The Impact of Music Downloads and P2P File-Sharing on the Purchase of Music: A Study for Industry Canada

by

Birgitte Andersen* and Marion Frenz**

Department of Management
Birkbeck, University of London
Malet Street, Bloomsbury
LONDON WC1E 7HX, England, UK

*Reader in the Economics and Management of Innovation, and
Director of E-Business Programmes
Tel: +44 (0)20 7631 6848
b.andersen@bbk.ac.uk

** Lecturer in Management
Tel: +44 (0)20 7631 6829
m.frenz@bbk.ac.uk

Table of contents

Abstract

The primary objective of this paper is to determine how the downloading of music files through Internet peer-to-peer (P2P) networks influences music purchasing in Canada. P2P networks permit members to transfer digitally-stored information to one another over the Internet; popular examples include BearShare, LimeWire and eMule. Using representative survey data from the Canadian population collected by Decima Research on behalf of Industry Canada, we attempt to quantify this economic relationship, while accounting for other factors that influence music purchasing. We undertake a variety of econometric estimations for the population of Canadians who engage in P2P file-sharing (P2P "downloaders"), as well as for the whole Canadian population. To our knowledge, this is the first study on P2P file-sharing that analyzes original and representative microeconomic survey data from the Canadian population. Few previous studies have analyzed representative microeconomic data, for Canada or any other country.

The existing literature identifies two competing effects associated with the P2P music file-sharing: the sampling and substitution effects. The sampling effect is characterized both by individuals downloading music in order to listen to it before buying it as well as by individuals downloading music that is not available in stores, while the substitution effect is characterized by individuals downloading music instead of purchasing it. In this paper, we further disentangle the sampling effect by adding a market segmentation effect, characterized by individuals engaging in P2P file-sharing because they do not want to purchase the entire bundle of songs on a CD.

Our review of existing econometric studies suggests that P2P file-sharing tends to decrease music purchasing. However, we find the opposite, namely that P2P file-sharing tends to increase rather than decrease music purchasing.

Among Canadians who engage in P2P file-sharing, our results suggest that for every 12 P2P downloaded songs, music purchases increase by 0.44 CDs. That is, downloading the equivalent of approximately one CD increases purchasing by about half of a CD. We are unable to find evidence of any relationship between P2P file-sharing and purchases of electronically-delivered music tracks (e.g., songs from iTunes). With respect to the other effects, roughly half of all P2P tracks were downloaded because individuals wanted to hear songs before buying them or because they wanted to avoid purchasing the whole bundle of songs on the associated CDs and roughly one quarter were downloaded because they were not available for purchase. Our results indicate that only the effect capturing songs downloaded because they were not available for purchase influenced music purchasing, a 1 percent increase in such downloads being associated with nearly a 4 percent increase in CD purchases.

We find evidence that purchases of other forms of entertainment such as cinema and concert tickets, and video games tend to increase with music purchases. It has been argued in the literature that the increase in the number of entertainment substitutes has led to a decline in music purchasing, but our results do not support this hypothesis. As expected, we find that reported interest in music is very strongly associated with music purchases. Finally, our results suggest that household income is not important in explaining music purchases.

1. Introduction

The technological revolution in information and communication technologies (ICT) and micro-electronics, including the emergence of a digital technological paradigm, has changed the economic status of creative expressions, such as music.

The economic status of music changes once it can be separated from the tangible object (for example, paper-sheet, magnetic tape, LP, CD) or person or location (for example performance venue) in which it is originally fixed. Technological change in printing, sound and play-back equipment, recording, broadcasting, television, the Internet and the invention of compressed digital formats such as the MP3 have facilitated such separation. Thus, the consumption of music is no longer limited by time and place of production.

When such separation occurs, the opportunities for increasing profits emerging from reproduction become the focus of business strategies. In such cases, profits become much more closely tied to the organization and management of copyrights (music royalties) in copyright-based markets (Andersen, Kozul-Wright and Kozul-Wright 2007). Assessing the economic nature of intangibles themselves, it can be claimed that creative expressions and other associated intangible knowledge-based assets are taking on a greater market scope in today's globalizing world (Rivera-Batiz and Romer 1991, Varian 2000). Music has some of the qualities of a public good since it can be consumed or enjoyed jointly; its value does not diminish by use; it incurs significant fixed costs in development; and, it can be reproduced very cheaply (this characteristic is usually referred to as the 'non-rival' aspect of a public good). But, unlike a public good, it is possible for the creator of an expression to exclude others from using it by using a copyright, and, thereby, opening the possibility for wider commercial exploitation.

However, it is here that technological change not only enables possibilities for profit and the creation of a sustainable industry, but also challenges and sometimes even undermines this economic status of the musical expression (Gallaway and Kinnear 2001, Romer 2002). When music is provided as a service through a live performance, the problems of joint consumption and (imperfect) excludability are reasonably easy to manage. The market is restricted and the market-control on the creative expression is reasonably secure.

Problems occur when music more easily acquires the properties of a non-rival public good/product via the evolution of (i) new sound and picture recording and playing technologies (for example, magnetic tapes, LPs, CDs, high fidelity stereos, video, digital audio technology), as well as (ii) new broadcasting and public performance techniques (for example, radio, television, cable, satellite, Internet). This opens up the possibility for widespread unauthorized copying. The low cost of (re)producing an intangible expression such as music in the *digital MP3 age* means that its market can be uncertain and fragile, quickly undermined by copying and downloading. This makes any investment in activities that rely heavily on intangible expressions and other intangible assets inherently risky (Landes and Posner 1989). This is particularly apparent with cultural products, such as a music sound recording or a film, where the investments made in establishing and promoting an artist are very specific and where

short product cycles mean profitability relies on explosive but ephemeral market growth.

Some countries have strengthened copyright legislation and enforcement policies in response to the changing information environment. However, the extent to which P2P file-sharing and music downloading activities displace/substitute or increase/stimulate music purchasing is uncertain.

Objective and outline of paper

The primary objective of this paper is to determine what influence P2P file-sharing and music downloading activities have on the purchasing of CDs and paid electronically-delivered music, based on quantitative analysis of representative survey data from the Canadian population.[1] The focus is in particular on whether such downloading and P2P file-sharing displaces (substitutes) or increases/stimulates music purchases. P2P file-sharing is a phenomenon characterized by the exchange of digital information between two members of a network connected via the Internet; any digitally stored information can be exchanged via P2P networks, but this paper is concerned only with the exchange of music files.[2] Music downloading activities are here considered distinctly from the sharing of music files through P2P networks; for example, downloading music free of charge from promotional websites or from non-commercial websites is treated in this paper as music downloading.

The analyses aim to assess the behavioural patterns associated with music consumption, as well as the motivations behind such behaviour. It is difficult to precisely capture the magnitude of a possible displacement/stimulus of music purchases resultant from P2P file-sharing. Underlying processes are dynamic and evolving rapidly over time. This paper attempts to provide insights into the dynamics of how P2P file-sharing and music downloading affect music purchasing.

The paper analyzes Canadian survey data[3] and results are representative of the Canadian population aged 15 and older. To our knowledge, this is the first empirical study to employ representative microeconomic data. Most previous studies examining the impact of P2P file-sharing on music purchasing/sales have employed macroeconomic (i.e. aggregated) data.

---

[1] In this paper, the terms "paid electronically-delivered music" and "paid electronically-delivered tracks" refer exclusively to music purchased from an Internet pay-site, delivered over the Internet and not packaged as a physical good. The largest and most popular supplier of paid electronically-delivered music tracks in Canada is iTunes, which supplies music in a proprietary format distinct from the MP3 format.

[2] Popular P2P protocols include Gnutella and BitTorrent.

[3] Research material feeding into this paper:
- Birgitte Andersen initially provided Industry Canada with the questionnaire developed for the survey. The final version was shaped in accordance with the recommendations by Industry Canada and Decima Research, and in accordance with the results of the pilot survey conducted by Decima Research.
- Birgitte Andersen developed the Methodology Report underpinning the design for the subsequent data analysis.
- Decima Research conducted 2,100 telephone interviews with Canadian households, and provided the raw data.
- Industry Canada prepared the survey database.

The paper is organized in the following way. Section 2 of this paper reviews the theoretical and empirical literature and develops the relevant hypotheses. Section 3 introduces the survey data and variables to test the hypotheses developed in Section 2. In this section we also introduce the estimation models used to test the hypotheses and discuss their relative strengths vis-à-vis alternative techniques. Section 4 discusses the results of the estimations in the context of the hypotheses developed in Section 2. The paper concludes in Section 5.

2. Hypotheses: theoretical focus and empirical review

When estimating the effects of music downloading and P2P file-sharing on music purchases there are many influences that ought to be taken into account. Demand theory provides an appropriate framework for investigation. The variables in this framework address some key concepts related to our analysis. As highlighted in economic textbooks (e.g. Begg, Fischer and Dornbusch 1994, chapter 3) the demand for a particular good is directly related to four key concepts: *(i) price of the good, (ii) price of related goods (whether substitutes or complements), (iii) consumer income, and (iv) consumer taste.*

This section aims to integrate these four determinants into the design of our analysis. The discussion is supported by the literature on P2P file sharing behaviour, adding to the design and arguments in this paper. We also identify and make a case for taking into account determinants in addition to those identified above. These include the role of demographic factors such as Internet skills, age, gender, occupation and education.

The determinants of demand

In this section, we introduce several hypotheses about the determinants of music consumption. We discuss the impact of prices, income and taste in music.

When measuring the direct effect of the price of music on CD consumption some hypotheses can be developed, based upon theoretical economic assumptions. The relationship between the price of goods and the demand for goods is well established within the economic literature (e.g., Begg, Fischer and Dornbusch, 1994). Therefore, our Hypothesis 1 states:

H1.   The price of CD albums is negatively associated with CD purchases. Likewise, the price of paid electronically-delivered music is negatively associated with purchases.

