WHO WILL PAY FOR INNOVATION IN THE DIGITAL MUSIC INDUSTRY? - PERSONAL versus COMMERCIAL USERS AND PRICE REGULATION

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Personal versus Commercial Users and Price Regulation

Andrew Burke

Abstract
The paper necessarily adopts an inter-disciplinary approach in order to analyse the impact of digital technology on music R&D and innovation. The paper addresses three main issues. Firstly, it argues that commercial music users (such as TV/Radio broadcasters, cinemas, shops etc) may be the only viable markets for music in the digital environment. Secondly, this is likely to cause regulators to raise the royalty rate/prices paid by commercial users. Thirdly, these price increases will be excessive if regulators continue with their longstanding usage of partial price regulation and may cause them to make greater use of simultaneous price regulation.

Key words: music innovation, regulation, digital technology

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1. Introduction.
The purpose of the paper is to investigate the impact of digital technologies on the application of copyright law as it affects the distribution of revenues and prices across the various markets of the music industry. The analysis is not merely intended as an analysis of the likely economic and business models that will increasingly apply, but is also conducted in order to highlight some major issues that need to be addressed in the realm of price regulation. Namely, the important questions of who should pay for music and how much should they pay. In order to tackle these issues, it is necessary to mix a synthesis of the economics, legal and technology literatures with our own theoretical and empirical contributions in order to plug various existing knowledge deficits. Thus, our methodological approach is necessarily inter-disciplinary but needs to move to narrowly focused analysis at key points of the discussion. Before we move to discuss the structure of the paper, we first provide some background on the music industry in order to provide context.

The music industry is a global business composed of an array of markets which can broadly be divided into public and private use markets. Private music use refers to personal non-commercial use of music and includes markets such records/CDs (albums and singles) and music DVDs/videos. Typically, these markets have been surrounded by allegations of monopolistic power and price fixing and subjected to scrutiny by regulators (Klaes, 1996). Public music consumption refers to cases where the audio experience of a single performance is available to a public audience i.e. live performances, broadcast (TV, radio and internet), synchronisation (film, software and multimedia), and the public performance of recorded music in hotels, bars, restaurants, retail outlets, cinemas, educational institutions and airlines. The expected profits and financial incentive for composers who create new music is determined by the cumulative royalties available from both private and public consumer markets. The same may be said for publishers who fund composers to undertake R&D in order to develop new music\(^1\).

\(^1\) Such R&D includes providing composers with a wage, equipment, rehearsal studios, recording studios and engineers and other inputs to new music creation. In return publishers receive up to 50% ownership of composers royalties derived from private and public markets.
The economic objective of copyright law is to ensure that creators have a sufficient incentive to produce new content. Regulators – including, antitrust authorities, copyright tribunals and laws courts – of copyright based markets seek to ensure that these incentives to create are maintained in a manner to maximise the public good/welfare. This regulatory activity plays a central role in establishing a distribution of effective prices for music across private and public markets. The purpose of this paper is to assess how the distribution of prices and revenue are likely to be affected by the diffusion of digital distribution of music. Our general conclusion is that the music industry is changing from a scenario where private music users pay half of the cost of new music creation to a situation where commercial users become the dominant, if not only, source of income for composers/publishers. A major cause of this is likely to derive from the difficulty of enforcing copyright law in the online environment. However, a central driver for this outcome is also likely to come from regulators, who will have a greater tendency to set higher prices in public markets for music. Thus, public users such as restaurants, hairdressers, shops, bars, live music venues as well as radio and TV stations may experience significant increases in the price of music in forthcoming years.

The paper is structured as follows. In the next section we outline the breakdown of composers’ and publishers’ royalty income from private and public markets over the period 1976-2002. The data shows the extent to which the current economic incentive for new music creation relies on revenues from private and public user markets. In this sense it defines the existing burden of who pays for music innovation in terms of funding new music creation. In section 2 we outline a model of regulatory pricing under copyright law which defines the interrelationship between regulatory prices for music in private and public music user markets. It also explains how the optimal set of regulatory prices is influenced by bargaining power between composers and publishers. In section 3 we outline the main economic changes affecting the music industry as a result of the diffusion of technologies associated with the electronic distribution of music. We end this section by conducting simulations of the likely effects of these changes on regulatory prices using the model in section 2. The paper concludes with a discussion of the main
findings and their implications for regulatory practice and the performance of the music industry.

The empirical analysis in the paper is based on the UK due to availability of good data in this geographic region\textsuperscript{2}. We argue that the empirical results in the paper provide a good indication of the relative shifts in regulatory prices that are likely to take place in other developed economies.

Section 1. Who currently pays for music innovation?

In the UK composers/publishers can generally expect around 8.5\% of revenue from a CD album sale, while for live concerts they may expect 3\% of revenue. In terms of financial importance, the CD market is their largest single source of revenue. However, contrary to popular belief the CD market, and consequently private music users, are not the main source of royalty revenue in the industry. In order to investigate this we constructed a number of new data sets. Composer and publisher royalty incomes for music performances in the UK, as well as broadcasts in the UK, were extracted from the annual accounts of the Performing Right Society (PRS). The PRS licences these markets in the UK for the entire world repertoire of music (secured through reciprocal licensing agreements with similar organisations such as ASCP & BMI in the USA, and SACEM in France). We deducted PRS administration costs from each income category and were also careful not to include revenue from the Republic of Ireland (which was within the PRS’s jurisdiction up until the early 1990s). International revenue from other countries is not included either. British revenues which are redistributed to non British composers/publishers are not deducted. Therefore, our royalty revenue data relate to the entire royalties collected in the UK for worldwide composers and publishers. We have not enough information to decompose royalty revenue into composer and publisher groups but common contractual practice in the industry involves a 50:50 split of royalties between composers and publishers so we think the revenues are fairly indicative. The combined net performance and

\textsuperscript{2} Britain has the most comprehensive data on the music industry available in the public domain. Record sales data since the 1970s have been published by the British Phonographic Industry (BPI) while the music performance and broadcast royalties have been published in the Performing Right Society (PRS) annual report dating back to the same period. The UK market is the 3\textsuperscript{rd} largest market for record sales in the World and is one of the World’s leading innovators of new music compositions. Thus, we believe that it is
broadcast royalty incomes are presented in table 1 below. Table 1 also contains royalty income from UK CD sales and this data has been collated from British Phonographic Industry (BPI) yearbooks. The data represents wholesale revenue. Composer/publisher royalty revenue has been calculated using an industry standard rate of 8.5% of the wholesale price of a record, CD or cassette.

The data in table 1 shows total composer-publisher royalty income growing by just over a multiple of ten from £24 million in 1976 to £247 million in 2002. As is apparent from the last column of table 2 this is equivalent to a real income increase of just over a multiple of 2. The main driver of this rise in income has come from public music user markets. Column 4 shows that as a percentage of all royalty income the record/CD market broadly declines from a 61% share in 1976 to a 41% share in 2002. In fact, after 1980 and with the exception of 1987, public user markets took over from private user markets as the main source of income for composers and publishers. Thus, in terms of the economic right in copyright achieving its objective of providing composers and publishers with an adequate economic incentive to create new music, the growth in the importance of public music user markets has the corresponding effect of increasing the importance of regulators ensuring that pricing practice in these market is consistent with the objectives of copyright law. Later in the paper we will be using the data in table 1 to estimate how these regulators are likely to respond in terms of defining welfare optimal prices for music in response to the impact of digital technologies. For the present we want to provide a bit more background to price regulation in the music industry.

