrust.org/law/US/mg.html>>).

in that it puts unduly little emphasis on the dynamics of the market and the importance of future-generation products. However, the analytic difficulties in reliably predicting future-generation product markets are obviously considerable, as “all that we presently can observe is the current generation goods market, existing assets, and the research and development efforts proposed or in progress” (OECD 1997, p. 13). Hruska (1992) elaborates:

[I]n a rapidly evolving high-technology market, it is hard to define a product which continually changes both in its internal characteristics (such as the speed and fluidity of the operating system) and its interaction with other similarly developing products (such as the interaction of OS software and continually advancing microprocessor hardware). (p. 330)

In an antitrust context an appropriate definition of the product market in operating systems is, due to the uncertainties of development and the ambiguity of economic models, highly difficult.¹⁶

2 Transaction Costs

The recognition of property rights is central to the capitalist system.¹⁷ It is a widely accepted notion among economists that private property enhances social welfare due to the incentives associated with diverse kinds of property relationships.¹⁸ However, those rights are not natural, but depend upon the existence and enforcement of legal rules.¹⁹ Only the establishment of private property rights

¹⁶OECD (1997) states:

Product market definition poses severe difficulties in a context where research and development efforts continuously change the nature of products, the possible substitutes for those products, and the identity of suppliers of the products and their substitutes. (p. 9, footnotes omitted)

For an excellent survey of relevant economic and legal literature in this field see OECD (1997, pp. 7–39).

¹⁷In fact, property rights and the freedom to utilise properties as desired are the defining characteristics of the capitalist system.

¹⁸See for example Usher (2000), and Olstrom (2000).

¹⁹It is a fallacy to believe that property rights can be solely designed according to economic efficiency considerations. As Schmid (1989, p. 59) puts it nicely: “[The economy is] a universe of human relations” and not merely “a universe of commodities”. And Samuels (1981, p. 155) remarks: “There is no independent test by which the law’s solutions can be said to be the efficient solution”. Institutional economics holds that a purely efficiency driven approach to

gives rise to potential mutually beneficial transactions in a market.²⁰ Indeed, the concept of property had been expanded from a purely physical conception to one which takes exchange value into account. The differential between individuals' valuations (or costs) of goods and services which gives rise to 'clearing' in a market place is recognised and legally protected. That is, "the *expected earning power* of those things is property" and thus "[t]o deprive the owners of the *exchange value* of their property is equivalent to depriving them of their property" (Commons 1924, p. 16, emphasis in original).

The recognition and protection of property rights gives rise to costs, and so does the exchange of properties rights. Throughout the history of economics this has been widely recognised. Adam Smith repeatedly points at the costs of maintaining property rights,²¹ the costs of transferring properties,²² as well as "concepts of costly information and the ability of individuals to exploit others' ignorance to their own advantage" (Allen 2000, p. 912).

It was not until Coase's (1937) famous article that the concept of transaction costs was explicitly introduced to economic thinking. Coase did not define transaction costs with any precision, simply calling it "[the] cost of using the price mechanism" (p. 391), which he considered in the context of institutional choice, effectively arguing that positive transaction costs were both necessary and sufficient for an explanation of the firm. Only much later he provided some

institutional change is too narrow and somewhat misleading, given the evolving and interdependent character of law and economics. For "owing to human interdependence and scarcity, each individual's opportunity set is constrained and shaped by the opportunity sets of others in society" (Medema, Mercuro, and Samuels 2000, p. 437), property rights are constantly evolving and changing. "Since each individual desires to make choices from a set that is as unconstrained as possible, individuals will wish to control the choices and hence opportunity sets, of others who may constrain their choice." This conflict is especially severe with respect to intellectual property. See section 5.

²⁰Allen (2000, p. 898) puts it: "Given that trade is the transfer of property rights, there can be no trade (and hence no gains from trade) in the absence of property rights".

²¹"He [the rich man] is at all times surrounded by unknown enemies, whom, though he never provoked, he can never appease, and from whose injustice he can be protected only by the powerful arm of the civil magistrate continually held up to chastise it" (Smith, as cited in Muller 1993, p. 147).

²²"If the two countries are at a great distance, the difference may be very great; because though the metals naturally fly from the worse to the better market, yet it may be difficult to transport them in such quantities as to bring their price nearly to a level in both. If the countries are near, the difference will be smaller, . . . *because in this case the transportation will be easy*" (Smith 1910, p. 173, emphasis added).

elaboration of the concept (Coase 1960), yet the notion was to remain a vexed one. Whereas the existence of transaction costs is undisputed, its implications are obscure to the present day. It has proven an insufficiently powerful tool of analysis in explaining institutional choice,²³ and its assumptions limit its predictive value.²⁴

Allen (2000) makes a useful distinction between two approaches to the notion of transaction costs: property rights and neoclassical approach. For the former “the two concepts of property rights and transaction costs are fundamentally interlinked” (p. 897) and transaction costs are defined as “the costs establishing and maintaining property rights” (p. 898). Thus, if property rights were complete, no transaction costs would occur.²⁵ Alternatively, departing from the Coase theorem,²⁶ transaction costs may be defined as the “costs that cause the Coase theorem not to apply” (Allen 2000, p. 905)

Beginning with Hicks (1935) the neoclassical approach defines transaction costs more narrowly as the “costs resulting from the transfer of property rights” (Allen 2000, p. 901). Hence “in the neoclassical approach, enforcement type costs *within* the firm are *not* transaction costs (p. 902, emphasis in original).

Regarding the causes of transaction costs, both approaches are relatively similar. Parties must:

find each other, they have to communicate and to exchange information . . . goods must be described, inspected, weighted and measured. Contracts are drawn up, lawyers may be consulted, title is transferred and records have to be kept. In some cases, compliance needs to be enforced through legal action and breach of contract may lead to litigation. (Niehans 1987, p. 676)

Defining transaction costs poses significant difficulties. Demsetz (1988) pointed out that applying the term too broadly threatens to make it tautological and

²³For a seminal criticism see Alchian and Demsetz (1972), and for a summary of approaches to the theory of the firm see Hart (1989) and Foss, Lando, and Thomsen (2000).

²⁴For two articles challenging major assumptions and implications of transaction cost economics see Norderhaven (1995), and Zajac and Olsen (1993).

²⁵Cheung (1992, p. 52) states: “[T]he dual specifications of clearly delimited rights and zero transaction costs are redundant. If transaction costs are truly zero, the delineation of rights can be ignored”.

²⁶The Coase theorem states that in the absence of transaction costs the outcome of private bargaining will be Pareto-efficient regardless of the distribution of property rights. For an extensive review and discussion of literature on the Coase theorem see Medema and Zerbe Jr. (2000).

useless. Schlag (1989) summarises: “an overly expansive view of transaction costs threatens to make the Coase theorem tautological. On the other hand, an overly restrictive view of transaction costs can effectively invalidate the theorem” (p. 1675). Moreover, the notion of transaction costs draws on the assumption that economic actors behave opportunistically whenever they engage in market transactions. It remains inevitably silent on the nature and origins of its causes.