However, Liebowitz (2004) illustrated that prices for CD albums have been almost constant over a 30-year period (1973-2002) suggesting that changes in record sales would seem to be, of statistical necessity, due to other factors.

We also have to consider the price of related goods, whether they are substitutes or complements.

H2a.   There is a positive relationship between the price of CDs and (i) purchases of electronically-delivered music, as well as (ii) music downloading activities and P2P file-sharing.

This hypothesis can be tested in several ways.

'Cross-price elasticity':

- It can be tested if an increase in CD price will increase purchasing of paid electronically-delivered music tracks.

'Album too expensive':

- Individuals may engage in music downloading or P2P file-sharing if they feel that the price of purchased music is too high. Respondents who engaged in P2P file-sharing were asked about their motivations for doing so.

The substitution effect

The substitution effect occurs when the downloaded copy directly substitutes for the purchased original (Liebowitz, 2005b). Important issues regarding perfect substitution include whether (i) the quality of music between the original and the substituted copy is the same, (ii) the information attached to the original and the downloaded file is the same, and (iii) the ability to listen to the downloaded file should be available in as many locations as the original.

In general, some substitution is expected since the marginal cost of P2P file-sharing is essentially zero. It can be tested whether there is a negative association between P2P file-sharing or music downloading and music purchasing.

This direct substitution effect is due to the unwillingness to pay for authorized copies. Liebowitz (2004, 2005b) argued that P2P file-sharing decreased music CD sales by 20-25%. He also states that file-sharing is the cause of the entire decline in record sales that has occurred and also appears to have vitiated what otherwise would have been a fairly robust growth in the industry.

Such evidence is supported by Zentner (2004), who analyzed survey data from 15,000 European respondents and found that file-sharing may reduce the probability of music purchases by up to 30%. Sundararajan (2004) argues that the free alternatives are attractive, so we need a new pricing schedule enforced by digital rights management. Evidence from Rob and Waldfogel (2004) in an analysis of 500 US college students suggests that each downloaded album reduces music purchases by 0.2. Finally, using data from the Global Market Information Data base (CMID), Hui (2003) finds that the demand for CDs decreases with (physical) CD piracy. He finds that each pirated album reduces music purchases by 0.42, and he suggests that such 'theft' outweighs the possible positive effects of CD piracy and that the music industry has lost up to 6.6% of its revenues to piracy, although this is much lower than the industry estimates which he also refers to.

In an analysis of 200 US college students, Gopal, Bhattacharjee and Sanders (2006) found a strong positive association between downloading from free MP3 sites and the intention to subsequently purchase those same songs as part of a CD or as electronically-delivered music tracks. They refer to a sampling effect of 'awareness and increased popularity' as sampling provides exposure to unknown artists. Thus, they argue that free sampling may have major benefits for the music industry, provided that their works are offered for purchase on-line. That is, although Gopal, Bhattacharjee and Sanders (2006) recognize that P2P file-sharing may sometimes lead to reduced music purchasing, they suggest that the phenomenon is a complex one. Their views resemble those of Blackburn (2004), who used microeconomic data from 14,000 US retail outlets to analyze the effect of file-sharing on CD sales.

Blackburn distinguishes between two separate effects, the *substitution effect (*where some consumers may substitute free music downloads for purchases) and the *penetration effect* (where increased exposure through P2P file-sharing leads to increased purchasing of those works). The substitution effect is found to be strongest for well-known artists, while the penetration effect is strongest for the unknown artists. The overall negative impact of file-sharing is mainly due to the fact that the industry is dominated by a few well-known artists. Consequently, P2P file-sharing not only provides exposure for some new artists, but also results in some income redistribution within the music industry. For this reason, many superstars oppose P2P file-sharing.

Bounie (2005) separates the P2P file-sharing population into two groups: "explorers" who discover new music and increase their CD purchasing, and "pirates" who substitute P2P downloads for CD purchases. Furthermore, Madden (2004) also confirms in a report on the *Pew Internet & American Life Project* that artists are divided with regard to their view on whether the Internet has made it possible for them to make more money from their work, or whether it has made it harder to protect their work from piracy and unlawful use. Still, many of the artists do not view the Internet and file-sharing as a great threat. 52% of all artists and 55% of all paid artists believe that it should be legal for Internet users to share unauthorized copies of music and movies over P2P file-sharing networks, compared to 37% of all artists and 35% of all paid artists who say it should be illegal.

However, in his analysis of CD sales and P2P file-sharing data from Japan, Tanaka (2004) shows that there is little evidence that file-sharing reduces CD sales.

The following hypothesis can be tested in this context:

H2b.   *People who engage in music downloading and P2P file-sharing do so partly because they wish to hear a soundtrack or an artist before buying. Thus, there is a positive relationship between P2P file-sharing and music purchasing.*

Liebowitz (2005b) attacks the possibility of a positive P2P sampling effect by arguing that although consumers may learn more about the music and make superior choices, record companies are not necessarily better off. Liebowitz sees two opposite effects of sampling, which are both about 'tolerance':

- Free music exploration online may increase demand for music purchases: basically when you have found what you like you want more, i.e. the music consumption (or tolerance) is not yet saturated.
- Free music exploration online may decrease music purchases: when you have explored and found the music you like, the exploration phase has surpassed your tolerance to music. You will move on to things other than music (Liebowitz 2005). Liebowitz draws the analogy to beer or wine tasting. When you are done with such tasting activities you may be full and do not want any more.

Liebowitz found that people generally belong to the latter category which decreases music sales, as highlighted in the above section on the 'substitution effect' between free music downloads and CD purchases.

A survey of 2,002 Canadian respondents conducted by Decima Research (2005) investigated the means by which new music is discovered. The results showed that radio is by far the most important medium for discovering new music. Still, about one quarter of the younger population (age 15 to 34), particularly males, also discovers new music via the Internet. Younger people and especially women discover new music through television and word-of-mouth. Other ways of discovering new music (such as concerts, stores, movies, etc.) are relatively unimportant. The extent to which the discovery of new music via the Internet occurred through free sites or pay-sites was not investigated.

We believe that the decision to engage in music downloading or P2P file-sharing is not only a response to the price of music; it is also a response to the availability of musical works. For example, rare songs, music from bands that have not signed with a record label, or private recordings from live concerts may be available through P2P networks but may not be available for sale. However, whether such new markets are so similar to the existing markets that they in fact substitute in practice is difficult to guess. We would marginally anticipate the creation of competing new markets to have a negative impact on music purchases in the existing markets.

Hypothesis 2c states the following:

H2c. People who engage in P2P file-sharing or music downloading are less likely to purchase music in traditional markets.

In order to consider the relative importance of the 'sampling' and 'substitution' effects associated with P2P file-sharing and music downloading, the two effects ought to be considered together. Moreover, in our analysis we divide the 'sampling effect' into a 'market creation effect' and a 'market segmentation effect'. The two effects are distinct, but tend to be mixed in the existing literature. More specifically, the market creation effect refers to situations where the individual engages in P2P file-sharing in order to hear a particular song before buying it and where such activity increases that individual's music purchasing. The relevant variable is 'hear before buying', one of several possible motives behind P2P file-sharing identified by respondents. Another market creation effect refers to the situations where the music is not available in stores or from pay sites. The relevant variable is called 'not available elsewhere', another motive identified by respondents. The market segmentation effect refers to situations where the respondent does not want to buy a whole album, that is the whole bundle of songs. The relevant variable is called 'not whole album'. Finally, the market substitution effect refers to situations where the respondent engages in music downloading or P2P file-sharing activities because the song or album price is considered to be too high. This variable is called 'album too expensive'.

We now consider the effect of the prices of related entertainment goods on demand for music. We develop a double-sided hypothesis:

If an entertainment good is a direct complement to music (such as MP3 players in relation to paid electronically-delivered music), a negative relationship is expected, in the sense that a fall in the price of MP3 players will result in increased purchases of paid electronically-delivered music; if the good is a substitute (such as a film/movie)

then a positive relationship is expected, such that an increase in the price of a CD or electronically-delivered music track will result in increased purchases of films.

However, as the price of related entertainment goods is not available for most observations (see Section 3), this paper simply considers the effect of the ownership of MP3 players, as well as the number of purchased entertainment goods. These factors are addressed below in the new double-sided hypothesis that we now propose:

H2d.   *If a good is complementary to, or compatible with, paid electronically-delivered music (e.g. MP3 player) but not complementary to CDs, then the ownership of this good leads to a preference for purchasing music in electronic format over (physical) CDs and vice versa. If a good can be regarded as a substitute for music (e.g. a film/movie), then purchases of this good are negatively associated with music purchases.*

This hypothesis can be addressed by considering the following factors:

MP3 player ownership as a complementary good:

One would expect that ownership of an MP3 player tends to (i) be associated with a relatively large volume of electronic music purchases and to (ii) be associated with a greater likelihood of engaging in music downloading and P2P file-sharing activites, compared with not owning an MP3 player. However, it should be noted that to some extent, the direct effect of MP3 player ownership on CD markets is uncertain, as the relative magnitudes of the complementary *and* substitution effects cannot be known a priori.

Substitute entertainment goods and the issue of time:

Assuming people not only have limited money (i.e. they are constrained by income) but also limited time, other entertainment goods can be assumed to be in direct substitution with music purchasing with respect to both CD and MP3 purchasing. As put forward by Liebowitz (2004), "There is another element involved in listening to music, and that is the constraint of time. Listening to music requires time, and higher income does not necessarily lead to a great amount of free time". In this context, Liebowitz (2005a) considered the effect of substitute entertainment goods, and found that movie revenue per capita, video game revenue per capita and units of pre-recorded videos per capita grew hand in hand with record sales for most of the period 1990-2003, and he discussed whether the positive correlations between the variables suggested that the goods were complements (e.g. movies spur sales of a soundtrack or playing video games while listening to music). He found that after accounting for time constraints (assuming the movies and music CDs are substitutes), the observed increase in per capita sales of VHS and DVDs could only explain half of the drop in per capita sales of sound recordings.