(Table 1 near here)

The revenues that composers and publishers secure from private and public music markets are frequently subject to regulation; particularly price regulation. This can determine both the royalty rates charged by composers/publishers to commercial intermediary buyers along the supply chain (e.g. radio stations or retail outlets) and the actual price charged to final music buyers (e.g. the price of CDs or radio advertising).

a good benchmark of a dynamic market for music and can proxy for other markets which have vibrant new music composers/publishers in other developed economy music markets and in particular, the USA.
Price regulation usually takes place through competition authorities (such as the EU Competition Commission of the US Federal Trade Commission), the law courts (invoking copyright and/or competition/antitrust laws) or through arbitration. The justification for regulatory intervention in markets for music usually stem from (1) refusal to pay for music by consumers (2) the market power of successful musicians (which despite a highly competitive market for new music innovation are able to command dominant positions of varying temporal duration), (3) the fact that composers/publishers frequently licence their music collectively thereby creating a second level of market power and (4) the fact that commercial intermediary music buyers frequently have market power so that there has also been a concern that composers/publishers may be exploited. The fact that regulators have left most of the royalty rates and fees unchanged in public music markets reflects a view that after receiving these payments composers’/publishers’ incomes are equitable and fair in the eyes of the law. In other words, cumulatively the sum of these and other revenues from private music markets ensure that there is sufficient but not excessive returns on investment in new music creation.

Thus, the fact that commercial music users such as radio stations, TV, retailers, pubs, hotels, guest houses, and cinemas have faced little change over the last half century in the royalty rates they have paid for music, appears to reflect that the basic economics of the music industry has not altered much over the same period. However, new technology has now begun to enforce a new economic model. As a result, the price regulatory status quo of the last half century may be subject to a shock of seismic proportions. Whether this is the case or not is central to our investigation. In the next section we examine copyright law and model some hitherto ignored economic implications of the law for the regulation of the composers’ and publishers’ licence fees.

2. The aims of copyright law in the context of music composer rights.
Copyright law provides creators with rights to control copying of their work. The aims of the law promote the interests of the author and the public good. This in turn depends on two forms of benefit which have given rise to a demarcation of copyrights into moral and economic rights. The economic right is the more important of the two and in the case of
the practice of price regulation is the main, if only, driver. It is called the economic right because its motivation is found in economic welfare analysis – specifically, in instances of market failure due to free riding on innovators’ risky investment by imitators. The premise here is that in order for a creative work to be produced, brought to the attention of, and then disseminated to consumers, there must be sufficient financial incentive for all the agents along the supply chain to continually promote this form of innovation. In the case of music this requires that composers, musicians, music publishers, recording studios, record companies, marketing firms, music distributors and music retailers all have an ongoing incentive to undertake a sufficient level of investment and risk in order to bring new music to a wide array of private and public music user markets.

The economic right in copyright seeks to ensure that copies of music used in all these forms and range of markets cumulatively provide those involved in the music supply chain with sufficient incentive to promote the creation and dissemination of music. The central justification for the right is that in its absence, copies would be used without permission/remuneration and would ultimately reduce the incentive to create and supply new music\(^3\). Market failure would result in cases where the introduction of copyright would promote new music creation, which even after the transactions cost of enforcing copyright have been taken into account, would generate a net benefit to society. The economics objective of copyright law is clearly stated in most, if not all national and international copyright statues. For example, the 2001 EC Copyright Directive which seeks to harmonise copyright states in clause (10) of its preamble that:

> "If authors or performers are to continue their creative and artistic work, they have to receive an appropriate reward for the use of their work, as must producers in order to be able to finance this work. The investment required to produce products such as phonograms, films or multimedia products, and services such as "on-demand" services, is considerable. Adequate legal protection

\(^3\) Industry executives are acutely aware of how closely the viability of their business depends on the effective of copyright law and frequently reiterate some of the welfare arguments behind the economic right. For example, Peter Jamieson the Executive Chairman of the British Phonographic Industry (BPI) sums up a typical viewpoint when he states “Whether it is home CD burning – which has seriously damaged the record business in some countries – or, worst of all, full-scale commercial piracy linked to organised crime, every CD sold which does not benefit the creators of that music undermines the ability of the record business to create the music of the future”. BPI, (2003b), p.1.
of intellectual property rights is necessary in order to guarantee the availability of such a reward and provide the opportunity for satisfactory returns on this investment." European Parliament, (2001).

This is the economics backdrop to the price regulation of copyrights. Price regulation seeks to strike a balance in terms of promoting the creation of new music while at the same time trying to allow greater access to music for consumers. It sometimes takes the form of direct price regulation in terms of setting prices but often it involves changing licence terms or practice in order to encourage markets to operate more in line with the economic objectives of the law. Frequently it draws on the powers of antitrust and competition laws in order to achieve this objective. In general, the regulatory hypothesis is that higher prices tend to stimulate a gain in greater creativity but a loss in lower access to music. Higher (lower) prices are justified when a marginal increase (decrease) causes a net gain of benefits over costs. Thus, in an ideal world price regulation would optimise welfare by charging lower prices to the more price sensitive consumers.

In reality, regulators do not set prices simultaneously in all markets for music. In fact, each copyright market price when, if ever, regulated attempts to achieve the welfare objective of the economic right on a partial optimisation basis (see Burke, 2000 for a more detailed analysis of this aspect). In other words, it takes the royalty revenues generated in all other markets for the same set of works as given and then seeks to ascertain the impact of price in the regulated market on creativity and dissemination. In the case of price levels, buoyant revenue from one market effectively allows regulators to set lower prices for music in other segments. In this sense an interrelationship exists between different markets for music copyright to the extent that collectively they must generate enough revenue to produce an optimal level of music creativity. Thus, to illustrate let us assume that the financial costs for creating compositions for a new album are denoted by term ‘I’ which is the sum of costs incurred by composers $I_c$ and publishers $I_p$. We assume that the composers and publishers could invest resources $I_c$ and $I_p$ elsewhere and secure a financial return equivalent to $(1+r_c)I_c$ and $(1+r_p)I_p$ respectively. The sum of these two reservation rates of return is defined as $(1+r)I$. The
actual expected economic joint composer-publisher profit from investing in the creation of new music is defined in equation 1 below.

\[
\pi = \theta \left[ \sum_{i=1}^{n} \alpha_i T_{vi} + \sum_{j=1}^{k} \beta_j T_{bj} \right] - (1 + r)I
\]  

(1)

Where \( T_{vi} \) and \( T_{bj} \) denote the respective revenues from the \( n \) \( \{ j=1, \ldots, n \} \) private and \( k \) \( \{ i=1, \ldots, k \} \) public music markets. The terms \( \alpha_i \) and \( \beta_j \) represent the music royalty rates that composers and publishers receive in each of these markets. The term \( \theta \) represents the probability of an album of music compositions being a success. Therefore, we depict the most usual scenario where a successful album is a necessary condition in order to generate revenues in both private and public music user markets. Composers and publishers divide these royalties according to the specific terms of their publishing arrangement which typically involves a 50:50 split of royalties. In order for both the publisher and composer to have enough incentive to invest resources in the creation of new music for an album, each of their expected royalty revenues must not be less than their reservation rates of return.