3 Information Costs

The principal cause of transaction costs are information imperfections. If information was perfect no transaction costs would arise (Barzel 1977). The classic article calling for a more rigorous treatment of information was that by Stigler (1961), but it was mainly Stiglitz who formalised and elaborated the notion of the economics of information. From an information costs perspective imperfect information rather than transaction costs are at the heart of economic problems.

Grossman and Stiglitz (1980) showed that informationally efficient markets are impossible, due to the fundamental conflict between the incentives to produce costly information and the efficiency with which it is disseminated.²⁷ The only information that could be efficiently distributed was costless information. Hence “the idea of a perfect market in information is internally contradictory even in theory” (Boyle 2000, p. 2013).

In the context of consumer decision making the problem of limited information can have severe impacts on the market structure and equilibrium. Consumer welfare may as a result be affected. Carlton and Perloff (2000, pp. 421–2) identify five chief reasons for limited consumer knowledge: differing reliability of information; cost of collecting information; limited ability to store and recall information; bounded rationality, i. e. the use of simplified rules to process information; and differing ability to process information correctly due to education and intelligence.

It has been argued that limited quality information about goods or services on the part of the consumer may result in the non-existence of a market, or only the lowest-quality good may be sold (Akerlof 1970).²⁸ The inefficiencies resulting from asymmetric information may be prohibitively expensive to remedy

²⁷They put it: “There is a fundamental conflict between the efficiency with which markets spread information and the incentives to acquire information” (p. 405).

²⁸Carlton and Perloff (2000) put it tersely: “*There is no market for good-quality used cars*” (p. 425, emphasis in original).

by means of government intervention. However, there are ways of equalising information levels or efficiently remedying the prejudices to consumers resulting from ignorance, to alleviate the information imperfections.²⁹ Guarantees and liability laws may serve as an assurance to consumers that the quality accords with the claims of the seller. Reputation as a signal of quality in markets where sellers expect repeated purchases and hence have a strong incentive not to sell defective goods may constitute a similar check. Independent parties may provide reliable information to consumers if the resulting increase in consumer welfare outweighs the costs of provision.

Limited price information may result in the disappearance of a market or in a multi-price equilibrium (Carlton and Perloff 2000, p. 431). A single-price equilibrium can occur at the monopolistic price (or at least above the marginal price) (p. 433), which may cause the market to disappear, depending on the search costs and the number of sellers (Stiglitz 1979). The nature of the equilibrium is understood to depend upon the number of informed and uninformed consumers, which determines the loss of business to sellers that raise their price above the competitive equilibrium price, and hence their ability to profitably do so.³⁰

The result of these distortions relative to the theoretical optimal market with a hypothetical Walrasian auctioneer is that the fundamental law of supply and demand and the law of one price do not hold in markets where information is limited. “[M]arkets with limited information differ from those with perfect information” (Carlton and Perloff 2000, p. 447). Moreover, “market prices are not the only signals which convey information about scarcity, and prices do convey information other than that about scarcity”. There are a variety of other ways being utilised to convey information (Stiglitz 2000, p. 1449). The hope that information imperfections could be treated with conventional tools in the neo-classical framework (Stigler 1961) has largely proved futile, since “many of the standard results – including welfare theorems – do not hold even when there are small imperfections of information” (Stiglitz 2000, pp. 1443–4).

With special respect to high tech markets Sirgy and Su (2000) argue that “[t]he complexity of technological innovations has increasingly undermined the foundations of perfect competition” (p. 1) and “consumers in an increasing world of high

²⁹The remainder of this paragraph draws heavily on Carlton and Perloff (2000, pp. 426–7).

³⁰Generally speaking, the more informed consumers there are, the higher the probability that competitive prices prevail. See Carlton and Perloff (2000, pp. 431–41) for an elaboration.

tech have less knowledge about what constitutes quality, let alone the ability to compare and contrast the quality of two or more high tech products. . . preventing the average consumer from making wise and informed decisions” (p. 7). Consumer sovereignty, resting on the notion that people *know* what is good for them and can value it accordingly, is becoming a fiction rather than a useful assumption.³¹ Hence, they argue, businesses have to implement the stakeholder concept (Freeman 1984), and behave in a socially responsible manner. However, it is clear that profit-maximising companies will capitalise on information differentials where possible.³² Stiglitz (2000) puts it: “Firms know that it is costly for customers to search, and will exploit that. Managers know that it is costly for shareholders to monitor them, and will exploit that” (p. 1455). Economic actors have an incentive to create noise or take actions to increase the level of asymmetries of information (Edlin and Stiglitz 1995; Stiglitz 2000).

4 Network Externalities

The notion of externalities can be traced back at least to Pigou (1938) who argued that possible spillover effects could create unpriced externalities, affecting the socially optimal allocation of resources.³³ His taxation solution had subsequently

³¹Uncertainty, information imperfections and bounded rationality potentially render them unfit to make rational decisions. See also marketing textbooks (for example Adcock et al. 1998, pp. 71–2, Kotler et al. 1999, pp. 243–51) for the notions of selective attention, selective distortion, and selective retention.

³²To be sure, the empirical evidence that ‘socially responsible’ companies do on average perform better than other companies due to the impact of ‘socially responsible’ investors and consumer activism is mounting (Heal 2001). From an orthodox CAPM perspective this seems puzzling, but see also for example Chatterjee, Lubatkin, and Schulze (1999) who contend that markets are imperfect and ‘strategy matters’.

³³Says Pigou:

[T]he essence of the matter is that one person A, in the course of rendering some service, for which payment is made, to a second person B, incidentally also renders a service or disservice to other persons (not producers of like services), of such a sort that payment cannot be extracted from the benefited parties or compensation enforced on behalf of the injured parties. (p. 183)

Pigou himself owed a fair amount to Marshall:

We must call to mind the fact that the struggle for survival tends to make those methods of organisation prevail, which are best fitted to thrive in their environment; but not necessarily those best fitted to benefit their environment, unless it happens that they are duly rewarded for all the benefits they confer, whether direct or indirect. And in fact this is not so. . . . [A]nd as a result many businesses

been largely rejected by proponents of the public choice and the property rights approach. Coase (1960) in his celebrated article rearticulated Knight's (1924) critique, arguing that taxation is rigid and arbitrary, and would simply create another externality, foreclosing the possibility of the affected parties to strike a mutually advantageous bargain. Not only is the precise tax impossible to compute, it also creates incentives that render the tax as a means to achieve efficiency futile:

... to do so would require a detailed knowledge of individual preferences and I am unable to imagine how the data needed for such a taxation system could be assembled. ... [E]ven if the tax is exactly adjusted ... [it] would not necessarily bring about optimal conditions. ... Without the tax, there may be too much smoke and too few people living in the vicinity of the factory; but with the tax there may be too little smoke and too many people living in the vicinity of the factory. (Coase 1960, pp. 41–2)