In an analysis of music downloads in 16 countries, Peitz and Waelbroeck (2004) argue that 'Internet piracy' played a significant role in the decline in CD sales in 2001. However, they suggest that the *later and continued* drop in record sales needs to be attributed to something quite different. Today people are doing different things with the Internet, such as listening to radio and audio clips, viewing video clips,

creating picture albums, and using it more generally. Thus, the Internet offers new forms of entertainment, effectively replacing old forms of entertainment. In this line of argument the pertinent issue is the advent of changes in lifestyle rather than P2P file-sharing and music downloading substituting for music purchases.

To this end, a 2001 Canadian survey of 5,682 youth aged nine to 17 (i.e. 13 to 21 years of age in 2005 when the survey for this paper was conducted) demonstrated that children used the Internet for different purposes and at different locations: 57% of children downloaded music (which is important in light of the results of the survey conducted for this paper, as only 15% of children had ever purchased something on the Internet), 56% used the Internet for sending Email, 50% surfed the web, 48% played and downloaded games, 41% obtained information unrelated to school work (e.g. health related information or to look up things related to their hobbies), 40% engaged in chat-rooms and used the Internet for homework. As discussed below, the survey also showed that girls tend to use the Internet more for social communication and chatting, and boys used it more for music, games and schoolwork (Environics Research Group 2001).

A consumer survey by McKie (2006) of 1,229 Canadian consumers aged 13 and above found that 83% of young people aged 18-24 considered music played on the radio to be repetitive (tracks were "played to death" so they did not find a need to purchase the track or the album). This suggests that music on the radio displaces music purchases. The survey results also suggested that in order to increase music choice Canadian consumers turned to (or were pushed to) self-programming, especially from the P2P file-sharing sources.

Thus, a decline (or lack of growth) in purchasing in CD markets may not only be attributable to increases in price or the emergence of free music downloads and P2P file-sharing, but also to other entertainment goods. We have data on the following: number and price of purchased DVDs, number and price of purchased video games, number and price of movie tickets bought and the number and price of live concerts attended. This information is used to test Hypothesis 2d.

Then there is the effect of consumer income:

H3.   *In accordance with economic theory, a higher income is associated with increased purchasing, so we expect a positive relationship between income and music purchasing.*

Whereas a positive relationship between income and purchasing is relatively simple to understand with respect to CDs, one does not, at first glance, expect purchasing of electronic music files to be related to income, as they are relatively inexpensive. However, other factors may come into play here. As higher income groups are also at the 'upper end of the digital divide' having better Internet access and/or Internet skills (see hypothesis H5 and associated text for discussion), a positive relationship between income and purchases of paid electronically-delivered music can also be expected.

Using per capita GDP and CD sales data, Liebowitz (2005a) found that income had a *minor impact* on album sales ($1,000 increase would alter per capita sales by only 0.28 units). However, based on household income, Liebowitz (2005b) demonstrates

(counterintuitively) that higher household income is more likely to lower per capita sales of albums. Again, this could be explained by the digital-divide argument (discussed in relation to hypothesis H5 below). That is, higher income groups are more likely to use the Internet, and that such use leads to substitutions away from CD purchasing. However, contrary to Liebowitz (2004), Peitz and Waelbroeck (2004) find a strong positive effect of income (measured as GDP growth) on CD purchases.

As discussed previously in this section, the degree of purchasing and price tolerance in CD and MP3 markets is also expected to vary with consumer taste.

H4.   In accordance with economic theory, a greater taste for music is expected to be associated with increased music purchasing.

However, as we have no direct data on consumer taste (see Section 3), this paper considers two proxies:

Perception of music quality:

Firstly, a respondent who answered that the 'quality' of music had increased between 2004 and 2005 is perceived to have a 'taste' for the music available during 2005. Similarly, respondents who answered that the quality had declined are considered not to have a taste for the music supplied in the market during 2005, and respondents who answered that they did not believe quality had changed between years are considered to have a neutral taste for music available during 2005. Taste for music available, or the perception of music quality can, for example, increase because a certain artist a consumer likes has been releasing albums.

Music interest:

Secondly, 'music interest' can also be related to music taste where a person with a strong interest can be perceived as having a taste for music. Thus, music interest is also expected to influence music purchasing and price tolerance in CD and paid electronically-delivered music markets. Thus:

(i) A positive relationship is expected between the degree of experienced 'music quality' or 'music interest' and music purchasing.
(ii) Taste for music available is expected to be associated with a less price elastic music demand curve.
(iii) Taste for available music is also expected to be associated with increased music downloading and P2P file-sharing.

Liebowitz (2005a) used financial success of concerts (1990-2001) and time spent listening to the radio as proxies for change in music quality. However, he found that increased concert revenues (which should reflect an increase in music quality) were associated with a decrease in record industry revenues. He, therefore, discussed whether his estimated 9 percent decline in radio listening (indicating lowering of music quality) could explain the decrease in record industry revenues, although he concluded that the evidence was very weak and it depended on age and music genre.

The effect of demographic factors

Demographic factors such as Internet skills, age, gender, occupation and region may also have an influence on music purchasing. Some hypotheses can be suggested in this context, based upon the 'digital divide' discussion famously led by Castells (2001), where it is suggested that such demographic factors, and others, influence the participation in Internet-based activities. Although Castells (2001) mainly focused on Internet access in the USA, his research sought to explain why certain groups did not have, or did not choose to have, Internet access. In this context, we discuss the Internet as a means of acquiring music (both through P2P file-sharing and purchasing of electronic tracks), in contrast with traditional CD purchasing and CD copying.

According to Castells (2001), the people using the Internet (i.e. those at the *upper-end of the digital-divide*) are more likely to be high income earners (and the children of such high income families are advantaged in terms of both access from their bedroom and in high-quality teaching in computer and Internet skills), the educated, the younger generation, males, persons in the labour force, and inhabitants of urban areas. However, persons who do not use the Internet (i.e. those at *the lower-end of the digital divide*) are more likely to be low income earners (and the children of such low income families are particularly disadvantaged in terms of access from their bedroom and in terms of low quality teaching in computer and Internet skills), of lower education, elderly, female, outside the labour force, and outside urban areas.

The 2001 Canadian survey of 5,682 youth using the Internet, referred to above, demonstrated that youths acquire their Internet skills mainly from friends rather than parents. Thus, quality of friends in schools and neighbourhoods is very important in perpetuating the digital divide. The same survey also showed that girls tend to use it more for social communication and chatting, and boys use it more for music, games and school work (Environics Research Group 2001).

The 2005 survey by Decima Research found that the likelihood of having access to the Internet decreases with age (while only 2% of Canadians between 15 and 20 could not access the Internet, this increased to 14% among those aged 35 to 54 and spiked at 44% among those over 55 years old). Again, residents of urban areas are more likely than rural residents to have access both at home (74% vs. 64%) and at work (33% vs. 27%), while 26% of rural residents (compared to 17% among urban residents) do not have any Internet access at all.

H5.   It follows that we expect that those at the 'upper end' of the digital-divide are more likely to engage in P2P file-sharing and to purchase paid electronically-delivered tracks than those at the 'lower end' of the digital-divide.

Thus,
(i) A positive relationship is expected between Internet skills and P2P file-sharing and music downloading.
(ii) A negative relationship between Internet skills and purchasing of CDs and CD copying is expected.
(iii) A negative relationship between age and P2P file-sharing is expected.
(iv) A positive relationship between being male and P2P file-sharing is expected.

(v) A positive relationship between being a student or working and P2P file-sharing is expected.

(vi) A positive relationship between degree of education and P2P file-sharing is expected.

3. Data and methodology

The aim of this section is to introduce the data used within this paper and to discuss the statistical analysis procedures. The dataset is derived from a large-scale survey of Canadians. It is scaled up using weights to be representative of the Canadian population. The survey was designed and conducted in collaboration between Dr. Andersen, Industry Canada, and Decima Research in 2006. Data are analyzed using single equation regression methods.

This section is structured in the following way. The first sub-section introduces the survey, including sampling and interviewing techniques. The following sub-section discusses the dependent and independent variables developed to test our hypotheses. This section builds upon Section 2 where the variables were selected based on the theoretical approach in this paper. Finally, the last sub-section discusses the specific regression estimations used, including advantages and disadvantages of the methods vis-à-vis alternative techniques.

Contribution of this research paper in terms of scope of the data and analysis

This research paper adds to the discussion on the extent and effects of music downloading and P2P file-sharing by using microeconomic survey data and by extending the analysis to account for a wider range of relevant variables/factors underlying music purchasing.

Most previous studies on P2P file-sharing have tended to analyze aggregated (e.g. macroeconomic) data. Thus, the analyses using those data are merely indirectly measuring the statistical relationships on which micro-assumptions and conclusions are based.

The analysis in this paper is based on direct answers (or micro-data) provided by 2,100 Canadian respondents. For example, respondents were asked about how many CDs and paid electronically-delivered tracks they purchased and the average prices paid. There are advantages from using measures of the respondents' recalled purchases and experienced average prices. A key issue here is that markets can take many forms (on-line, brick and mortar shop, second-hand, etc.) so no official music industry recorded price will capture the *true* demand and the *true* price which consumers are facing.

Moreover, our analysis is wider than previous studies, which tend to focus on P2P downloads only, as it considers a comprehensive range of ways in which music can be acquired. These are: purchasing CDs, ripping CDs and copying them onto computers, buying music tracks from online pay-sites like iTunes or Archambault, downloading free music from P2P file-sharing networks, like Kazaa, LimeWire, eDonkey, BearShare or Gnutella, downloading free music from promotional websites, downloading music from peoples' private Internet websites and copying MP3s from friends.