In this setting, the task of a regulator is to attempt to maximise welfare which we define as the profits derived from selling music, plus consumer surplus less copyright enforcement and licensing transactions costs. This is defined in equation (2)

\[
W = \Pi + H + C_s - t
\]  

(2)

where \( W \) is welfare from all markets for music, \( \Pi = \sum_{g=1}^{q} \pi_g \), is the sum of the joint composer-publisher profits, \( \pi \) in equation 1 for the total number, \( q \) of published music. \( H \) is the corresponding sum of profits for all other parties along the music supply chain directly attributed to the sale of \( q \) albums. This would include record companies, recording studios, CD manufacturers, advertising companies, record stores etc. \( C_s \) represents consumer surplus which is assumed to be a positive and decreasing function of \( q \) and a negative function of the price of these albums \( p \) the private market. \( C_s \) will also
be negatively related to composer-publisher royalty rate increases in public music markets where these are passed onto consumers in the form of a higher composite price (e.g. an increase in the price of drink, entrance fee etc). Finally, $t$ denotes the transaction costs of enforcing and licensing the copyright in these $q$ albums in both private and public markets for music.

Thus, a copyright regulator who only has regulatory power over the market which it has been asked to investigate (e.g. just cinemas) and is within its jurisdiction (usually due to national boundaries) will make an attempt at partial welfare maximisation of equation (2) with respect to the specific royalty rate. Thus, for example, in the case of a music royalty rate in a market for public music use, $\beta_j$, three properties of the regulator’s decision making become apparent. Firstly, optimal $\beta_j$ can be zero if transactions costs associated with the licensing of this market are excessive. Secondly, in cases where reductions (increases) in $\beta_j$ do not cause any increase in consumer surplus but merely result in profit transfer between $II$ and $H$ then partial welfare optimal $\beta_j$ is non-unique. In this case a change in the composer-publisher royalty rate only causes a reallocation of welfare between different businesses and does not affect the overall level of economic welfare. Thus, from an economics point of view (and in the absence of knock-on effects such as resulting greater innovation in any of these business ventures) these represent indifferent states in terms of policy objectives. However, if reductions in $\beta_j$ do result in increases in consumer surplus – usually where it results in a fall in the price of the final good and where consumers respond to price reductions by increasing consumption - then welfare gains can arise within an interval defined by the composer-publisher joint venture profit constraint. This constraint merely implies that in a case where a royalty reduction will be passed onto consumers who in turn will increase their consumption of music, the expected return on investment for both publishers and composers will still be sufficient to inspire music creation. Thus, if the reservation rate of return for composers and publishers is identical then in the standard market case where composers and publishers share royalties on a 50:50 basis we can define the welfare optimal royalty in a public consumer market by setting equation 1 equal to zero and solving for a unique partial welfare optimal $\beta_j^*$. This is represented in equation (3) below.
\[
\beta^*_j = \frac{(1+r)I}{\theta} \left[ \sum_{-j}^k \beta_j T_{hj} + \sum_j^k \alpha_i T_{vi} \right] / T_{hj}
\]

Equation (3) indicates that the optimal partial regulatory royalty rate will be higher the greater the minimum rate of return required by composers and publishers, the lower the probability of creating a successful album, the lower the level of revenue for music in the market under regulation, and the lower the level of royalty revenues secured from all other public and private consumption of music markets. Thus, ceteris paribus, the stability and legal justification for any particular regulatory price in a particular market for music depends on the existence of a similar stability in the level of royalty income derived from all other markets. If such revenues decrease (increase) dramatically it follows, ceteris paribus that the justifiable regulatory royalty rate would be expected to increase (decrease).

However, in cases where composers and publishers have different reservation profit levels then the optimal royalty rate \( \beta^*_p \) is sensitive to this difference and also to the division or royalties agreed between composers and publishers. To illustrate this and in order to examine the properties of these influences on the optimal regulatory royalty rate we let \( x \) \((0 < x < 1)\) and \(1-x\) define the share of royalties assigned to publishers and composers respectively. Thus, we define the profit function and minimum \( \beta^*_p \) acceptable to publishers as equations (4) and (5) respectively. The equivalent equations for composers simply require replacement of subscript \( c \) for \( p \) and \( x \) for \( 1-x \).

\[
\pi_p = x\theta \left[ \sum_j^k \beta_j T_{hj} + \sum_i^n \alpha_i T_{vi} \right] - (1+r_p)I_p
\]

\[
\beta^*_p = \frac{(1+r_p)I_p}{x\theta} \left[ \sum_{-j}^k \beta_j T_{hj} + \sum_j^n \alpha_i T_{vi} \right]
\]
Optimal $\beta_j^*$ must satisfy both the minimum profit requirement of both publishers and composers in order to ensure that they have a sufficient incentive to produce new music. In order to do so it must rise to whatever is the highest value among $\beta_{jp}^*$ and $\beta_{ji}^*$. However, it follows that each $\beta_j^*$ is a function of $x$, being highest when $x$ reaches upper and lower extremes. We illustrate this in figure 1 where we have drawn two iso-profit schedules denoting combinations of $x$ and $\beta_j^*$ which ensure profits are equal to the minimum profit requirements of composers and publishers. The lowest possible regulatory partial welfare optimum is defined at $x^*$ where the iso-profit schedules intersect generating the lowest possible value of $\beta_j^*$. Any other value of $x$, such as $x_I$, requires the regulator to choose a royalty rate which ensures that one of the parties secures normal (zero) economic profits while the other earns supernormal profits. In figure 1, we observe that if a negotiated agreement between publisher and composer gave publishers the fraction $x_I$ of royalty income, this implies that the optimal regulatory royalty rate charged to music users in public market $j$ is $\beta_j^* = \beta_{jp}^* > \beta_{jc}^*$.

Figure 1: the welfare optimal level and division of composer-publisher royalties

One feature that becomes obvious from figure 1 is that a regulator has most power to enhance welfare if $x$ is already at the optimum $x^*$. Thus, if the regulator had the
jurisdiction to simultaneously rectify deviations of $x$ from $x^*$ before setting $B_j$ then welfare benefits could be enhanced. Since deviations of $x$ from $x^*$ imply that at least one group are earning supernormal (monopolistic) profits such a realignment is within the public good jurisdiction of both copyright and competition laws. However, regulators may be constrained to just undertake the partial regulation outlined in equations 4 and 5 as most regulatory authorities such as law courts, copyright tribunals and competition commissions normally do not have simultaneous jurisdiction over multiple markets. Thus, as we mentioned before they have to take practices elsewhere as given and do the best they can in terms of regulating the market in question.

However, in the case of the division of royalties between composers and publishers copyright collection societies tend to enforce a rule where publishers may not secure more than 50% of royalties. Our analysis indicates that this practice has the additional benefit of pushing the market towards the vicinity of $x^*$ (which due to the properties of the iso-profit curves must be between the extreme high and low values of $x$) thereby enhancing the impact of price regulation.