From his perspective the externality problem is essentially one of transaction costs. Therefore the remedy has to focus on property rights rather than taxation. Dahlman (1979) carries this point further, stating that the concept of externalities is a highly normative one, and deeming the economy to be in a Pareto-efficient equilibrium. Due to the associated costs and uncertainties government intervention is not justified.³⁴

languish and die, which might in the long run have done good for society if only they could have obtained a fair start. (1916, pp. 596–7)

³⁴Says Dahlman (1979):

If we include the costs of transacting in the constraints that describe the conditions under which economic agents perform their individual wealth maximization, we would then describe an attainable optimum, and this is one we should use in judging optimality and welfare problems. ... The conclusion ... would seem to be that if it exists it must be optimal, and if it does not exist it is because it is too costly, *so that is optimal too*. If you do not like the smell of the air, seek comfort in the knowledge that it would cost you more than it is worth to you to do away with the stench, for, otherwise, would you not do it? (pp. 153–4, emphasis added)

and continues:

There is no proof that the market, in the presence of costs of transacting, does not attain an optimum, but a simple assertion: the market leads to an inoptimal solution *relative to what the government can attain*. To make this a reasonable proposition we must *assume* that the government can do better than the market

A considerable shortcoming of both Pigou and his critics is their representation of the allocation problem in a partial equilibrium context rather than in one of dynamic generation and resolution, as Dragun and O'Connor (1993) point out. Coase's (1960) "formal symmetry in any situation of externality", they argue, "is highly problematical (not to say self-serving) in a properly dynamic view of externality generation and resolution". Incidentally, according to a study by economists at St Andrews University 19,500 Britons die prematurely due to air pollution every year,³⁵ and it is doubtful that there is any perceptible immediate symmetry in cause and effect and a reasonable opportunity for the affected parties to remedy the situation themselves, not only due to transaction costs but due to highly imperfect information. The absence of symmetry in a large number of externality cases is crucial, and suggests that property rights approaches to phenomena like environmental degradation and pollution are not as academically sound as its proponents purport.³⁶

Network externalities are of a fundamentally different nature than Pigovian externalities, yet they pose the same set of challenges regarding the warrant and nature of government intervention. The concept of network externalities has been receiving increasing attention over the last decades by economists and policy makers. Courts have in recent cases largely accepted that software markets are subject to considerable network externalities, justifying the potential need for antitrust enforcement actions. Unfortunately, the policy implications are less clear.³⁷ Whilst some argue that the purported welfare loss due to possible 'lock-in' effects and inefficient network size is largely unproven, and advocate a hands-off approach because of the highly dynamic nature of software markets and the uncertainties and costs of antitrust measures (Liebowitz and Margolis 1999),

can – and this is the implicit point of reference according to which we judge market performance. (p. 155, emphasis in original)

³⁵Jim Pickard, et al., *Pollution 'kills 19,500 a year'*, Financial Times, January 15, 2001, p. 6.

³⁶See also, for example, Gorringer (1999, ch. 3), and Schumacher (1973).

³⁷Say Katz and Shapiro (1994):

[I]t is theoretically possible for government intervention to improve market performance. But ... the extent of the market inefficiency is unclear, ... [and] even if policy-makers try to maximize total surplus, they may lack the information needed to do so. ... [W]e are far from a general theory of when government intervention is preferable to the unregulated market outcome. (pp. 114–5)

others see a strong need for government intervention to promote social welfare.

Network externalities stem from the characteristic of certain products to derive some of their value from the number of others using the same or a compatible product, that is, the users of these products form a network, and the utility of each single product depends partly on the size of the network, the classic example being a telephone network. The more people are connected to the network, the higher the potential individual benefit. This ‘positive feedback effect’ (Arthur 1990) may result in unpriced externalities and possible ‘lock-in’ into a Pareto-inferior equilibrium, which potentially affect social welfare.

Katz and Shapiro (1985) make a useful and widely accepted distinction between direct and indirect network externalities. The former is “generated through a direct physical effect of the number of purchasers on the quality of the product” (p. 424).³⁸ The latter is given rise to by ‘indirect effects’, commonly referred to as the ‘hardware–software paradigm’, (Katz and Shapiro 1985, p. 424) and applies to complementary products which form systems.³⁹ The owners of these systems can be considered to form a ‘virtual network’. Indirect consumption externalities arise when complementary components to a system are purchased at different times (Page and Lopatka 2000, p. 955), for example cars and various postpurchase services; hardware and software; video players and tapes. The costs and availability of complementary products to a base product, and hence the value of the base product and the *whole* system, may depend upon the number of users of the same or a compatible base product.⁴⁰

Liebowitz and Margolis (1994) make a distinction between network *effects* and network *externalities* in order to discriminate between ‘merely pecuniary externalities’ and true network externalities, which in their view are far less common than network effects generally. They argue that most indirect network externalities are, in fact, pecuniary externalities, “external effects that work through the price system”, and reserve the term network externality for “a specific kind

³⁸Note, however, that direct network externalities might also arise in the absence of a physical network, consider for example human languages.

³⁹Page and Lopatka (2000) define a system as “any combination of a durable good and associated goods or services that perform some desired function” (p. 955).

⁴⁰The classic example here is that given by Katz and Shapiro (1985):

[A]n agent purchasing a personal computer will be concerned with the number of other agents purchasing similar hardware because the amount and variety of software that will be supplied for use with a given computer will be an increasing function of the number of hardware units that have been sold. (p. 424)

of network effect in which the equilibrium exhibits unexploited gains from trade regarding network participation”.⁴¹

As mentioned earlier, networks that exhibit direct externalities may have a sub-optimal size, since the private marginal benefit of participating in the network is lower than the total social benefit. That is, there are ‘adaption externalities’ which the individual is unlikely to consider upon making a decision. The equilibrium size of the network may be smaller than the social optimum (Katz and Shapiro 1994). Further, future expectations on the part of the individual and coordination problems resulting in a ‘social dilemma’ situation may affect network size. At the extreme, two markedly different equilibria are possible, depending on the expectations of every individual.

Property rights that allow the internalisation of consumption externalities may solve the problem of inefficient network size (Katz and Shapiro 1994; Liebowitz and Margolis 1994). Single ownership of the network may allow pricing that reflects the overall benefit derived from an additional user, and the owner may deploy a whole host of different strategies to attract users. However, in the case of inexhaustible economies of scale, as is typically the case with software products, a monopoly may exacerbate inefficiencies. When cooperation is viable, possibly facilitated by intermediary organisations, internalisation of externalities may be possible without single ownership.