The demographic information in the survey, too, is very detailed, including information on gender, age, income, region in which they live, degree of music

interest, Internet skills, occupation and educational level. See discussion of sampling technique below as well as Table 3.3 for an overview of such data.

Sampling technique

The sampling technique used was quota-based random sampling, stratified by age (participants were 15 years or older), gender, geographical region and downloading status. This was done because a purely random sampling strategy would not have produced sufficient sample sizes for key segments of interest to this and other studies; e.g. youth, Francophones and P2P downloaders (i.e. persons engaged in P2P file-sharing). Therefore, stratification was introduced to allow for sufficiently robust analysis within these segments. The total number of survey responses was 2,100. For a detailed discussion on the sampling and interviewing techniques, see Decima Research (2006).

The resulting stratification across the four key demographic dimensions is detailed in Table 3.1. Both the numbers of unweighted as well as weighted observations are reported in Table 3.1. Sampling weights were constructed in order to scale the number of observations to match the actual Canadian population according to Statistics Canada 2001 Census data. As the actual proportion of downloaders in the population was unknown prior to conducting the survey, weights in relation to downloaders vs. non-downloaders reflect how the distribution occurred naturally or randomly during the survey prior to quota constraints being reached. In terms of the actual sample, the data contains 1,005 respondents who declared that they were P2P downloaders and 1,095 that declared not to have engaged in P2P downloading. With respect to the weighted data, the downloaders account for around 30 percent of the population and the non-downloaders for 70 percent. The weight attached to each survey response is the inverse of the probability of being included in the sample divided by the sample proportion. For instance, if the true proportion of female downloaders under the age of 25 living in Quebec is 1.1 percent of the population, and the sample proportion is 4.5 percent, then the applied weight to this segment is 0.244.

The first two columns in Table 3.1 give the number of observations in the survey, and, in relation to this, the final two columns are the weighted observations that are scaled up to match the Canadian population. In total there are 2,100 observations in the sample that represents a population of around 24 million. All following analyses will use weighted data to be representative of gender, age and regional distributions with respect to the Canadian population.

The remainder of this section explores different patterns of how people acquire music, e.g. buying CD albums and various ways of downloading tracks through websites. This is done to assess the extent to which various phenomena occur compared to other means of acquiring music.

Table 3.2 suggests that the dominant way of acquiring music is through purchasing CD albums. The survey data indicate that around 77.2 percent of the Canadian population purchased a CD album in 2005. This is over twice as common as alternative means of music acquisitions. 29.0 percent downloaded music through P2P networks and 29.2 percent ripped songs from CDs. 20.5 percent used friends to copy MP3s and 8.5 percent downloaded music from free music websites. 13.6 percent

bought music tracks from pay-sites. 23.2 percent downloaded music for free from promotional websites. Appendix 1 explores different patterns of acquiring music depending on gender, age and region.

Variables

Table 3.3 provides an overview of the variables used in our analysis.

Dependent variables: music purchases

Our dependent variables are designed to capture purchasing of music, either in relation to CD markets or in relation to paid electronically-delivered music markets. Our first variable is the number of CD albums that respondents estimated they had purchased in 2005. Over and above the actual count data we also use two transformations of the actual data in our estimations. The variable capturing the number of CD albums bought in 2005 exhibits a positive skew with relatively more participants reporting low numbers of CD album purchases. To address this, we use two common types of data transformations in the case of OLS estimations; (i) taking the square root of the values of the dependent variable and (ii) taking the natural log. Because the log of zero values is not defined we add a value of one to the reported number of purchased CD albums prior to taking the natural log. Adding one, compared to any other value, is common practice within the area of economics and management studies (Tabachnick and Fidell, 2006) and is done because the log of one equals zero and thus the transformation does not lead to a shift in the distribution, i.e. both the untransformed and the transformed data take zero as the smallest value.

Our second set of dependent variables relates to the number of paid electronically-delivered music tracks respondents estimated they purchased in 2005. First, we use the count data. Second, we use the same data transformations as for the number of CD albums, i.e. we compute the square root and the natural log of the number of tracks purchased. Moreover, in the case of paid electronically-delivered tracks only, we also use a binary dependent variable which is coded zero if respondents purchased none and coded one if any tracks were purchased. The reason for including binary information in relation to MP3 purchases is that 85 percent (or 1,750) of responses were zeroes in this specific variable.

Independent variables

To test *Hypothesis 1,* which states that the price of music (CD albums) is negatively associated with the purchase of music (CD albums), we use a variable which reflects the price of CD albums participants purchased in 2005 as estimated by the participants, thus it is the perceived price of CDs. The variable is continuous and measured in Canadian $. This variable follows approximately a normal distribution. Hypothesis 1 also suggests that the price of paid electronically-delivered music tracks is negatively associated with the magnitude of purchases. However, because only 166 participants in the whole sample and 16 participants among the P2P file-sharers gave information on the estimated price of paid tracks in 2005, we omitted this variable in the regressions as this would have resulted in a huge drop of observations. Furthermore, when analyzing the sub-sample of P2P file-sharers, we use a variable that is called 'album too expensive'. This variable captures the percentage of P2P

files that were downloaded because participants felt that the price of a music CD was too high. This variable takes values between zero and 100.

In relation to *Hypothesis 2a,* which states that there is a positive relationship between the price of CDs and number of songs downloaded from P2P networks, we regress the price of CD albums onto the number of reported purchases of paid electronically-delivered music tracks rather than onto CD purchases (this is an indirect way of measuring the cross-price elasticity of the two music markets).

The questionnaire contains two questions related to the number of P2P downloads. The first is a binary variable, the second is a quantitative variable giving an estimate of the number of P2P downloads in an average month in 2005. 246 respondents answered yes to being a downloader and estimated the number of downloads to be zero or did not report an answer. Decima Research (2005) states, "Normally, it is expected that 1%-3% of respondents arrive at this section, and then give a 'don't know' or non-behavioural response (i.e. zero downloads). In this instance, 246 of our 1,000 respondents gave a 'zero' response or answered 'don't know'. Given the magnitude of this proportion of respondents, additional analysis was warranted to better understand true downloading behaviour. Post-hoc analyses were conducted to determine if these individuals should be categorized as downloaders or non-downloaders." Based on their analysis, Decima Research concluded that the 246 respondents in question should be treated as downloaders. Responses for the year 2005 regarding their number of downloads were imputed, where imputed values corresponded to mean values of downloaders, based on age and gender. This variable is used in Appendices 4 and 5.

Further sources of free music included in this paper measure activities of ripping songs from CDs, downloading songs from promotional websites, downloading songs from private websites and copying MP3s. In the case of estimations based on the whole population, we use binary information for all these variables, e.g. whether or not an individual downloaded P2P files (yes is coded one and no coded zero). Although count data on the number of songs downloaded through P2P networks, ripped from CDs and files downloaded from promotional websites are available, a large proportion of the population did not engage in such activities. As a result there are very few observations different from zero and this causes problems in relation to the estimation when using count data. Thus, binary variables are presented and commented on in the paper. Results based on the relevant count data (using the natural log of the count data) are included in Appendices 4 and 5.

In the case of estimations based on the subset of P2P file-sharers, we use the natural log of the number of free songs, e.g. natural log of the number of songs ripped from a CD plus one to account for any zero observations in the variable. This is done because in the case of this particular sub-set of the data (P2P file-sharers) the proportion of zero answers is considerably lower. The equations for estimations are introduced in the last sub-section of Section 3. Furthermore, the 246 individuals who initially declared that they were P2P downloaders but subsequently did not provide a non-zero response when asked about the volume of their file-sharing were omitted from the estimations using the sub-sample of P2P downloaders.

Hypothesis 2b states that people who sample music (for example have the possibility to listen to music before purchasing) buy more CDs and paid electronically-delivered music tracks than those who do not sample music. This hypothesis is directly tested using the sub-sample of P2P file-sharers. The relevant variable is called 'hear before buying'. This variable is the percentage of P2P files that were downloaded due to the fact that people wished to hear a song prior to making a purchasing decision.

Hypothesis 2c states that people who download music and purchase paid electronically-delivered tracks tend to purchase fewer CD albums. In order to examine purchases of paid electronically-delivered tracks and their effect on the purchase of CD albums, the former measure was used as an independent variable in the estimations predicting CD purchases. In the results discussed in this paper we use the binary variable for purchases of paid electronically-delivered tracks when examining the whole sample (although estimations on the natural log of the related count data are included in Appendix 4) and the natural log of the count data plus one in the case of the sub-sample of P2P file-sharers for reasons discussed above.

Furthermore, in the case of all estimations based on the sub-sample of P2P downloaders, we use two variables labelled, 'not whole album' (capturing a respondent's decision to engage in P2P file-sharing because of an unwillingness to purchase an entire album) and 'not elsewhere available' (capturing a respondent's decision to engage in P2P file-sharing because the music being sought was not available for purchase). These variables give the percentage of P2P downloads due to these two factors and are measured on a scale from zero to 100.

Hypothesis 2d links the purchase of alternative entertainment goods to the purchase of music. We use several variables to test for a negative relationship between purchases of alternative entertainment goods and the purchase of music. These are the number of DVDs purchased, the number of videogames purchased, the number of cinema tickets and the number of concert tickets bought. For the purpose of the regressions we take the natural log of the number of DVDs, videogames and tickets purchased (after adding one to account for zeros in the variables). As discussed while developing Hypothesis 2d, the number of purchased entertainment goods (rather than their prices) is an appropriate measure for many reasons, including the fact that previous studies show that a 'time element' or 'lifestyle' choice is more important than the impact of price. (See Section 2 for elaboration of this argument.) Also, the response rate in relation to the price of goods within the survey was generally low; for example, only 583 participants gave an estimate for the price of video games.