In the next section of the paper we examine how the new online and digital music based technological changes are likely to affect the iso-profit curves of composers and publishers and hence the optimal partial welfare royalty rates that regulators will tend towards in both private and public markets for music.

**New economic frameworks for the music industry**

The music industry has always been characterised by periods of technological change; particularly in the realms of audio hardware and software. This often led to periods of either vertical integration or co-operation between audio hardware manufacturers and record companies when the network economics of format dominance dictated that availability of content on a format would be a key driver determining its success. However, outside of these epochs of technological change the industry itself experienced limited alteration. The record industry remained a highly concentrated oligopoly with the same firms dominating the market over a 30 year period. Simultaneously, the
single/albums market dominated revenues compared to individual broadcast and public performance markets. This financial dominance was so great that in general parlance, to the music industry was frequently taken to mean the music recording industry i.e. firms in the albums/singles markets.

The culmination of technological advances including digital music recording, file compression and the electronic distribution of digital files through the internet/telecommunications has begun to change the underlying economics of the recording industry. The implications of this economic change threaten the revenues from the singles/albums markets. With a view to assess the impact of these developments on welfare optimal regulatory prices, tariffs and royalty rates, we examine three likely scenarios here. These include endemic piracy, a highly competitive online market for music and a dramatic rise in the supply of composers. These scenarios are not necessarily mutually exclusive and point towards a significant drop in music profits in the albums/singles market. We examine each in turn.

**Influence 1: Endemic Online Distribution and CDR Piracy**

In some ways this is considered the doomsday scenario by the recording industry. The internet with already spectacular effect – through companies such as Napster (now no longer facilitating breach of copyright), Gnutella and Kazaa – has become a distribution network for unauthorised digital copies of music. The distribution network can be both centralised (e.g. from a web portal) and decentralised (e.g. initiatives such as freenet and bearshare). While centralised distribution can be eventually traced and shut down decentralised peer to peer networks without a central hub are far more difficult to control. The industry fear of piracy stems from networks such as these being used as a source for private copying both on hard disk and recordable CDs. The high quality of these unauthorised products reduces an incentive to buy authorised legitimate copies. Thus, acquisition of unauthorised copies of music cannibalises the revenues of the offline singles/albums market.
This threat is already real. At one time Napster had over 60 million users. Similar levels of activity have been attributed to peer to peer sites such as Kazaa where over 3 million songs are downloaded per week (www.kazaa.com Sept 2 2003) – equivalent to approximately 40% of the total number of singles sold in the entire World in a week. Auction sites where compilations of authorised recordings are sold have proliferated and in 2001 the BPI closed down 2315 sites (BPI, 2002b). There is no question that online illegal downloading of music is extensive and therefore, there is no surprise that it is claimed to have had a big impact on the fall in the number of album and single units sold throughout the world (BPI, 2002c and BPI, 2003a). Similar effects on revenue impact on prices as the availability of free illegal downloads limits monopolistic power over prices in the offline arena. Indeed, this is already occurring with record companies reducing prices in developed economies in response to the diffusion of both legitimate and illegal online music.

These events occur against a background where online consumption of music is still only at the early stages of its diffusion due to demographic and technological change. A report on music downloading conducted by the BPI (2003b) indicated that 31%, 27% and 19% of consumers aged between 15-24, 25-34 and 35-44 downloaded music. Thus, demographic change appears to herald the growth in popularity of downloading music. On the technological front the same survey indicated that the time taken to download music (19 minutes per track for a 56k modem) was a major impediment to downloading tracks – 42% saying this is why they did not bother to download albums. Therefore, growth of bandwidth provision alongside demographic change can be expected to act as a major boost to the diffusion of music downloads. Similarly, Audio hardware that can play digital downloaded music is only in its infancy and that too will not be a long term phenomenon. Although existing hardware can play CDRs the market penetration of CD-R/RW drives on household computers was only 26% in the UK in 2001. In sum, the threat to offline CD singles/albums sales is currently significant and can be expected to escalate much further.
The music industry has undertaken a number of initiatives which attempt to mitigate these effects and protect the revenue base of the online market. They have adopted two non mutually exclusive approaches entailing digital rights management (DRM) and lawsuits. The DRM initiatives involve variants of encryption, watermarking and subsequent licensing of digital content. The trouble with this business model is that it only takes one 'hacker' to crack the code and make an 'open' digital file of the music available on the web. With clone to clone digital copies this can quickly diffuse across the market in an epidemic style pattern. The issue then arises of how easy it is to crack an encryption code. The general view is that technology is advancing in a way which will allow computers to experiment with increasingly complex algorithms in order to find the one that successfully decrypts a digital file. Furthermore, if open files are available on CD as is the case for the entire current repertoire of music then the ability to place an open file on free internet access arises from a much easier route.

This perspective was reinforced by a seminal technology paper by Biddle et al (2002) who gave an overview of an audit by Microsoft employees of the likely effectiveness of DRM based initiatives. Biddle et al come to a firm conclusion that none of the DRM initiatives are likely to be able to undermine decentralised peer to peer networks which they think will become increasingly prolific as bandwidth diffuses. However, the real sting in the tail for the music industry from this report is the fact that if DRM is introduced then for the first time ever pirate/illegal tracks will be superior products to legitimate tracks simply because the illegal file is open whereas the legitimate version is supplied with restrictions. Thus, one of the traditional means for the music industry to lure people to pay for the product by offering higher quality looks like a non starter in the online downloading environment.

Over and above this problem there is also another compelling argument being mooted by some other technology innovators in peer to peer technology. They claim that DRM solutions will be very costly to administer and place undue restrictions on basic liberties. Clarke et al (2002) including some of the founders of Freenet argue that in order for DRM/SDMI technology to achieve its objective of stamping out piracy, it will have to
place inordinate restrictions on the flow of *all* digital content on the web – since it will have to check every digital file crossing the net as a potential unauthorised copy of a digital music file. This imposition on the flow of digital content will entail costs for all internet users both in terms of facilitating the functioning of DRM technology and subsuming the inevitable time delays in transporting digital content across the web. In addition, it will entail a element of ‘Big Brother’ in that personal liberties (rights to privacy) will inevitably be intruded as the content of digital files are inspected for potential content of unauthorised copies of digital music files. These technologists argue that this is contrary to the spirit of liberalism underlying the internet.

If we accept the arguments put forward by the technologists and then link them to the underlying motivations for copyright law outlined above, we very quickly find that the case for valid copyrights for private use rests on very contentious economic welfare foundations. The economic right is a straightforward economic welfare calculation and if we bear in mind the following (1) that DRM will only partially prevent pirating of music files online (2), that it will entail significant transaction costs to be operational and (3) that it will reduce the welfare of both music and non-music consumers who use the web through infringement of privacy, then even at a conceptual level it is difficult to foresee how the enforcement of copyright in this particular market for music will enhance economic welfare i.e. be in the public interest⁴.