The inefficiencies in networks with indirect externalities stem largely from uncertainty about future availability and price of the software⁴² in the presence of significant switching costs. That is, a user may be ‘locked in’ to a product, due to sunk pecuniary and learning costs. If a monopolist supplies both hardware and software, there is a danger that he will exploit ‘locked in’ consumers (Katz and Shapiro 1994). To remedy those problems a sponsor of a hardware–software

⁴¹Note, however, their point of departure:

[B]oth by name and by some of the explicit results of the network literature, network externalities are asserted to constitute market failure. If almost every aspect of the economy exhibits network externality, and if externalities presumptively are market failures, then our most basic results about the efficiency of markets may be in error and dramatic policy changes might be warranted. We believe such changes would be misguided. (p. 134)

Their work in general may be seen in the context of the general propensity of the Chicago school to defend basic neoclassical assumptions and concepts. See also Freedman (1998).

⁴²I am using the word software here in the context of the ‘hardware–software paradigm’.

network can make binding commitments regarding future software availability and pricing. Since this is not always a feasible option, the sponsor may open the market to independent software suppliers, thereby assuring customers they will not be exploited (Farrell and Gallini 1988). Leasing hardware can lower the sunk cost commitment of the consumer (Katz and Shapiro 1994).

The existence of network externalities can have significant effects on the nature of competition between incompatible systems (Arthur 1990; Katz and Shapiro 1994). Due to increasing returns to scale an early standard may ultimately dominate the whole market. It has been suggested that the resulting equilibrium may be suboptimal, a superior standard may not be adopted by the market due to prohibitively high switching costs and coordination dilemmas (David 1985; Arthur 1990). Katz and Shapiro (1994, p. 106) state that “standardizing on a single system can be very costly if the system turns out to be inferior to another system”. The tendency of network markets to tip towards one standard can result in particularly intense competition in the early phase, leading competitors to employ aggressive strategies like penetration pricing in a bid for future profits from the de facto standard (Katz and Shapiro 1994).

Liebowitz and Margolis (1994, 1995a, 1999) strongly dispute that those effects lead to market failure, especially that of inferior choice among discrete networks. They contend that value-increasing transitions do occur, submitting, however, that the nature of these transitions is poorly understood in economics. Liebowitz and Margolis (1999) maintain that software markets are subject to Schumpeterian competition (Schumpeter 1942), that is, rapid innovation is a major source of creation and destruction in the economy and monopolies are of a serial nature. Further they contend that most industries are subject to decreasing returns to scale, and therefore multiple networks can exist (Liebowitz and Margolis 1994).⁴³

A considerable shortcoming of the literature on network externalities is the lack of empirical support for the possibility of market failure. It is unfortunate that the example most often cited by proponents of the concept is the notorious QWERTY case (David 1985). Liebowitz and Margolis (1990) have argued forcefully that the story is factually incorrect. Similarly, Liebowitz and Margolis (1994) show that the Beta videotape format is no better than VHS, as was asserted by Arthur

⁴³Although it is generally understood that software markets exhibit increasing returns to scale, Liebowitz and Margolis (1999) argue that these markets may also be subject to decreasing returns, with a, however, tenuous example (pp. 81–2). For a brief critique see Brown (2000).

(1990).⁴⁴

A further important limitation to models of network externalities is the assumption that network value functions rise without limit (see for example Katz and Shapiro 1986). Moreover, heterogeneous consumer preferences may allow multiple competing networks to coexist (Katz and Shapiro 1994; Liebowitz and Margolis 1998).

Closely related to the notion of network externalities is that of path dependence. It has been asserted that the existence of network externalities in markets with increasing returns may cause ‘path dependence’ (Arthur 1989), that is, insignificant historical events may result in an inefficient and unremediable equilibrium. The classic paradigm setting case, again, is that of the QWERTY keyboard, which, as mentioned above, was proved flawed by Liebowitz and Margolis (1990).

Liebowitz and Margolis (1995b) draw a distinction between three progressively increasing degrees of path dependence, the first two of which occur commonly and do not affect efficiency. Rather, they merely reflect ordinary durability. Third-degree path dependence relates to an inefficient outcome, where there exists a preferable outcome which is not obtained, albeit feasible. This inefficient ‘lock in’ is commonly ascribed to ‘interactive behaviour’ problems. The empirical evidence for the existence of third-degree path dependence is weak and no clear policy implications can be drawn (Liebowitz and Margolis 1995b, 2000).

However, switching costs, including learning and transaction costs, and coordination problems can impede the transition to a superior standard and reduce social welfare. Firms may have an incentive to increase switching costs through incompatible proprietary standards and contractual means (Klemperer 1987; Katz and Shapiro 1994; Shapiro 1999), thwarting competition.⁴⁵ Compatibility of competing products can be welfare enhancing, leading to intense competition in the mature stage of the market and substantially lower switching

⁴⁴To be sure, the evidence that the QWERTY keyboard arrangement is as good as the Dvorak or any other arrangement is, in fact, not conclusive. The mere exposure of flaws in Dvorak’s research is not sufficient for the conclusion that there exist no adverse and insuperable network externalities. See for example MacKenzie and Zhang (1999), and Marmaras and Lyritzis (1990).

⁴⁵Says Shapiro (1999, p. 10):

[L]ack of compatibility can be the death-knell of a new technology, even if it is superior in some absolute or stand-alone sense. And incumbent firms often have the incentive to exert their intellectual property rights to deny such compatibility to would-be entrants.

costs. There are two principal mechanisms to achieve compatibility (Katz and Shapiro 1994):

standardization, whereby systems are designed to have interchangeable components; and adapters, which attach to a component of one system to allow it to interface with another system. With adapters, the principal cost is that of the adapters themselves, *plus the fact that adapters may work imperfectly*. By contrast, the primary cost of standardization is a loss of variety: consumers have fewer differentiated products to pick from, especially if standardization prevents the development of promising but unique and incompatible new systems. (emphasis added, footnotes omitted)

Firms tend to prefer incompatibility and spend resources to block compatibility if they have a “distinctly superior overall package, including its product offering, its installed base, and its reputation” (Katz and Shapiro 1994). If that is not the case, firms may prefer compatibility.

In software markets firms can employ intellectual property rights and contractual means to block compatibility and thereby increase switching costs. Regulatory policies that encourage standardisation and make compatibility possible may thus be welfare enhancing.

5 Intellectual Property Rights

Intellectual property “continues to be one of the law’s more obscure and esoteric fields” (Millard 2000, p. 177). It is an area of unusual conceptual difficulties, and is justified on a whole host of different theories, non of which provides a fully satisfactory framework, and conclusive justification and guidelines for policy measures.⁴⁶ Rather, intellectual property constitutes a trade-off between a host of

⁴⁶Menell (2000) captures the problem neatly:

Economic theorists have produced multiple plausible models for which empirical distillation will remain elusive and unlikely to be of much predictive value due to the heterogeneity of inventive activity, the diversity of research environments, the complexity of technological diffusion, the richness and changing nature of real world institutions and the obvious measurement problems in conducting empirical research of this type. . . . [T]he holy grail of a perfectly calibrated incentive system is unattainable. (p. 163)

stakeholders, shaped by social welfare considerations and rent seeking activities.⁴⁷

The principal argument in favour of private intellectual property rights is that they provide crucial incentives for the creation of ideas, the principal framework being that of utilitarianism.⁴⁸ Says Bentham (1839, p. 71):

[T]hat which one man has invented, all the world can imitate. Without the assistance of the 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.