Furthermore, we include a variable that distinguishes between people who downloaded music onto their MP3 player and those who did not. We call this relevant variable 'MP3 player ownership'. We believe that a variable capturing 'yes' responses to the question on whether the respondent stored P2P downloads on an MP3 player is a better proxy for analysis of complementary goods in music markets, than the direct measure of MP3 ownership. This is mainly due to the fact that MP3 players are still new technology and many who own MP3 players have received them as gifts but have never used them. The relevant variable is a binary variable coded one if participants declared that they downloaded on an MP3 player and coded zero if not.

In order to examine *Hypothesis 3,* which states that the level of income is positively associated with the magnitude of music purchases, there are five dummy variables representing five income bands.[4] The first dummy is an estimated household income below 10K. This forms our base group against which the effects of all other income bands are compared. The remaining income groups are; 10 to 20K; 20 to 40K; 40 to 60K; and 60K and above. The income variable refers to household rather than individual income of participants. Moreover, household income data were also imputed to overcome a high rate of non-response and, thus, our findings in relation to this variable should be treated with some caution.

Two types of variables are used to look at *Hypothesis 4,* which suggests that the level of music taste matters. They are designed to capture music interest and the perception of music quality. Firstly, we use five dummies which group individuals according to their self-reported level of music interest categorized under: interest very strong, somewhat strong, moderate, somewhat low and very low. The individuals who have very low music interest form our base group against which the effects of the other categories are compared. Secondly, we use a questionnaire item that asked respondents whether they perceived an increase or a decrease in the quality of music over the last year, or whether they felt the quality of music remained unchanged. The resulting variables are three dummy variables. The base group is the dummy coded as one if a participant perceived no change in the quality of music.

Finally, *Hypothesis 5* suggests that people with higher Internet skills are more likely to purchase paid electronically-delivered music. To examine this relationship we use five dummies which are the following categories of Internet skills self-ratings: very skilled, skilled, somewhat skilled, not very skilled and not at all skilled. The last category (people who reported that they were not at all skilled in the use of the Internet) is the base group.

We also test for a number of demographic factors in the regression models. First, we include seven age categories. These are 15 to 19, 20 to 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64 and 65 and above. The last group, people who are 65 or older, is our comparison group. We also control for gender, coded as one for women and zero for men. Finally, we control for region (Quebec is coded as one and the rest of Canada is coded as zero).

It should be noted that the survey output does include demographic data on 'occupation' and 'education'. However, we found these data highly correlated with the other independent variables, so they were omitted from our digital divide estimations in order to avoid problems of multicollinearity.

Models

In order to examine the impact on music purchased of our independent variables we use single equation regression methods. Weighted data are used throughout the analyses. The following equations are estimated.

---

[4] All monetary values are given in Canadian dollars.

Equation [1]: based on the whole sample

$$y_i = \alpha + \beta_1 \Pr ice\ of\ CDs_i + \beta_2 P2P_i + \beta_3 Rip\ CD_i + \beta_4 \Pr omotional\ website_i + \beta_5 \Pr ivate\ website_i +$$
$$\beta_6 Copy\ MP3_i + \beta_7 Purchase\ MP3_i + \beta_8 Number\ of\ DVDs_i + \beta_9 Number\ of\ videogames_i +$$
$$\beta_{10} Number\ of\ cinema\ tickets_i + \beta_{11} Number\ of\ concert\ tickets_i + \beta_{12} Income_i + \beta_{13} Change\ in\ quality$$
$$of\ music_i + \beta_{14} Interest\ in\ music_i + \beta_{15} Internet\ skills_i + \beta_{16} Age_i + \beta_{17}\ Gender_i + \beta_{18} Region_i + \varepsilon_i$$

where y_i is an indicator of music purchased which is a measure based on the number of CD albums purchased in 2005 as self-reported by the survey participants as previously.

Equation [2]: based on the whole sample

$$y_i = \alpha + \beta_1 \Pr ice\ of\ CDs_i + \beta_2 P2P_i + \beta_3 Rip\ CD_i + \beta_4 \Pr omotional\ website_i + \beta_5 \Pr ivate\ website_i +$$
$$\beta_6 Copy\ MP3_i + \beta_7 Number\ of\ DVDs_i + \beta_8 Number\ of\ videogames_i +$$
$$\beta_9 Number\ of\ cinema\ tickets_i + \beta_{10} Number\ of\ concert\ tickets_i + \beta_{11} Income_i + \beta_{12} Change\ in\ quality$$
$$of\ music_i + \beta_{13} Interest\ in\ music_i + \beta_{14} Internet\ skills_i + \beta_{15} Age_i + \beta_{16} Gender_i + \beta_{17} Region_i + \varepsilon_i$$

where y_i is an indicator based on the number of paid electronically-delivered music tracks purchased in an average month in 2005 as self-reported by the survey participants. With respect to the independent variables, in the case of Equation [2], β_7 measuring the effects MP3 purchases on CDs albums purchases in Equation [1], is excluded as it forms the dependent variable in this equation.

We compute a second set of estimations based on the sub-sample of P2P file-sharers. This is done because some variables that we analyze are only applicable for this particular group; e.g. what is the percentage of P2P files that people downloaded due to the fact that they wanted to listen to a song before buying. (For an overview, see review of variables feeding into the various hypotheses in Sub-section 'Variables'). The 246 participants who declared that they were P2P downloaders but subsequently did not give the number of downloads or responded that they had downloaded zero tracks from P2P networks were omitted from the analyses because their responses are not reliable. The following equation is estimated both on CD albums and MP3s.

Equation [3]: based on the sub-sample of P2P downloaders

$$y_i = \alpha + \beta_1 \Pr ice\ of\ CDs_i + \beta_2 album\ too\ \exp ensive_i + \beta_3 Number\ of\ P2P_i + \beta_4 Number\ of\ CDs\ ripped_i$$
$$+ \beta_5 Number\ promotional\ website_i + \beta_6 Number\ private\ website_i + \beta_7 Number\ copy\ MP3_i +$$
$$\beta_8 Number\ of\ MP3s\ purchased_i + \beta_9 Number\ of\ DVDs_i + \beta_{10} Number\ of\ videogames_i +$$
$$\beta_{11} Number\ of\ cinema\ tickets_i + \beta_{12} Number\ of\ concert\ tickets_i + \beta_{13} Not\ elsewhere\ available_i$$
$$+ \beta_{14} Not\ whole\ album_i + \beta_{15} MP3\ player\ ownership_i + \beta_{16} Hear\ before\ buying_i + \beta_{17} Income_i +$$
$$\beta_{18} Change\ in\ quality\ of\ music_i + \beta_{19} Interest\ in\ music_i + \beta_{20} Internet\ skills_i + \beta_{21} Age_i + \beta_{22}\ Gender_i +$$
$$\beta_{23} Region_i + \varepsilon_i$$

where y_i is measures CD album sales as discussed before.

Equation 4: based on the sub-sample of P2P downloaders

$$y_i = \alpha + \beta_1 \Pr ice\ of\ CDs_i + \beta_2 album\ too \exp ensive_i + \beta_3 Number\ of\ P2P_i + \beta_4 Number\ of\ CDs\ ripped_i$$
$$+ \beta_5 Number\ promotiona\ l\ website_i + \beta_6 Number\ private\ website_i +$$
$$\beta_7 NumberCopy\ MP3s_i + \beta_8 Number\ of\ DVDs_i + \beta_9 Number\ of\ videogames_i +$$
$$\beta_{10} Number\ of\ cinema\ tickets_i + \beta_{11} Number\ of\ concert\ tickets_i + \beta_{12} Not\ elsewhere\ available_i$$
$$+ \beta_{13} Not\ whole\ album_i + \beta_{14} MP3\ player\ ownership_i + \beta_{15} Hear\ before\ buying_i + \beta_{16} Income_i +$$
$$\beta_{17} Change\ in\ quality\ of\ music_i + \beta_{18} Interest\ in\ music_i + \beta_{19} Internet\ skills_i + \beta_{20} Age_i + \beta_{21} Gender_i +$$
$$\beta_{22} Region_i + \varepsilon_i$$

where y_i is an indicator of electronically-delivered music tracks purchased.

Regressions are sensitive to misspecification of models. Such misspecifications are an issue that will almost always apply when statistical tests are carried out and they are difficult to address (e.g., Kennedy, 2003). One possibility that is adopted in this paper is to estimate and compare a number of alternative or competing models. These estimation models are described below.

The dependent variables, number of CD albums purchased and number of paid electronically-delivered music tracks purchased in 2005, represent count data, i.e. the dependent variables take non-negative integer values only. The most commonly used model to analyze count data is the Poisson model. The probability of an event occurring is $e^{-\lambda} \lambda^y / y!$, where λ is both the mean and the variance of the distribution. Although the Poisson model is perhaps the most frequently used estimation technique to predict count data, the assumptions it makes are often not met by data. In particular, Poisson regressions assume that the variance of occurrences is equal to the mean of occurrences (Greene, 2003 and Kennedy, 2003). The assumption of equal mean and variance is unlikely to hold, and, in our case, the variance of number of CD purchases is greater than the mean, i.e. our data are overdispersed which has an adverse impact on our regression estimates. If the dependent variable is overdispersed, the most commonly used model is the negative binomial model where the mean is λ and the variance is $\lambda + \alpha^{-1} \lambda^2$ and α is the parameter of the gamma distribution (Kennedy, 2003). For the purpose of our analyses we compare the results of both the Poisson and the negative binomial models.