The point to take away here is that the impact of technology could undermine the case for copyright in the online albums/singles market, if not the government’s appetite to enforce it. If regulators take this view, then the resulting loss in revenues (as the free use of music by private online consumers cannibalises the offline singles/albums market) to the many firms who are involved in creating, developing, marketing and distributing music to

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⁴ If we then move to consider the moral rights implications, the infringement of civil liberties inherent in DRM causes the Lockean justification for moral rights to be conditional on not causing undue loss of other liberties such as the right to privacy - hence, significantly undermining the justification for copyright. In contrast, Kant’s argument provides a more stable justification for copyright in this environment but since his objective is one of preserving the reputation of authors, this itself is a non absolute premise for the existence of copyright. Thus, the economic implications of the technological changes seem likely to seriously weaken if not undermine some of the foundations for using government resources to enforce economic and moral copyrights in the online private consumer market.
consumers will cause them to seek revenues elsewhere. Thus, in a bid to preserve the 
ongoing creation and dissemination of new music, regulators will inevitably be drawn to 
consider means of generating more revenues for music from public performance and 
broadcast markets. We will return to this issue again later.

The second means through which the music industry has sought to fight off the revenue 
erosion has been through legal recourse. The Record Industry Association of America 
(RIAA) has led a series of initiatives which date back to law suits against music portals 
such as MP3.com, then to centralised peer to peer networks such as Napster and finally 
now onto the component parts (ISPs, universities and consumers) of decentralised peer to 
peer networks. The idea is to sue individual online music users through a series of 
lawsuits against private users, ISPs and universities. The idea becomes feasible because 
most peer to peer services cannot fully conceal the names of members. Similarly, ISP 
providers, universities and corporations generally know the names of users. The option 
to sue is facilitated because, as noted by Biddle et all (2002), most peer to peer networks 
source the vast bulk of their tracks from a minority of (super) peers i.e. users who are 
happy to leave their computer ‘open’ to uploading. These individuals can be targeted and 
hence, if successful deter others from providing this ‘charitable’ service – penalties in the 
USA are generally around the $150,000 per title but the RIAA has settled for less (in the 
tens of thousands of dollar bracket) with consumers who have admitted culpability and 
promised not to re-offend. From a game theoretic perspective, since most users of peer to 
peer networks act selfishly this provides a credible threat.

Biddle et al (2002), do not consider the economic dynamic but focus on the fact that as 
bandwidth increases it will become increasingly easier (less costly) for peer members to 
allow uploading. Hence, they argue, the difficulty in stamping out peer to peer networks 
could become insurmountable from a legal perspective. However, the conclusion is far 
from clear; especially if the ISP providers, universities, corporations and other 
telecommunication intermediaries find that even temporary caching becomes a crucial 
means of facilitating illegal downloading. Burke (1999) demonstrates that in these 
circumstances even temporary cached copies take on ‘economic significance’ as it is
understood in terms of the EU Copyright Directive and hence could be in breach of copyright law. If this is the case then since it would be very difficult for an uploaded track to make its way from peer to peer without going through one of these cache gateways, it might be possible for the industry to limit the use of the distribution power of peer to peer networks. Whether this can be achieved without the undue interference in personal liberty (as pointed out by Clarke et al 2002) in terms of monitoring every file that is cached could be the key stumbling point. Thus, we can conclude that the doomsday scenario where illegal online music availability becomes endemic and causes serious erosion to offline revenues through reduced CD sales and prices is a very real threat and already an active economic force.

In terms of our economic model, if this outcome occurs then it will cause a shift to the right of the iso-profit curves in figure 1 indicating a higher regulatory royalty rate for music. Since the album and singles markets comprise nearly all of the private music user market revenues it follows that the rise in $\beta^*$ is in fact confined to the $\beta_j ... \beta_n$ public consumer markets. In other words, commercial users of music such as retail outlets, bars, cinemas and television stations could face an increase in the price they pay for music. Regulators are likely to seek to maintain the financial incentive for composers and publishers by compensating for some of the loss of income from the CD market by supporting increased revenues from public users markets i.e. from commercial users.

**Influence II: A Productive Competitive Online Market for Music**

The online market for private music involves lower costs and far less importance for economies of scale than the offline equivalent. The manufacturing function is effectively removed, while distribution economies of scale are diminished to a level of peripheral economic concern. Marketing costs still prevail and this represents a significant economy of scale factor. The lower costs and reduced minimum efficient scale (MES) of the record company section of the supply chain are likely to promote a significant increase in entrants in this sector. As long as antitrust activity curtails anti-competitive

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5 The forgoing discussion of ‘influence II’ is a summary of the analysis outlined in Burke (2003) and the reader is directed there for a more in depth account.
activities between vertically integrated record companies and online retail portals, one can expect the record company segment of the market to become highly competitive. This increased competition will reduce the profits that one can expect from this sector. As a consequence they are likely to reduce the revenue flow to upstream providers such as composers and publishers who will no longer be able to negotiate lucrative record deals on the back of a monopolistic highly concentrated record industry. Price and margins will be tight in this environment as the multitude of record companies compete for market share and simultaneously will be incited to charge low prices in a bid to lure consumers away from online pirated sources of music. With the lack of revenues emanating from both online and offline private consumer albums markets (which as we noted above account for an average of 49% of their revenue over the period 1976-2002), composer, and publishers will either have an economic incentive to produce less music or seek to maintain their incentive to invest by securing higher revenues from broadcast and public performance markets – namely commercial buyers / public users of music. In cases where they raise their prices in these markets, regulators will inevitably take on board the reduced returns generated from private users of music and the extent to which they negatively affect the creation and development of new music. If revenues are viewed as being insufficient – a shift to the right of iso-profits curves - then correspondingly a range of commercial users will have to pay higher prices/royalties – especially those who are less likely to reduce their use of music following this price increase.  

**Influence III: A Destructive Competitive Online Market for Music.**

The advent of electronic distribution of music has reduced barriers to entry to the music industry. The sunk costs associated with marketing and manufacturing CDs for music that consumers may ultimately not want to buy constitutes a significant barrier to entry in the current offline market. If we also consider a scenario where liquidity constraints (Evans and

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6 This is especially likely in segments where blanket licences are applied. In these cases blanket licences allow music users to utilise as much music as they like for a fixed fee. As long as a rise in the price of music is below the music buyer’s reservation price the rise in the price of the blanket licence will not cause a fall in the use of music. Likewise, in cases where performing right organisations can negotiate on an individual basis with each consumer (i.e. a small number of large buyers) a similar outcome is likely.
Jovanovic, 1989, Burke, FitzRoy and Nolan 2000) can influence firm entry, then the high financial costs associated with marketing and manufacturing will also pose a significant impediment to entry for new artists. Since the online market reduces both the total cost and economies of scale inherent in both of these inputs, it thereby reduces barriers to entry. Hence one might expect a greater number of composers choosing to enter the industry as the probability that even low quality music has a good chance of being commercialised is increased. This likelihood is increased by the proliferation of record companies stimulated by reductions in barriers to entry and MES in the online market. It is normally assumed that an increased supply of artists would be a positive feature in terms of its impact on economic welfare – increased price competition and more varieties on offer to consumers. However, what we consider here are the circumstances that can actually cause the increased supply of artists to reduce economic welfare - specifically, to cause an increase in prices and a reduction the supply of varieties of music which consumers might actually want to hear.