Effectively, the conferment of intellectual property rights renders inherently non-rivalrous information goods claims on the rivalrous good money in a monetary exchange context, endowing it with a legally recognised and protected exchange value.⁴⁹ The chief trade-off regarding the extent of intellectual property rights protection is that between creating incentives for innovation and the deadweight loss of monopoly exploitation.⁵⁰ The point of departure for intellectual property rights has traditionally been the recognition that information is a public good,⁵¹

⁴⁷Note the rhetoric quality of the metaphor ‘intellectual property’, obfuscating the fact that *a priori* there are no natural exclusive rights whatsoever to ideas, and implicitly shifting the focus from public to private benefit.

⁴⁸For an account of the principal arguments against utilitarianism as a framework for public policy see Brown (1992).

⁴⁹It may be argued that contractual measures can serve the same purpose. However, absent a clear legal understanding of its merits as private property, this has proven somewhat difficult.

⁵⁰Lord Mansfield in *Sayre v. Moore* (1785) stated:

We must take care to guard against two extremes equally prejudicial; the one, that men of ability who have employed their time for the service of the community, may not be deprived of their just merits, and the reward of their ingenuity and labour; the other, that the world may not be deprived of improvements, nor the progress of the arts be retarded.

⁵¹Jefferson (1813), reflecting upon the public goods attributes of information, non-excludability and inexhaustibility, put it:

It is agreed by those who have seriously considered the subject, that no individual has, of natural right, a separate property in an acre of land, for instance. By an universal law, indeed, whatever, whether fixed or movable, belongs to all men equally and in common, is the property for the moment of him who occupies it; but when he relinquishes the occupation, the property goes with it. *Stable ownership is the gift of social law*, and is given late in the progress of society. It

which gives rise to a principal conflict between the creation of knowledge and social welfare, recognised by Arrow (1962):

[A]ny information obtained... should, from the welfare point of view, be available free of charge... This insures optimal utilization of the information but of course provides no incentive for investment in research. In a free enterprise economy, inventive activity is supported by using the invention to create property rights; precisely to the extent that it is successful, there is an underutilization of the information. (pp. 616–7)

Proponents of the property rights approach have questioned the appropriateness of the public good attribute of information as a starting point for economic thinking about intellectual property, arguing that strong intellectual property rights should be provided (Demsetz 1969, 1970), drawing on the principal property rights approach claim that the distribution of property rights does not affect the efficiency of the outcome (Coase 1960). However, allocative and productive efficiency are largely static concepts which are not readily applicable to innovations and creative works in an intrinsically dynamic context, ‘marked by persistent evolutionary pressures’ (Gastle and Boughs 2001).

Arriving at reasonable assumptions for and conceptualisations of the notion of intellectual property is inherently difficult,⁵² yet does not pose entirely new

would be curious then, if an idea, the fugitive fermentation of an individual brain, could, of natural right, be claimed in exclusive and stable property. If nature has made any one thing less susceptible than all others of exclusive property, it is the action of the thinking power called idea, which an individual may exclusively possess as long as he keeps it to himself; but the moment it is divulged, it forces itself into the possession of everyone, and the receiver cannot dispossess himself of it. Its peculiar character, too, is that no one possesses the less, because every other possess the whole of it. He who receives an idea from me, receives instruction himself without lessening mine; as he who lites his taper at mine, receives light without darkening me. That ideas should freely spread from one to another over the globe, for the moral and mutual instruction of man, and improvement of his condition, seems to have been peculiarly and benevolently designed by nature, when she made them... Inventions then cannot, in nature, be subject of property. (emphasis added)

See also Stiglitz (1999) for a discussion of knowledge as a public good.

Incidentally, tribes in the highlands of Papua New Guinea still have an understanding of property which coincides with Jefferson’s conjecture that “whatever, whether fixed or movable, belongs to all men equally and in common” (pers. comm. Philip Briggs).

⁵²Global traditions on intellectual property differ significantly. See for example CSTB (2000,

problems. Boyle (1992) sharply noted that:

[I]ntellectual property... actually presents exactly the same problems as the liberal conception of property generally. It merely does so in a more obvious way and in a way which is given particular spin by our fascination with information. All systems of property are both rights-orientated and utilitarian, rely on antinomical conceptions of public and private, and present insuperable conceptual difficulties when reduced to mere physicalist relations.

The empirical evidence that the granting of intellectual property rights is, in fact, needed to stimulate inventive activity and investment is not conclusive. The seminal papers questioning the validity of the economic efficiency argument in intellectual property are those of Plant (1934a, 1934b). He contended that much creative activity is of a spontaneous nature, and that first-mover advantages and other factors provide sufficient rewards to create.

There are four major areas in intellectual property: patents, copyrights, trademarks,⁵³ and trade secrets.⁵⁴ Patents can be considered the strongest form of intellectual property since they grant property right or a limited monopoly over an idea, provided it is sufficiently useful, novel and non-obvious, and hence also any manifestation of that idea, and its commercial exploitation.⁵⁵ Although traditionally regarded as not applicable to software products, patent protection has been granted in some recent cases.⁵⁶

pp. 56–7) on the traditional differences between America and Europe regarding moral rights of authors, and the tradition in Asian countries where the expression of an idea is regarded as a social one, not an individual one. See also Alford (1995) and Gilligan (1996, p. 119). In fact, it was not until 1991 that the Republic of China passed a formal copyright law. For a critique of the basic romantic concepts of ‘the author’ and ‘the inventor’, underlying intellectual property, see for example Boyle (1992, 2000) and the references in Menell (2000, p. 162).

⁵³I will not deal with those, but see Menell (2000, pp. 149–50).

⁵⁴Trade secret law affords “formal legal protection to those who make reasonable efforts to maintain trade secrecy”, however, “the rightholder may have little effective recourse if a trade secret becomes widely known or if a user of the information acquired it without knowledge of its having been misappropriated” (Menell 2000, p. 150–1). See Coleman (2000). It is worth noting that there may be a public interest in disclosure which can potentially override trade secret law and render an act of disclosure exempted from liability under rules of confidentiality.

⁵⁵The economics of patents has been principally debated in the industrial organisation literature. There is a strong divergence of opinions as regards the economic effects of patent protection. See for example Carlton and Perloff (2000, ch. 16).