Furthermore, we compare the estimates of the Poisson and negative binomial models with OLS estimators. This is done because OLS estimations often compare rather favourably with the results of more complicated models. This is because the classic linear model is less prone to problems caused for example by errors in variables. In our case, errors in variables may arise in relation to all those variables where participants were asked to report on the number of albums or files acquired in a specific year (or month). We examined frequencies of such variables and found that respondents were likely to give approximations of the number of music purchases rounded to values of 10, 20, 30, and so forth.

OLS requires that the dependent variable is approximately normally distributed. The variable 'number of CD albums bought in 2005' exhibits a positive skew with relatively more participants reporting low numbers of CD album purchases. To

address this, we use two common types of data transformations in the OLS model: (i) taking the square root of the values of the dependent variable, and (ii) taking the natural log. Because, and as mentioned before, the log of zero values is not defined we add a value of one to the variable CD albums prior to taking the natural log. Adding one, as opposed to any other value, is common practice within the area of economics and management studies (Tabachnick and Fidell, 2006). This is done because the log of one equals zero and thus the transformation does not lead to a shift in the distribution, i.e. both the not transformed and the transformed data take as the smallest value the zero. Three separate OLS regressions are performed with respect to CD albums and with respect to purchased electronic music tracks.

The variable 'number of MP3s purchased in an average month in 2005' exhibits an even stronger positive skew compared with the number of CD albums purchased. A large number of survey participants (1,750[5] out of the total of 2,100) did declare that they purchased no electronic music tracks, thus there are 1,750 zero observations in this variable. As a result both the Poisson model and the Negative binomial model did not converge.

For the purpose of OLS estimations we use the actual data, the square root and the natural log of 'number of MP3s'. In the analysis of purchases of electronically-delivered music tracks, we also use a binary variable (coded one for persons who reported purchasing in 2005 and zero otherwise). On the basis of this variable, we estimate Logit and Probit models. Logit estimations are based on a logistic function and Probit models are based on a cumulative normal distribution, both of which follow a similar s-shape and produce highly similar results. On historical grounds the Logit is perhaps more frequently applied (pre advanced statistical software packages) as it is easier to calculate.

In the case of four variables we test the linear hypotheses of equal parameters after the negative binomial model in case of number of CD albums and the Probit model in the case of electronically-delivered music purchases. The difference in coefficients we are specifically interested in refers to the variables 'album too expensive', 'hear before buying', 'not elsewhere available' and 'not whole album' because these variables relate to sampling effects and market segmentation versus market substitution effects.

We now discuss potential issues with respect to the regressions carried out in the paper. These relate to problems of inferring causality from cross-sectional data, issues of endogeneity and omitted variables, heteroskedasticity and errors in variables.

Firstly, regressions based on cross-sectional data cannot prove causality; instead they only show an association between variables. Thus, with respect to this paper causality may only be inferred on the basis of theoretical reasoning carried out in previous

---

[5] The questionnaire contains two questions related to the number of electronically-delivered music tracks purchased; the first is a binary variable (1,750 respondents declared that they did not purchase any tracks); the second is a quantitative variable giving an estimate of the number of tracks purchased in an average month in 2005. With respect to the latter question 1,832 respondents estimated that on average they bought zero tracks per month. We computed the regressions omitting all those 82 observations where respondents initially reported purchasing paid electronically-delivered music tracks in 2005 and and subsequently reported zero as the number of purchases. These regressions yielded extremely similar results compared with the ones reported here.

sections. To this end, estimations based on panel data used, for example, in Liebowitz (2004, 2005) are advantageous, however, the clear disadvantage is that panel data with an equivalent richness of information and the same level of disaggregation (i.e. individual responses) compared to our dataset are not available.

Secondly, single equation estimations assume that all independent variables are exogenous and all important variables are included in the estimation. If, however, any of the independent variables are influenced by the dependent variable and/or any of the independent variables, or important independent variables are omitted, then the included independent variables tend to be correlated with the error term leading to inconsistent estimates (Kennedy, 2003). Problems of endogeneity are likely to affect our results. For example, the use of P2P downloads may be determined by CD purchases or, in fact, by other independent variables. Techniques designed to address issues of endogeneity are systems of simultaneous equations (e.g., Wooldridge, 2000). These are based on the use of instrumental variables in order to predict the endogenous regressors. Observed values of the endogenous variable are replaced with the predicted values in the ultimate equation, with the predicted values being uncorrelated with the error term.

Unfortunately, useful instruments are inherently difficult to find and this is why we decided not to use instrumental variable techniques. Simultaneous equations produce consistent estimates only if the instruments are uncorrelated with the error terms, i.e. they are truly exogenous to the system, and when the instruments are highly correlated with the endogenous variable. In reality almost every variable carries some degree of endogeneity. Moreover, Monte Carlo studies suggest that estimators of single equation regressions are less sensitive to the presence of other estimation problems, such as errors in variables or misspecifications of equations (Greene, 2003).

Thirdly, regression methods assume that the variances of the disturbances, in other words the errors of prediction, are approximately constant. A violation of this assumption is called heteroskedasticity (e.g., Kennedy, 2003). Heteroskedasticity may for example occur if the variation in music purchases is greater for people on a high income compared to people on low incomes. It may also arise when a variable is skewed or when a variable is correlated with an omitted variable. We tested for and found the presence of heteroskedasticity using a White test. To account for this, our regressions are based on robust standard errors.

4. Results

This section presents and discusses the results of the regression estimations testing our hypotheses developed in Section 2. The set of regression equations is designed to analyze a range of variables determining CD album and paid electronically-delivered music purchases based on the whole of the Canadian population (see Section 3 and Table 3.3 for an overview of the variables). In this section we also integrate a distinct analysis and discussion on a sub-set of the survey that is based on all those respondents who declared that they participated in P2P file-sharing. We analyze this sub-set separately because it enables us to include a wider range of variables that are derived from sections of the survey only applicable to respondents who were downloaders. These additional variables are included and commented on in sub-sections of the relevant hypotheses introduced in Section 2.

We focus on the results obtained from our negative binomial and Probit estimations. The negative binomial model is chosen over alternative models for the following reasons: (i) the model specification is the most appropriate in terms of the dependent variable and (ii) the negative binomial model has the highest model fit. Similarly, Probit estimation exhibits the best fit in models where the dependent variable is the purchases of electronically-delivered music tracks.[6] OLS, Poisson and Logit estimation were undertaken as part of our sensitivity analysis; some results are discussed in footnotes in order to qualify our findings, but the full set of results is presented in the appendices.

The effect of P2P file-sharing on music purchasing

Our results regarding the effect of P2P file-sharing and music downloading on music purchases are mixed.

Hypothesis 2a asserted that P2P file-sharing would be negatively associated with music purchasing. In other words, we expect some form of displacement effect.

In the aggregate, we are unable to find direct evidence that P2P file-sharing either increases or decreases CD purchases in Canada. That is, in our analysis of the whole Canadian population we are unable to find any relationship between the number of P2P music tracks that were downloaded and the number CD purchases (Table 4.1 and Appendix 4).[7]

In Table 4.1 the P2P file-sharing variable is a binary variable coded as one if the participant engaged in P2P file-sharing and coded as zero otherwise. In Appendix 4, similar results are presented using the number of P2P downloads instead of the binary

---

[6] While we would have preferred to undertake Poisson or negative binomial regressions for the models explaining purchases of electronically-delivered music tracks, these were not feasible. The reason had to do with the very high proportion of zero observations (85 percent of all observations) for this specific variable. Neither the Poisson nor the negative binomial model based on the count data converged (i.e. found a solution).

[7] One of the OLS specifications, as well as the Logit estimation, reported in Table 4.1 show a statistically significant and negative coefficient on the P2P variable. As noted earlier, we consider the results from the negative binomial model to be the most reliable.

variable. Again, we are unable to find any influence of P2P file-sharing on music purchasing.[8]

Among Canadians engaged in P2P file-sharing, we find a positive and statistically significant relationship between the number of music tracks downloaded via P2P networks and the number of CDs purchased (Table 4.3).[9] For an increase in the average number of P2P downloads per month of 2.718282, the number of CD purchases per year will increase by 1.212. For an increase in the average number of P2P downloads per month of 1 (ie., 2.718282/2.718282), the number of CD purchases per year will increase by (1.212/2.718282 =) 0.44. This suggests that there is some form of music creation effect derived from P2P file-sharing, discussed below.

With respect to the effect of P2P file-sharing on purchases of electronically-delivered music tracks, our results are mixed. In the aggregate, we find some evidence of a positive and statistically significant relationship in one of our Probit regressions (Table 4.2). However, we do not find any statistically significant relationship between P2P file-sharing and electronic music purchasing when using only the sub-sample of P2P downloaders (see Table 4.4).

We also find that both the P2P file-sharing group and the entire population show a positive and statistically significant association between ripping CDs and CD purchases. For the entire population, there is also a positive and significant effect on CD purchasing from individuals downloading via private web sites (see Table 4.1). However, the number of individuals copying MP3 files has a statistically significant negative effect on CD purchasing, as illustrated in the results of Table 4.1.

We now evaluate the 'market sampling' versus the 'market substitution' effects attributed to P2P file-sharing. As discussed and outlined in Section 2 above, we separate the sampling effect in this discussion into market segmentation and market creation effects.

As shown above, individuals who participate in P2P file-sharing because they find CD albums to be too expensive also purchase fewer CDs. This is illustrated by the negative impact the 'album too expensive' variable has on CD purchases (M.E.=-0.032; p<0.01; see Table 4.3). Here, the size of the estimate evaluated at its mean of 40 percent (see Appendix 3) suggests that individuals who increased P2P file-sharing (i.e. Downloading from P2P networks) by 1 percent because they considered an 'album too expensive' purchased 3.2 percent fewer CDs.

Turning to the market segmentation effect, we find no relationship between the variable 'not whole album' (i.e. Where individuals report engaging in P2P file-sharing because of an unwillingness to purchasing the whole album) and CD purchasing.