Thus, in the appendix we outline a model where uncertainty plays a role, namely the case where publishers do not know the quality (as judged by consumers i.e. commercial appeal) of composers’ music in advance of investing in their creative efforts. In fact, this characteristic is central to the real business world challenge faced by publishers. Therefore, we believe that the model is more than just a theoretic curiosity but highlights active forces which one might expect to be in play in the emerging online market for music. The logic behind the results simply indicates that whether an increased supply of composers is a good or bad thing depends on their quality. If the increase in supply is dominated by low quality composers then it can actually reduce the probability that a publisher is investing in commercially viable repertoire when signing a composer. In turn, this reduces the rate of return on investment for a publisher. The impact of this is a reduction in the amount of investment undertaken by publishers and an increase in the price they charge to downstream users in public and private user markets. In a sense the bad composers push (or crowd) the good composers out of the market. If, on the other hand, the increase in the supply of composers is predominantly of the higher quality variety then publishers have an increased probability of signing a commercially viable artist with corresponding positive effects on return on investment. In this case welfare is enhanced as consumers are exposed to
increased supply of music compositions and at lower prices. Thus, in this setting it appears that the whether the diffusion of the online market for music results in a positive or negative impact on regulatory prices will depend a great deal on the quality of new composers entering the market. If one takes the view that on average higher quality artists, who can expect to make higher incomes, have a greater incentive to attempt to enter despite barriers to entry, then it follows that if barriers to entry fall then the remaining stock of potential entrants will have a higher proportion of low quality composers. Thus, an inflow of lower quality composers increases the risk of a publisher wasting investment in the R&D of non commercially viable music. In sum, this is the necessary condition for the higher regulatory price result to occur.

**Simulations.**

We now combine the analyses of sections 1-3 in order conduct some simulations of possible effects on regulatory justifiable prices in markets for music. In the previous section we outlined three scenarios where royalty income from private music users could decline quite dramatically. Bearing in mind that these scenarios are not mutually exclusive it follows that simultaneous occurrence could have devastating effects on revenues in private markets for music. In the extreme it may even be worth considering a case where public user markets for music are the only ones where it is feasible to generate revenue. We can apply these scenarios to the model of regulatory pricing carried out in section 2 in order to ascertain how prices might change in public user markets. We provide three simulations of the impact on regulatory price in public user markets of declines in private market revenues equivalent to a fall of 10%, 30%, 60% and 90% in CD market revenues. We provide simulations for changes in regulatory prices in 6 public user markets including public service TV broadcasting (the BBC), cinemas, classical concerts, niteclubs, hairdressers and live performances. These markets are chosen merely because the PRS tariff structures for these licences are more straightforward than many of the other public music user markets. Most of the PRS tariffs are multi-part contracts which have extensive degrees of price variation within licensing pool groups. Frequently, discounts are awarded to smaller outlets or consumers using radio instead of a CD player etc. Thus, we decided to hone in on more simple tariff structures which allow us to extract a reasonably accurate representative single
royalty rate/price to use in the simulations. In making adjustments in these prices/rates to reflect regulatory practice we use the partial regulation optimal tariff charged to consumers which is based on equations 3 and 5 in section 2.

The simulations are carried out for the most recent year for which we have data which is 2002. It is notable that over the sample period this is the year in which private user markets accounts for the lowest share of composer/publisher royalty income – comprising 41% compared to a mean of 49% (and a maximum of 72%). Thus, in terms of reductions in private market revenue causing a rise in regulatory rates/prices in public user markets, this simulation will derive the smallest rise in these tariffs. The fact that we show that widespread use of partial price regulation by regulatory authorities would lead to a very dramatic rise in royalty rates/prices in public user markets for 2002 gives an indication of the economic importance of the likely demise of the offline record industry.

Table 2 indicates that a 10%, 30%, 60% and 90% fall in revenues in private user markets in the UK would need to be matched by increases in PRS revenues of £10.08m, £30.25m, £60.50m and £90.75m respectively. With a total PRS UK net revenue of £146m in 2002 these represent increases in PRS UK revenue in a range of 7% to 62%. The issue of course is how these increases are spread across the different public user market pools. On a fairness criteria one might expect a regulator to try to spread these increases evenly across PRS licensing pools with due regard for negative effects on the demand for music i.e. trying to minimise a reduction in music use as a result of higher tariff rates.

However, as we know regulators have never attempted to set/affect prices in all markets simultaneously which is exactly what this would need to entail. If in contrast regulators continue with past practice and continue to regulate markets on a case by case basis then partial price regulation is used instead. In other words, regulators take income in all other markets for music as given and then attempt to set a welfare maximising price in the markets in which it has control. If this occurs then the burden of making up for shortfalls in royalty income falls on the markets which are being regulated first.
In table 2 we highlight how extreme the resulting regulatory price increases can be as a result of partial price regulation. The simulations assume perfect price inelasticity for ease of exposition (with the effect of showing the highest possible price increases) but it is worth pointing out that with blanket licences this assumption may in fact hold for many markets which need music as a fundamental input to business (e.g. niteclubs, live performance, radio etc). In the case of television, if the shortfall was secured entirely from licence fee income from public service television one would see increases in the BBC tariff in the range 29%-258%. In terms of cinemas, the licence fee which is based on a percentage of box office (excluding confectionery and advertising revenue) revenue would stand to rise from 1% to a possible range of 1.8% - 15.9%. Niteclubs could find themselves paying up to £1.60 per customer as opposed to the current rate of £0.07 per customer. Of course, it is very clear that partial price regulation could not impose some of these price increases due to price elasticity of demand constraints. For example, hairdressers who currently pay an average rate of £56 per outlet per annum could find the price rising within the range £472 - £4242 and it seems likely that if the price increase was at the upper end of this range that too many hairdressers would decide not play music on their premises at all. In a similar fashion, the simulations show that the classical music performance market is not big enough to make up for shortfalls of revenue in private music user markets - even if the tariff was set at 100% of revenue.

(Table 2 near here)

The simulations give an indication of the potential severity of how a regulator might impose a redistribution of the burden of who pays for new music creation. It is clear that commercial users who over the sample period accounted for roughly half of composer/publisher royalties look destined to pay a significantly greater amount. However, it is also the case that partial price regulation is likely to be a very unfair and undesirable means of achieving the welfare objectives of copyright law. As we note in the simulations above, it leaves too much potential for a single public user group to end up paying a disproportionate share - resulting in excessive reductions in the use of music. The simulations indicate that these undesirable features of partial price regulation are not
trivial. Therefore, they indicate that regulators may need to consider a style of regulatory practice not frequently used in the past, namely using simultaneous price regulation. In other words, regulators ought to examine the feasibility of regulating a large number of public user music markets simultaneously in order to spread the costs more evenly across consumer groups and hence minimise reductions in music use resulting from higher tariff rates.