⁵⁶The dual nature of software as both a literary work and a machine has challenged the

Copyrights provide exclusive rights to reproduce and publish an original expression to the creator of a literary work for a limited time period. Further, particular rights to the creation under the ‘fair-use’ doctrine are left in the public domain. There is an ongoing discussion about the appropriateness of criteria regarding originality in copyright law. Whilst some argue that “at least some minimal degree of creativity” should be satisfied,⁵⁷ others claim that “what is worth copying is *prima facie* worth protecting”.⁵⁸ The scope of copyright has been considerably broadened throughout the 20th century. Originally devised to promote literary and artistic creativity and the diffusion of works, which at the inception related solely to books,⁵⁹ it was subsequently applied to sound

traditional patent concept. It was not until *Diamond v. Diehr*, 450 U.S. 175 (1981), in which a computer program was part of a process which was claimed patentable, that the first patent for a computer program was granted (CSTB 2000, p. 193). Patenting of software products is a highly controversial issue, which I will not further explore here. As a means of protecting intellectual property it is not as widely used as copyright, due to the disclosure requirements, and the danger that a granted patent may be invalidated at a later point on grounds of originality requirements. But see Press (2000), Hart, Holmes, and Reid (1999), and also CSTB (2000, pp. 192–8), Lloyd (2001, pp. 293–4), and Moens (2000, pp. 422–6). For the current European patent law harmonisation debate see PbT Consultants (2001).

⁵⁷In the US copyright does not extend to mere collections of facts such as telephone directories, notwithstanding the fact that they might be expensive to compile. In *Feist Publications, Inc. v. Rural Telephone Service Co. Inc.* 111 S.Ct 1282, 18 U.S.P.Q. 2d 1275 (1991) the Supreme Court rejected the former ‘sweat of the brow’ standard. However, as regards computer programs the requirement coincides with the European notion of originality which was stated in Article 1.3 of the EU Software Directive (91/250): “A computer program shall be protected if it is original in the sense that it is the author’s own intellectual creation”. See Derclaye (2000a, pp. 15–6). Millard (2000, p. 187) concludes:

The low level at which the originality threshold has tended to be fixed by the courts means that even relatively simple and utterly mundane works can be protected by copyright. This is very important in the computer context where programs and other functional works may lack aesthetic appeal and display little creativity yet be of tremendous commercial value. Were a higher threshold to be set for the originality test, it is probable that much computer software and data would fall completely outside copyright. (footnotes omitted)

In Europe copyright has been extended to databases, provided they achieve a certain level of originality. At present, however, the standard of originality remains untested before courts. See Chalton (2000) for the current European legislation.

⁵⁸Peterson J. in *University of London Press Ltd v. University Tutorial Press Ltd* (1916) 2 Ch. 601 at 610, as cited by Attridge (2000, p. 563).

⁵⁹The Statute of Anne (1709, passed in 1710, available online from <<http://edge.net/~flowers/statute%20of%20anne.htm>>) was confined to books, and titled: “An act for the encouragement of learning, by vesting the copies of printed books in the

recordings, films, broadcasts, and most controversially, computer programs and databases. A long-standing principal characteristic of copyright is that it does not extend “to ideas, procedures, methods of operation or mathematical concepts as such”.⁶⁰ The idea/expression dichotomy is, however, not always a satisfactory tool of analysis.

As indicated above, neither legal nor economic arguments for copyright are entirely convincing. A judge at one occasion opined that it approaches “nearer than any other class of cases belonging to forensic discussions, to what may be called the metaphysics of law, where the distinctions are, or at least may be, very subtle and refined, and, sometimes, almost evanescent”.⁶¹ Although the marginal costs of copying have fallen significantly over the last decades,⁶² which has by some been taken as an argument for the tightening of copyright law, the principal arguments of Plant (1934a), calling copyright into question from an economic perspective, remain largely valid. He makes an explicit distinction between authors for whom writing constitutes their profession and those who write for other *non-financial reasons*. The former may depend upon royalties, although this need not necessarily be the case, whilst the latter are *antedate* indifferent towards royalties, for whatever reason.⁶³ Further, he points out that

authors or purchasers of such copies, during the times therein mentioned”. Some have argued that it was not the pressure from authors, but rather the lobbying efforts of the stationers, that led to the enactment of what is considered the world’s first copyright law. Kretschmer (2000, p. 216) concludes: “The history of copyright can be characterised as a continuous expansion of owners rights, favouring in general investors over creators”. Moreover, authors were required to register their works with and pay a fee to the Stationer’s Company in order to obtain copyright protection. Attridge (2000, p. 563) points out that the rationale behind copyright law prior to the Act was public censorship, which, however, with developments in the printing industry, was rendered futile, and shifted to the commercial interests of stationers and the Crown. That is, rent seeking rather than economic efficiency considerations brought about modern copyright law. Boyle (2000, p. 2037) puts it tersely: “Intellectual property policy has consistently under-valued the public domain”.

⁶⁰Article 2 of the WIPO Copyright Treaty (1996). This principle is embodied in the EU Software Directive (91/250) Article 1.2 and Recital 14, and in the US Copyright Act 1976 § 102 (b).

⁶¹*Folsom v. Marsh*, 9 F. Cas. 342, 344 (C.C.D. Mass. 1841)(No. 4,901), as cited in Boyle (1992, n. 16 and accompanying text).

⁶²In fact, the digital nature of a large number of today’s works challenges the foundational legal and conceptual notion of copying as the fundamental perspective that underlies copyright in a number of unprecedented ways. The discussion about this controversial issue and its implications is only just beginning (CSTB 2000, pp. 140-3).

⁶³*Inter alios* most academics, and artists who comprehend art in a fashion that excludes the immediate symmetry between creation and reward belong to the second group. “Freely

traditionally some of the most important works of art known to man were created under a system of patronage,⁶⁴ and challenges the non-excludability dilemma argument using empirical data from the 19th century. Hurt and Schuchman (1966) and Breyer (1970) coincide with Plant's conclusion that the need of copyright is questionable.⁶⁵

Apart from the questionableness of the copyright system encouraging creation better than would be the case in its absence, there are considerable costs to the system. The first and foremost is the social welfare loss due to monopoly pricing if the intellectual property right entails a monopoly. For economic efficiency it is irrelevant to whom the consumer surplus, the difference between marginal cost and individual utility, accrues. Therefore perfect price discrimination would constitute a remedy to the welfare loss (Demsetz 1970), but it has been argued that perfect price discrimination is *impossible* to attain due largely to information imperfections.⁶⁶ Further costs are transaction costs of licensing, and administration and enforcement costs.⁶⁷ Transaction costs may be prohibitively high, retarding progress built upon the creation in question, which is seen as one justification for the fair use doctrine.⁶⁸ Along with the deadweight social loss, but on a dynamic rather than static level, copyright "increases the cost of borrowing from previous works and thus weakens the incentive to create" (Gordon and Bone 2000, p. 195). It puts a possibly undue emphasis on the output side to the creation as opposed

have I received, freely given, and want nothing in return", Martin Luther said of his writing. Mann (1998) conjectures that only as a result of growing book trade the romantic notion of the artist, a "sovereign being who creates beauty out of nothing but inspiration" has developed in the 18th century. See also Boyle (1992, n. 130 and accompanying text), and *supra* note 52. Note that the reasons for the indifference towards pecuniary rewards largely evade orthodox economic modelling.