---

[8] The estimates associated with the negative binomial model should be treated with caution. This is because the estimates are likely to be inconsistent, an issue that almost always arises. Thus, the size of the coefficient may be an under- or over-estimate.

[9] The estimates from the OLS and Logit models also indicate a significant and positive relationship (Table 4.3).

Our discussion now turns to the market creation effect and *Hypothesis 2b*, which states that people engage in P2P file-sharing and music downloading because they wish to hear music before buying it. We are unable to find any relationship between the variable 'Hear before buying' and CD purchases, either for the Canadian population as a whole or for the P2P file-sharing subpopulation.[10]

With respect to a market creation effect, our results show that people who participate in P2P file-sharing because the music is 'not available elsewhere' also tend to purchase more CDs (M.E.=0.036; p<0.01; see Table 4.3). This might be interpreted as indirect evidence of a positive relationship between exploring music through P2P file-sharing and CD purchases.

We also tested several hypotheses regarding the differences in coefficients related to the 'market substitution effect', 'market creation effect', and 'market segmentation effect' (as reviewed just above and the effects are also defined in the text next to hypothesis 2b and 2c in Section 2). We did this in order to shed light on whether we could make inferences about which one of the effects is strongest. We did this by testing some linear hypotheses of equal parameters using the results from the negative binomial model reported in Table 4.3.

First, we tested in detail for all market creation (i.e. 'not available elsewhere' and 'hear before buying') and market segmentation (i.e. 'not whole album') effects against the market substitution variable 'album too expensive'. Testing the hypothesis that 'album too expensive' is significantly different from 'not available elsewhere', we found that the parameters were statistically different at the 1 percent significance level (F=14.97; p<0.01). Furthermore, testing the hypothesis that 'album too expensive' is significantly different from 'not whole album', we found that the parameters were not statistically different at the one percent significance level (F=0.84). And, testing the hypothesis that 'album too expensive' is significantly different from 'hear before buying', we found that the parameters were statistically different at the one percent significance level (F=6.17; p<0.01).

Second, we tested for the entire market creation effect (i.e. 'not available elsewhere' + 'hear before buying') versus the market substitution effect 'Album too expensive'. Here we tested the hypothesis that ('not available elsewhere' + 'hear before buying') is significantly different from 'album too expensive'. We found that the parameters were statistically different at the one percent significance level (F=14.59; p<0.01).

Third, and finally, we tested for the total of the market creation effect combined with the market segmentation effect (i.e. 'not available elsewhere' + 'hear before buying' + 'not whole album') against the market substitution effect 'album too expensive'. Here, we tested the hypothesis that ('not available elsewhere' + 'hear before buying' + 'not whole album') is significantly different from 'album too expensive'. We found that the parameters were statistically different at the one percent significance level (F=6.80; p<0.01).

Focusing on our second group of tests (market creation versus substitution) and the relative sizes of the various estimates, we can conclude that results indicate that the

---

[10] The coefficient is slightly larger than zero and statistically significant in one of our OLS regressions.

negative CD 'market substitution effect' is balanced out by the much more positive overall 'market creation effect' from P2P file-sharing. This is in line with the arguments put forward by Blackburn (2004), Gopal, Bhattacharjee and Sanders (2006), Bounie (2005) discussed in Section 2.

Turning to purchases of paid electronically-delivered music markets, neither the market substitution effect (which in the context of MP3 market would mean that people who participate in P2P file-sharing because the CD album is too expensive also purchase more paid electronically-delivered music tracks) nor market segmentation effects are statistically significant.[11]

The effect of music price on music consumption

While *Hypothesis 1* predicts that the price of CDs is negatively associated with the number of CD albums purchased, we find no statistically significant relationship for the entire population (Table 4.1 and Appendix 4). That is, we find no direct evidence that CD price influences CD purchases.[12] Thus, our results suggest that people have different music price elasticities, even within the same CD price category. This finding is in line with the findings reported by Liebowitz (2004). Given that he too finds that CD prices have remained stable over the last 30 years, this implies that a change in CD purchasing must be explained by a range of other factors to which we turn later.

However, for the subpopulation of P2P file-sharers we find a statistically significant negative relationship between the variable 'Album too expensive' (the variable capturing whether the perception that CD prices were too high motivated P2P activity) and CD purchases (Table 4.3). We interpret this as indirect evidence that CD purchasing does depend on price, among those who engage in P2P file-sharing.

No analysis was done regarding the effects of paid electronically-delivered music prices on purchases for the following reasons. Only 166 participants out of all participants answered the relevant question and 16 participants among the P2P file-sharers. Moreover, as the price of paid electronically-delivered music is much lower than the price of CDs, any change in the price of paid electronically-delivered music is unlikely to affect music demand. In this respect, we believe the key concern is about a link between paying for electronic music tracks versus not paying for them (see below).

Moreover, we look at the relationship between CD prices and the purchase of electronically-delivered music. Table 4.2 shows results for the entire population and Table 4.4 shows results for the P2P file-sharing subpopulation. In accordance with *Hypothesis 2a* we expect that the price of CD albums is positively associated with paid electronically-delivered music purchases, i.e. the more expensive CD albums are perceived to be the greater the number of purchased paid electronically-delivered music tracks. In the case of the entire population (Table 4.2), we find no statistically significant relationship. However, for the P2P file-sharer group (see Table 4.4) there

---

[11] There is some indication of a positive and statistically significant association with the 'hear before buying' variable in the three OLS models in Table 4.4, suggesting a market creation effect.
[12] The coefficient on the price variable is not significant in any of the OLS or Poisson regressions (Tables 4.1 and 4.3 and Appendix 4).

is negative support for this hypothesis, the price of CDs being negatively associated with the number of paid electronically-delivered music tracks purchased (M.E.=-0.017; p<0.01). Thus, respondents who experienced a higher CD price purchased fewer electronically-delivered music tracks. This seems counter-intuitive. One reason could be that the two markets are so separate that no cross-price elasticity between them exists.

The effect of entertainment substitutes and complements on music consumption

With respect to *Hypothesis 2d,* which states that there is a negative relationship between purchasing competing entertainment goods and CD purchases, we find a positive rather than the anticipated negative relationship.

The results in Table 4.1 suggest that there is strong evidence that people who buy a high number of DVDs, videogames, cinema tickets and concert tickets also purchase a high number of CD albums. The same is the case if we view P2P file-sharers in isolation (although not significant for DVDs). This complementary effect of the entertainment goods also contradicts the 'mainstream' argument suggesting that price or time make entertainment goods substitutes. Rather, our results suggest that people who are interested in entertainment goods (such as music) are also interested in DVDs, concerts, cinema/movies and video games. Thus, music and entertainment is a life-style of certain groups of society.

These results are also supported with respect to the paid electronically-delivered music (Tables 4.2 and 4.4), although they are only statistically significant for purchase of cinema tickets. Thus, there is some indication that people who visit the cinema more frequently also purchase more paid electronically-delivered music.

Finally, and as suggested in *Hypothesis H2d,* people who own an MP3 player appear to be less likely to purchase CD albums (M.E.=-1.851; p<0.10).

The effect of consumer income on music consumption

Our third hypothesis, *Hypothesis 3,* states that the level of income is positively associated with the sales of music CD albums. In our estimations this hypothesis is not supported. We find no statistically significant relationship between the income variables and CD album or purchases of paid electronically-delivered music tracks shown in Tables 4.1 and 4.2. We, therefore, conclude that music purchasing in general takes up a too low share of peoples' income to have any effect on purchasing behaviour.

The effect of consumer music taste on music consumption

Hypothesis 4 states that people with a stronger taste for music purchase more CD albums and more paid electronically-delivered music. This is tested using two sets of proxy-variables: first, the level of music interest and second, the perceived change in quality of available music.

We find this hypothesis supported with respect to music interest (see Tables 4.1, 4.2, 4.3 and 4.4). People who declared that they had a 'very strong interest' or 'somewhat

strong interest' in music compared with people who declared that they had a 'very low interest' in music purchased significantly more CD albums. Also, it was only the 'very strong interest' or 'somewhat strong interest' variables which had a statistically significant impact on the increased CD and paid electronically-delivered music purchases. (This was however not tested in the Probit or Logit models as we had problems of multicollinearity and too few observations to include all variables. See footnote text under Table 4.4)

The effect of perceived music quality was not significant for CD purchasing. However, our results for the entire Canadian population who perceived an increase in music quality over the last year prior to the survey reported higher purchases of electronic music from pay-sites (Table 4.2) and, equally, P2P file-sharing individuals who reported a perceived drop in the quality of music, purchased fewer paid electronically-delivered music tracks (Table 4.4).

The effect of demographic factors and the digital divide

Our final hypothesis, *Hypothesis 5*, suggests that people who are at the upper end of the digital divide, for example people with high internet skills, buy more electronic music tracks from pay-sites. Results shown in Table 4.2 support this hypothesis. People who rated their own Internet skills as 'very skilled' (M.E.=0.263; p<0.01), 'skilled' (M.E.=0.278; p<0.01), 'somewhat skilled' (M.E.=0.145; p<0.01) or 'not very skilled' (M.E.=0.185; p<0.01) were more likely to purchase MP3s compared to the base group 'not at all skilled'. With respect to CD sales (see Table 4.1), we find that there is a negative association between the level of skills and the number of CD albums purchased (e.g. Internet skilled M.E.=-3.416; p<0.01), again supporting the digital divide discussion in Section 2.

The results are not significant in the case where the estimations are based on the sub-set of P2P file-sharers, as shown in Tables 4.3 and 4.4. This could be due to the fact that the group is somewhat skilled altogether, even if some of the participants report that they have lower skills. In other words, the group they compare themselves to may exhibit higher levels of Internet skills *per se*, and their level of skills is higher compared to the overall Canadian population.