It is also the case that regulators may have to look at the supply side to attempt to ascertain optimal revenue pools for composers/publishers in terms of deriving optimal levels of new music creations. This is no mean feat especially in light of the fact that authors such as Salop (1976) and Dasgupta and Stiglitz (1980) have shown that more competition between innovators (in this case, composers/publishers) may in fact lead to an excessive supply of innovations (in this case, new music). Therefore, in terms of identifying optimal regulatory prices, it is not just a simple matter of ascertaining whether or not composer and publisher markets are competitive. In section 2 we addressed part of this question by highlighting how a regulator could improve welfare by influencing the royalty rate negotiated between composers and publishers. However, the wider issue of optimal supply and whether governments should attempt to estimate the optimal royalty rate from a supply perspective, is beyond the scope of this paper but a necessary area for further research. Given this observation, we need to put the empirical part of our analysis in context. Therefore, we state that the partial regulatory prices outlined in the simulations relate to a scenario where one attempts to maintain the current rewards enjoyed by publishers and composers. The argument which holds that this level of reward should be maintained can be based on the fact that these markets are highly competitive and that the cost reductions stemming from the diffusion of online music markets do not provide savings for the inputs to the music supply chain provided by composers and publishers. Thus, these groupings are likely to face lower revenues in the

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7 In other words, while the online market lowers the cost of manufacturing and distributing records/CDs, it does not reduce the time spent writing, rehearsing and recording a musical composition. In view of the fact that the expected profits from any new musical work in the online albums/singles markets will be a fraction of that generated in recent years in the offline CD based equivalent market, it follows that there is a greatly reduced financial incentive to invest time and money in the creation, development and recording of new musical compositions. Thus, if current revenues in the remaining markets for musical works (i.e. public
face of unchanged costs. The model in the appendix shows that these groups may also face higher risks. Thus, in these circumstances we feel that our empirical analysis is likely to be in the ‘ballpark’ of levels of financial adjustments in regulatory prices that regulators will need to consider.

Conclusions.
In the paper we examined the impact of electronic distribution of music on price regulation of composer/publisher copyright royalties. In order to do this we had to draw from the economics, legal and technology literature. The paper makes three contributions relating to regulatory theory of price regulation of copyrights, empirical analysis of price regulation in the music industry and highlighting a need to re-examine the extensive use of partial price regulation – with consideration of a greater use of simultaneous price regulation. The analysis indicates that the advent of the online market for music poses a threat of significant reduced revenues, higher risks and potentially unchanged costs for composers and publishers. We estimate that this reduction in revenue is confined to private music user markets, which have accounted for an average of 49% of composer/publisher royalty income in the UK over the period 1976-2002. We outlined a model of partial price regulation in the music industry, which shows that a reduction in revenues in one set of markets for music tends to push up regulatory prices in other markets for music. We used this model to produce simulations of how a fall in revenues in private music user markets would tend to cause an increase in prices paid by commercial music users. We estimated that commercial users could face price increases in a distribution range of 6% - 63% depending on the scale of the demise in revenues in private music user markets. However, we showed that the use of partial price regulation implies that in any individual market these prices increases could be much greater. For example, the tariff paid by the BBC could increase by as much as 258%, while niteclubs could face a price increase by a multiple of 22 - equivalent to a rise in the price of music per customer from £0.07 to £1.60.

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performance and broadcast markets) remain fixed, then there is likely to be a reduction in the supply of new music works – particularly musical works that are judged by consumers to be high quality.
The scale of the price increases are associated with a seismic shift in the music industry, from an era where private consumers are the biggest single market for music to a scenario where they may even pay nothing at all. In effect, the industry looks destined to be funded almost entirely from commercial music users. Regulators will play a major role in this process and are likely to be more active than at any previous time – given vested and conflicting financial interests of composers/publishers and commercial users of music. The scale of the shift of the financial burden from private to commercial users of music implies that regulators will need to re-examine their almost exclusive use of partial price regulation. They will need to consider other forms of price regulations such as simultaneous price regulation and have a greater emphasis on dynamic supply side effects.

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Appendix: The impact of electronic distribution on the supply of composers.

We seek to assess the impact of an increase in the supply of composers - stimulated by reduced costs in commercialising music as result the movement of the music industry from the offline/manufactured to the online/virtual environment - on the expected profits of publishers and ultimately the price that a publisher charges to downstream music users. We will also show how it affects the income of composers. We assume that the fixed/R&D composer/publisher costs of producing new music compositions such as composers’ wages, equipment, rehearsal studios, recording costs and session musicians are unaffected by the arrival of the online market – which mainly affects cost inputs further down the supply chain such as a reduction distribution and manufacturing costs. Downstream users can be both commercial buyers in public music use markets or indeed private users. For simplicity and without loss of generality in terms of our interest in general industry level effects, we use simple a monopoly/monopsony model. We assume that industry demand for music supplied by publishers is linear and defined

\[ p = a - bq \quad a, b > 0 \]  \hspace{1cm} (A.1)

where \( p \) is price and \( q \) is the quantity of music titles supplied by publishers. The publisher is assumed to face a composer supply, \( n \), comprised the pre-existing labour supply \( wf \) and the increase in labour due to technological change \( Q \).

\[ n = Q + wf \quad Q, f > 0 \]  \hspace{1cm} (A.2)

where \( w \) is the value of a publishing deal. For simplicity, initially we will assume that composer productivity is homogenous within each of the \( Q \) and \( wf \) groups, but not necessarily between them. It is then possible to identify the impact of an increase in the supply of composers due to technological change through a comparison of the three possible regimes: (1) \( Q \) and \( wf \) workers are equally productive, (2) \( Q \) are unproductive while \( wf \) are productive, and (3) \( Q \) are productive while \( wf \) are unproductive. As the last case is trivial,
we only examine the first two cases. We define the publisher’s production function of new music as

\[ q = zQ + wf \quad z \in [0,1] \quad (A.3) \]

We initially focus on the two extreme cases of \( z \) equal to unity and zero respectively. With these boundary regimes defined it is then simple to identify outcomes for intermediary values of \( z \). We assume that publisher pays productive composers \( w \) and unproductive workers \( xw \) where \( x \in [0,1] \). This assumption merely implies that if a publisher signs a composer who turns out to be unproductive (from a commercialisation perspective) then this entails a cost to the publisher proportional to the publishing fee paid to productive composers. This cost is less than the fee paid to productive composers because publishers can drop unproductive composers once they have evaluated their marginal revenue product. In practice, the value of ‘\( x \)’ will depend on the efficiency of monitoring composer productivity and transaction costs associated with the termination of a publishing contract. We also assume that publishers do not know each composer’s productivity but do know the probability, \( g \), of hiring a productive composer.

\[ g = 1 \quad \text{; when } z = 1 \]

\[ g = \frac{wf}{Q + wf} < 0 \quad \text{; when } z = 0 \quad (A.4) \]

**Case 1: New composers are all productive**

In this case the increase in supply of composers leads to an increase in the supply of productive composers in the artist labour market by amount \( Q \). Here \( z \), and hence \( g \) are unity so that the profit function is defined as

\[ \pi = an - bn^2 - wn \quad (A.5) \]

Solving (A.5) for optimal \( w^* \) yields
\[ w^* = \frac{af - Q - 2bQf}{2(f + bf^2)} \]  \hspace{1cm} (A.6)

Therefore, optimal output becomes

\[ q^* = \frac{af + Q}{2(1 + bf)} \]  \hspace{1cm} (A.7)

hence equilibrium price is

\[ p^* = \frac{2a + abf - bQ}{2(1 + bf)} \]  \hspace{1cm} (A.8)

and equilibrium publisher profits become

\[ \pi^* = \frac{(af + Q)^2}{4(f + bf^2)} \]  \hspace{1cm} (A.9)

Thus, we observe the expected result where an increase in the composer supply by amount \( Q \), reduces the value of a composer's publishing deal, increases output and reduces the price charged by publishers to downstream users.