⁶⁴This partly applies to the two groups mentioned *supra* in note 63.

⁶⁵Following on from these papers a number of studies have been conducted. For an overview see Watt (2000, ch. 4).

⁶⁶See Boyle (2000) and Gordon and Bone (2000, pp. 194–5). Boyle (2000) makes two important points: "We might believe that surplus in the hand of (generally poorer) consumers was more valuable than surplus in the hands of (generally richer) producers, because of the *diminishing marginal utility of wealth*" (p. 2027, emphasis added), and "[P]erfect state-backed price discrimination. . . would require massive information-gathering on the part of the producers and, perhaps ultimately, on the state. Perfect price discrimination requires more information about customers than can be revealed by mere self-selection and more information-gathering (to prevent illicit arbitrage, lending, or gifts)" (p. 2034).

⁶⁷See Gordon and Bone (2000, pp. 195–6).

⁶⁸Fair use is generally a statutory right, rendering claims otherwise invalid. Thus notes like: "Not to be quoted without written permission of the authors" are void.

to the input side.⁶⁹ Information is by its very nature cumulative (Landes and Posner 1989). The limitation of exclusivity to the expression, leaving the idea in the public domain, along with the fair use doctrine, is considered the chief characteristic of copyright law attempting to minimise the social cost of exclusivity.

Concerns regarding the warrant of copyright are even more acute in the context of computer programs.⁷⁰ The fundamental difference between software and more traditional creations that fall under the scope of copyright is the nature of the expression which is given protection to. Copyright is automatically given to all levels of software code, that is, the source code as well as the machine-readable binary code “[s]imply by virtue of the fact that they can be symbolically represented in a way which resembles the written word” (Gordon 1998, p. 10), the crucial difference being that the former gives expression to an idea in a human-readable fashion, whereas the latter is of a principal utilitarian nature and *not human-readable*. Hence the analogy to conventional writings is a difficult one to maintain.⁷¹ The applicability of copyright to software entails considerably strengthened intellectual property rights for their owners. Samuelson (1984) puts it:

The problem is a new one. Until the advent of computer programs, copyrighted works that were sold to the public communicated the ideas they contained. Unpublished works that might have claimed copyright protection had little or no commercial value. Now it is possible both to publish a work and to keep it secret, and keeping it secret is part of the way the commercial value of the work is maintained. Computer programs in machine-readable form are the first type of copyrightable work to have a major commercial value *without* disclosure. (p. 710, emphasis in original, footnotes omitted)

⁶⁹“Intellectual property policy has to focus on the input side of the table as well as the output side of the table” (Boyle 2000, p. 2032).

⁷⁰For an excellent account of European and American case law and legislative regarding copyright in software programs see Derclaye (2000a, 2000b).

⁷¹Welch (1992) argues:

Notwithstanding the representational similarity of programs to literary works, programs remain the technology for using computers. They are not designed to communicate information, thought, or feeling to human beings, nor are they designed to communicate with, as opposed to physically control, computers... [T]he program is in a fact a technological and not a literal product.

In the US computer programs have been considered copyrightable from 1964, on condition that a readable copy, the source code, was deposited with the Copyright Office. This requirement was effectively dropped with the 1976 Copyright Act (Samuelson 1984, pp. 715–7).

The only logical relation the machine code bears to the source code is an interdependence through a mathematical relation, defined by a compiler program, which transforms the higher level source code into executable binary code.⁷² Absent the availability of the source code, vast reverse engineering efforts are necessitated to derive the idea to the creation,⁷³ rendering futile the conventional notion that the subject of copyright is a creation which is intended to express an idea, and hence any conventional notion of fair use.⁷⁴

From a legal perspective the line between the idea and the expression in computer programs is an elusive one, giving rise to unprecedented non-literal infringement challenges. *Computer Associates v. Altai*⁷⁵ was the first case to establish a means of determining which non-literal elements of a program are copyrightable.⁷⁶ As non-literal elements were identified: program ultimate func-

⁷²Note that this automated transformation is not possible vice versa. In mathematical terms the mapping from the higher-level language domain to the image space of binary code is surjective, but not injective.

⁷³European and American law largely accepts reverse engineering as a means “to extract the ideas and structures from computer programs” (Attridge 2000, p. 568) and to achieve interoperability. In *Sega Enterprises Ltd v. Accolade, Inc.* 977 F. 2d 1510 (9th Cir. 1992) it was held that:

Disassembly of copyrighted object code is, as a matter of law, a fair use of the copyrighted work if such disassembly provides the only means of access to those elements of the code that are not protected by copyright and the copier has a legitimate reason for seeking access.

See Attridge (2000, pp. 568–9) for a brief account of recent developments in Europe and the US. See also Faull and Nikpay (1999, pp. 622 ff.).

⁷⁴For a seminal political statement for ‘free software’ see Stallman (1992). See also *infra* note ???. Note, however, that even the availability of the source code still necessitates a considerable effort to *understand* the code. One of the contributors to the focus group conducted by the author pointed out: “Having open sources does not mean that everyone will understand them. The intellectual effort to understand the source code is almost akin to that needed to create the code in the first place” (pers. comm. Jochen Witte).

⁷⁵*Computer Associates International v. Altai* 982 F. 2d 693 (2nd Cir. 1992).

⁷⁶The first case to recognise non-literal elements as copyrightable was *Whelan Associates, Inc. v. Jaslow Dental Laboratory, Inc.* 797 F. 2d 1222, 1238 (3d Cir. 1986), *cert. denied*, 479 U.S. 1031 (1987), in which the structure of the defendant’s program was substantially similar to that of the claimant’s. However, no rigid test was established. For a detailed account of the US and the UK position as regards non-literal infringement see Millard (2000, pp. 205–20).

tion or purpose, modules, organisational or flow charts, parameter lists, structure, and macros. The *Altai* ‘abstraction-filtration-comparison test’ was devised to determine whether the allegedly copyright infringing program is ‘substantially similar’ to the original. The non-literal elements are to be determined, unprotected components, including ideas and features that are dictated by efficiency considerations, required by external factors, or taken from the public domain, are to be removed, and the remaining components to be compared. In subsequent cases the test was further developed.⁷⁷ It is clear that the application of a rigid legal test to complex software may be infeasible or at least very problematic, a limitation that the *Altai* court was aware of, noting that the test “would have to be adapted to the particular circumstances of the case” (Derclaye 2000b, p. 58). European courts have thus far not adopted a structured approach to copyright infringement cases.⁷⁸ However, Jacob J. in *Ibcos Computers v. Barclays* (1994) opined that the copyrightability of an idea hinges upon how detailed it is:

The true position is that where an “idea” is sufficiently general, then even if an original work embodies it, the mere taking of the idea will not infringe. But if the “idea” is detailed, then there may be infringement. It is a question of degree.⁷⁹

At present, copyright does not seem to extend to software interfaces since “functionality is the realm of patent law protection, whereas copyright law protects non-functional works” (Derclaye 2000a, p. 12, n. 50).⁸⁰ Further, recent US cases have considered user-interfaces, as regards functional aspects, not to be copyrightable.⁸¹ However, whilst copying a user-interface does not present any

⁷⁷See Derclaye (2000b, pp. 58–9).