**Case 2: New composers are all unproductive**

In this scenario \( z \) is zero and \( g \) is non-negative and less than unity. A publisher's profit function is defined

\[ \pi = (p - w)gn - (1 - g)xwn \]  \hspace{1cm} (A.10)

Substituting (A.1), (A.2), (A.3) and (A.4) into (A.10) gives

\[ \pi = awf - bw^2 f^2 - w^2 f - xwQ \]

Solving (A.10) for optimal \( w^* \) yields
\[ w^{**} = \frac{af - xQ}{2(f + bf^2)} \quad (A.11) \]

Substituting \((A.11)\) into \((A.3)\) gives optimal output \(q^{**}\)

\[ q^{**} = \frac{af - xQ}{2(1 + bf)} \quad (A.12) \]

hence equilibrium price \(p^{**}\) becomes

\[ p^{**} = \frac{2a + abf + bxQ}{2(1 + bf)} \quad (A.13) \]

and equilibrium publisher profits become

\[ \pi^{**} = \frac{(Qx - af)^2}{4(f + bf^2)} \quad (A.14) \]

In contrast to the case where all new composers are productive, we now observe an increase in composer supply causing the supply of newly published music supply to fall and prices to rise. Note, however, that the value of publishing deals falls in both cases but through its effect on revenue it decreases at a faster rate when the new \(Q\) composers are productive. Also note that in case 1 a rise in \(Q\) is associated with a permanent increase in the number of composers who have publishing deals. In case 2, through \(w^{**}\) a rise in \(Q\) has the effect of pushing productive composers out of the market. Thus, crowding out and Gresham’s Law effects occur where the new bad quality (as judged by consumers) composers push the existing good quality composers out of the market. In addition it will increase the level of composer turnover in music publishing companies.

\[ \frac{\partial n^{**}}{\partial Q} = 1 - \frac{xf}{2(f + bf^2)} > 0 \quad (A.15) \]

In figures 1, 2, and 3 we plot the equilibrium publishing deal value, new music supplied by publishers and its price loci for cases 1 and 2 respectively. The diagrams allow us to inspect the effect of having a greater number of unproductive composers among the increase in composer supply, \(Q\), due to technological change. A movement from case 1 towards case 2
is represented by a swivelling of the relevant equilibrium schedule in the diagrams. Therefore, as $z$ increases above zero, causing a greater proportion of the supply of new composers to be unproductive, equilibrium value of publishing deals, price of music sold by publishers and publisher music supply are all scalar multiples of the case 1 locus. Thus, for any given value of $Q$, say $Q_1$, a decrease in the productivity of new composers pushes up the value of publishing deals, reduces the supply of new music and increases the price of music.
<table>
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<th>Composer/ Publisher Royalties from Performance and Broadcasting Markets: £m</th>
<th>Composer/ Publisher CD/Record Royalties as a percentage of All Royalties.</th>
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<td>124.52</td>
<td>38.89</td>
</tr>
<tr>
<td>1992</td>
<td>58.86</td>
<td>66.93</td>
<td>46.79</td>
<td>125.79</td>
<td>37.52</td>
</tr>
<tr>
<td>1993</td>
<td>66.79</td>
<td>74.29</td>
<td>47.34</td>
<td>141.08</td>
<td>40.86</td>
</tr>
<tr>
<td>1994</td>
<td>77.99</td>
<td>80.17</td>
<td>49.31</td>
<td>158.16</td>
<td>44.78</td>
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<tr>
<td>1995</td>
<td>86.33</td>
<td>88.80</td>
<td>49.30</td>
<td>175.13</td>
<td>48.18</td>
</tr>
<tr>
<td>1996</td>
<td>91.56</td>
<td>97.25</td>
<td>48.49</td>
<td>188.81</td>
<td>50.43</td>
</tr>
<tr>
<td>1997</td>
<td>90.04</td>
<td>109.08</td>
<td>45.22</td>
<td>199.12</td>
<td>51.74</td>
</tr>
<tr>
<td>1998</td>
<td>95.28</td>
<td>119.85</td>
<td>44.29</td>
<td>215.13</td>
<td>54.48</td>
</tr>
<tr>
<td>1999</td>
<td>96.35</td>
<td>124.98</td>
<td>43.53</td>
<td>221.33</td>
<td>54.79</td>
</tr>
<tr>
<td>2000</td>
<td>99.49</td>
<td>134.05</td>
<td>42.60</td>
<td>236.54</td>
<td>56.63</td>
</tr>
<tr>
<td>2001</td>
<td>104.72</td>
<td>143.07</td>
<td>42.26</td>
<td>247.79</td>
<td>58.85</td>
</tr>
<tr>
<td>2002</td>
<td>100.83</td>
<td>146.46</td>
<td>40.77</td>
<td>247.29</td>
<td>57.46</td>
</tr>
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</table>

Sources: the data are derived from BPI yearbooks and PRS annual accounts
Table 2: Simulations of decline in private music market revenues on partial price regulatory prices in public music user markets.

<table>
<thead>
<tr>
<th></th>
<th>2002 Revenue</th>
<th>2002 Revenue Tariff or price</th>
<th>Adjusted tariff for: 10% decline in CD sales: -£10.08m</th>
<th>Adjusted tariff for: 30% decline in CD Sales -£30.25m</th>
<th>Adjusted tariff for: 60% decline in CD sales -£60.50m</th>
<th>Equivalent tariff: 90% decline in CD sales -£90.75m</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Performance and Broadcast</td>
<td>£146.46m</td>
<td>£156.5m</td>
<td>£176.71m</td>
<td>£206.96m</td>
<td>£237.21m</td>
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<tr>
<td>Broadcast Licences</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>BBC</td>
<td>£35.12</td>
<td>% revenue plus other</td>
<td>£45.20m</td>
<td>£75.45m</td>
<td>£105.70m</td>
<td>£135.75m</td>
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<td>Performance Licences:</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Cinemas</td>
<td>£5.7m</td>
<td>1%*</td>
<td>1.8%</td>
<td>5.3%</td>
<td>10.6%</td>
<td>15.9%</td>
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<tr>
<td>Classical concerts</td>
<td>£1.7m</td>
<td>3.25%**</td>
<td>19.3%</td>
<td>57.8%</td>
<td>(115.7%)</td>
<td>(173.3%)</td>
</tr>
<tr>
<td>Discos / Niteclubs</td>
<td>£3.5m</td>
<td>£69.31 per 1000 clients</td>
<td>£179.19</td>
<td>£537.58</td>
<td>£1075.16</td>
<td>£1612.74</td>
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<tr>
<td>Hairdressers</td>
<td>£1.2m</td>
<td>£56.10 per outlet***</td>
<td>£471.38</td>
<td>£1414.14</td>
<td>£2828.28</td>
<td>£4242.42</td>
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<tr>
<td>Live gigs</td>
<td>£8.0m</td>
<td>3%*</td>
<td>3.8%</td>
<td>11.3%</td>
<td>22.7%</td>
<td>34.0%</td>
</tr>
</tbody>
</table>

* ignores minimum charges and discounts.
** based on the average tariff for PRS repertoire accounting for between 30-49% of musical repertoire
*** based on the fee for the vast majority of outlets who use a radio or TV and have less than 30 chairs of those who use a CD player and have up to 5 chairs.
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