⁷⁸See Derclaye (2000b, pp. 63–5).

⁷⁹*Ibcos Computers Ltd v. Barclays Mercantile Highland Finance Ltd* (1994) F.S.R. 497, at 291.

⁸⁰Article 6 of the Software Directive allows reverse engineering in order to obtain “information necessary to achieve interoperability”, and American case law has been firmly upholding the *Sega* precedent (see *supra* note 73). In *Sony v. Connectix* 203 F. 3d 596 (9th Cir. 2000) it was held that emulating an interface does not infringe copyright. In the absence of a patent the functional results of a copyrighted program are not protected (Fitzgerald 2001, pp. 123–4). Warren-Boulton, Baseman, and Woroch (1994) point at strong economic arguments against the copyrightability of interfaces. An interface which constitutes a *de facto* standard is the result of “the efforts of many sponsors” and can be an extremely valuable asset in the presence of network externalities. “Besides the original developer, there are the users that purchase the program, the makers of complementary hardware and software, and even suppliers of compatible substitutes” (p. 7).

⁸¹See Gordon (1998, pp. 12–3), and Derclaye (2000b, pp. 60–1). In *Apple Computer, Inc.*

severe difficulties as it is visible to the user, implementing the functionality of an existing API (software-software-interface) in the absence of specification or source code necessitates considerable reverse engineering efforts, and may effectively be impossible.⁸² Hence the perfect ownership of the source code in the absence of disclosure requirements regarding APIs potentially creates a *de facto* ownership over the software interface stemming from the copyright protection of the software.⁸³

Distribution of software is generally different from that of more conventional copyrighted information goods. It is licensed to a consumer rather than sold, allowing the producer to impose greater restrictions and limitations on the consumer than would be possible under a sales arrangement. The rights granted by the licence, not the program as such constitute the software product. This profoundly affects the rights of the consumer in most instances. He may be prohibited from transferring the program to someone else, or from doing certain things with the program.⁸⁴ The enforceability of such contracts is still a relatively open issue.⁸⁵ There may be overreaching provisions in software licences which

v. Microsoft Corp. 94 CDOS 7160 (9th Cir. 1994) it was held that Apple’s user-interface, being a ‘purely functional feature’, deserves no copyright protection. The court also recognised the desirability of “the adoption of compatible standards”. A similar reasoning was applied in *Lotus Development Corp. v. Borland International, Inc.* 49 F. 3d 807 (1st Cir. 1995), identifying a menu-command hierarchy as a ‘method of operation’ and therefore excluded from copyright protection. Judge Boudin did even go further, wondering why customers of Lotus should remain “captives of Lotus because of an investment in learning made by the users and not by Lotus” (quoted in Gesmer 1995).

⁸²See *infra* note ??.

⁸³Social welfare may, as a result, be affected. Says Millard (2000):

Where... a *de facto* industry standard has emerged... the possibility of copyright being used to monopolise the specification of interfaces... has enormous policy implications. Much of the rapid growth and diversity that has characterised the computer industry in the last two decades has resulted from the widespread development of hardware and software products that are ‘compatible’ with those most popular in the market. Such compatible products frequently improve substantially on the products offered by the company that initiated the standard both in terms of price and performance, and often also in terms of innovation. (p. 205, emphasis in original)

⁸⁴Some economists argue that restrictive licensing enhances social welfare since it allows moving closer to perfect or first degree price discrimination, but the argument is neither innocent nor conclusive. See *supra* note 66, and also Carlton and Perloff (2000, pp. 280–90).

⁸⁵See Ravicher (2000) for an account of recent US cases.

are not enforceable, especially if there is no equal bargaining power as is the case in most mass market software licence agreements.⁸⁶ Provisions attempting to circumvent the fair use doctrine are generally considered void.⁸⁷ Most mass market licence agreements have been considered enforceable, provided certain procedural requirements were met: “proper notice of the licence before purchase, adequate time to review and assert whether to assent to the licence’s terms, and the opportunity to return the software for a full refund if the licence is unacceptable” (Ravicher 2000). However, the state of law regarding this matter is not fully conclusive at the present moment.

A restrictive licence may add to the strong protection of proprietary rights in software granted by copyright and trade secret protection of the underlying source code.⁸⁸ Yet a licence may also be utilised to turn the conventional intellectual property rights notion on its head, and be designed to attain the exact opposite effect, not restricting the use of the software, claiming no proprietary rights, and leaving the intellectual property once and for all in the public domain.⁸⁹

6 Conclusion

This treatise should make clear that economic efficiency cannot be treated merely in Coasian terms, detached from considerations as to the conferment of property rights. In fact, these considerations appear to be crucial in view of vested interests of powerful opportunistic economic actors as against a public interest in dynamic innovation and competitive markets.

The dichotomy between the market and a limited field of areas where state intervention and regulation is required and justified is a false and misleading one, due to inevitable normative policy questions beneath the market. Any legal and regulatory framework is based on normative considerations. Market forces act in frameworks established by rights systems, created by the state and enforced by virtue of its coercive power.⁹⁰ The present intellectual property rights system that gives rise to monopolies such as Microsoft’s is neither fixed and irrevocable,

⁸⁶Mass market licence agreements are generally fixed and not negotiable, and come either in the shape of ‘shrink-wrap’ or ‘click-wrap’ licenses. By opening the package or clicking an affirmative label respectively the licence is deemed to be a binding contract.

⁸⁷See discussion above.

⁸⁸See for example the Windows end user license agreement (EULA).

⁸⁹See for example the GNU GPL. A list of GPL compatible licences is available from <http://www.gnu.org/philosophy/license-list.html>.

⁹⁰“[E]fficiency is a function of rights, and not the other way around” (Medema et al. 2000, p. 440).

nor is it founded on natural rights for the creators. If anything, it is *a gift of social law*, to put it with Jefferson, and its *raison d'être* is the promotion of social welfare rather than private benefit.

Today's economy is dominated by intangibles rather than tangibles, and fixed costs rather than variable costs. Neoclassical price theory has been largely invalidated by some pioneering work in the field of information economics, yet we are merely at the beginning of what may revolutionize mainstream economics and replace frameworks that have become inappropriate in view of their restrictive assumptions.

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