The remaining variables examine the effects of other demographic factors on the purchase of CDs and paid electronically-delivered music tracks. In the aggregate, age variables are only found to be statistically significant in the results shown in Table 4.1. Here, the base group is the 65 and plus category. In this category significantly fewer people purchased CDs compared to all other age groups. There is also some indication that men are more likely to purchase CDs. However, the opposite is the case for paid electronically-delivered music markets where there is an indication that women are more likely to purchase (M.E=0.046; p<0.05). Finally, we find that people living in Quebec appear to purchase more music albums compared to the rest of Canada (M.E.=-1.862; p<0.01). However, the results for the entire Canadian population found in Table 4.2 show that there is no indication that a difference in paid electronically-delivered music purchases depends on the regional variable (Quebec compared to the rest of Canada). Table 4.4 based on the sub-sample of P2P file-shares suggest that people living in Quebec are more likely to purchase paid electronically-delivered music tracks (M.E.=-0.164; p<0.01).

Overall, our demographic variables show some indication of a digital-divide in Canada with respect to Internet skills, age and region. However, there is no digital divide with respect to gender and Canadian females are relatively active downloaders of paid electronically-delivered music tracks.

5. Summary of findings

The primary objective of this paper is to determine the effects of P2P file-sharing on purchases of CDs and electronically-delivered music tracks, using representative survey data from the Canadian population.

In the aggregate, we are unable to discover any direct relationship between P2P file-sharing and CD purchases in Canada. The analysis of the entire Canadian population does not uncover either a positive or negative relationship between the number of files downloaded from P2P networks and CDs purchased. That is, we find no direct evidence to suggest that the net effect of P2P file-sharing on CD purchasing is either positive or negative for Canada as a whole. These inferences are based on the results obtained from estimation of the negative binomial models (Table 4.1 and Appendix 4).

However, our analysis of the Canadian P2P file-sharing subpopulation suggests that there is a strong positive relationship between P2P file-sharing and CD purchasing. That is, among Canadians actually engaged in it, P2P file-sharing increases CD purchasing. We estimate that the effect of one additional P2P download per month is to increase music purchasing by 0.44 CDs per year (based on estimates obtained from the negative binomial model in Table 4.3). Furthermore, we find indirect evidence of the 'market creation' effect of P2P file-sharing in the positive coefficient on the variable 'Not available elsewhere' (Table 4.3).

In the aggregate, we find mixed evidence on the relationship between P2P file-sharing and purchases of electronically-delivered music tracks in Canada (Table 4.2 and Appendix 5). Furthermore, our analysis of the Canadian P2P file-sharing subpopulation does not uncover any relationship between P2P file-sharing and the purchasing of electronically-delivered music files. These inferences are based on the results obtained from our Probit and Logit estimations (Table 4.4). It is difficult to conclude what is the net effect of P2P file-sharing on purchases of electronically-delivered music.

With respect to the influence of price on CD purchasing, we are unable to find any direct relationship between the respondents' reported average CD price and CD purchases in Canada (Table 4.3 and Appendix 4). However, we find some indirect evidence that price influences CD purchasing, as the variable capturing the motivation to engage in P2P file-sharing because of the perception that CDs were too costly was negatively associated with CD purchases.

This result is in line with the arguments put forward by Liebowitz (2005), Zentner (2004), Rob and Waldfogel (2004).

Another important finding is that the overall results show that people who purchase paid electronically-delivered music are not less likely to purchase music in traditional markets (CD albums). However, people who also own an MP3 player appear to be less likely to purchase CD albums.

Furthermore, there is a strong evidence that people who buy a high number of DVDs, videogames, cinema tickets and concert tickets also purchase a higher number of CD albums. The same is the case if we view the P2P file-sharers in isolation. These

results also hold for paid electronically-delivered music, although only for purchases of cinema tickets. As mentioned in Section 4, this complementary effect of entertainment goods also supports the findings and arguments put forward by Liebowitz (2005), but the results of this Canadian study differ from the findings of Peitz and Waelbroeck (2004) and McKie (2006), which suggest that entertainment goods are substitutes. Our results suggest that people who are interested in entertainment goods (such as music) are also interested in DVDs, concerts, cinema/movies and video games. Thus, music and other entertainment goods are not substitutes; instead the relationship is linked to a life-style choice of certain groups of society.

We find that income has no statistically significant effect on CD or paid electronically-delivered music purchasing. We, therefore, conclude that music purchasing in general takes up too low a share of peoples' income to have any effect on purchasing behaviour. This result on the Canadian population does not support the findings of Liebowitz (2005) and Peitz and Waelbroeck (2004) who analyzed the relationship between income and CD sales.

Regarding music taste, we find that people who declare that they have a 'very strong interest' or 'somewhat strong interest' in music compared with people who declared that they had a 'very low interest' in music purchased significantly more CD albums. Furthermore, our results based on the analysis of the entire population show that Canadians who perceived an increase in music quality reported increased purchases of paid electronically-delivered music files; and, P2P file-sharers who reported a perceived drop in the quality of music, purchased fewer paid electronically-delivered music tracks. Thus, music interest and the perception of music quality seem to be positively related to music purchasing.

Overall, our demographic variables show some indication of a digital-divide in Canada with respect to Internet skills, age and region of residence. Greater Internet skills and younger age groups were associated with increased music purchases from Internet pay-sites. These findings are in line with the arguments of Castells (2001) and the survey by Decima Research (2005). However, there is no digital-divide with respect to gender and Canadian females are relatively active music downloaders of paid electronically-delivered music tracks.

References

Andersen, Birgitte, Kozul-Wright, Richard and Kozul-Wright, Zeljka (2007): Rents, Rights N'Rhythm: Cooperation and Conflict in The Music Industry, Industry and Innovation. (forthcoming)

Begg, D., Fischer, S and R. Dornbusch (1994), Economics (4th edition) London: McGraw-Hill

Blackburn, David (2004). On-line Piracy and Recorded Music Sales. Harvard University. Unpublished Manuscript. November.

Bounie, David, Marc Bourreau and Patrick Waelbroeck. Pirates or Explorers?. June 2005. Working papers in Economics, Telecom Paris.

Castells, M. (2001). The Internet Galaxy: Reflections on the Internet, Business and Society. Oxford: Oxford University Press.

Decima Research (2005). Canadian Music and Film Opinion Study. Prepared for Department of Canadian Heritage, July.

Decima Research (2006) Industry Canada – Music File-sharing Study 2006: Methodology Report, Decima Research Inc., Canada.

Environics Research Group (2001). Young Canadians in a Wired World. The Students' View. Prepared for the Media Awareness Network and Government of Canada.

Gallaway, Terrel and Douglas Kinnear (2001). "Unchained Melody: A Price Discrimination-Based Policy Proposal for Addressing the MP3 Revolution." Journal of Economic Issues. Volume 35(2), June.

Greene, William H. (2003). Econometric Analysis (5th edition), New York: Prentice Hall.

Gopal, Ram D., Sudip Bhattacharjee and G. Lawrence Sanders. (2006) Do Artists Benefit From Online Music Sharing?. The Journal of Business, July, vol. 79, no. 4.

Hui, Kai-Lung and Ivan Png (2003). "Piracy and the Legitimate Demand for Recorded Music," Contributions to Economic Policy and Analysis. Volume 2(1).

Kennedy, Peter (2003). A Guide to Econometrics (5th edition). Malden, US, Oxford, UK, Carlton, Australia: Blackwell Publishing.

Landes, W.M. and Posner, R., (1989), "An Economic Analysis of Copyright Law", Journal of Legal Studies, vol XVIII, June.

Liebowitz, Stanley J. (2004). Will MP3 Downloads Annihilate the Record Industry? The Evidence so Far. In Gary Libecap (ed.) Intellectual Property and

Entrepreneurship. Series on <u>Advances in the Study of Entrepreneurship, Innovation and Economic Growth</u>. vol 15, 229-260.

Liebowitz, Stanley J. (2005a). <u>Pitfalls in Measuring the Impact of File-sharing</u>. CESifo <u>Economic Studies</u>, vol 51, 23, 439-477.

Liebowitz, Stanley J. (2005b). Testing File-Sharing's Impact by Examining Record Sales in Cities. Unpublished manuscript.

Madden, Mary (2004). <u>Artists, Musicians and the Internet</u>. Pew Internet & American Life Project. December 5, http://www.pewinternet.org/.

McKie, Duncan (2006) <u>CRIA Consumer Study of Radio and Music Survey Results</u>, Toronto: POLLARA Inc, February.

Oberholzer, Felix and Koleman Strumpf (2004). The Effect of File-sharing on Record Sales: An Empirical Analysis. University of North Carolina. <u>Unpublished Manuscript</u>. March.

Peitz, Martin and Patrick Waelbroeck (2004). The Effect of Internet Piracy on CD Sales: Cross-Section Evidence. <u>CESifo Working Paper</u> No.1122. January.

Rob, Rafael and Joel Waldfogel (2004). <u>Piracy on the High C's: Music Downloading, Sales Displacement, and Social Welfare in a Sample of College Students</u>. National Bureau of Economic Research, Working Paper 10874. October.

Rivera-Batiz. L. and Romer, P. (1991). Economic Integration and Endogenous Growth, <u>The Quarterly Journal of Economics</u>, 2: 531-55.

Romer, Paul (2002). "When Should We Use Intellectual Property Rights?" <u>American Economic Review</u> , Volume 92, Number 2. May.

Sundararajan, Arun (2004): "Managing Digital Piracy: Pricing and Protection," <u>Information Systems Research</u>. Volume 15(2). September.

Tabachnick, Barbara G. and Fidell, Linda S. (2007). <u>Using Multivariate Statistics</u> (5th edition) Northride: Pearson Publishing.

Tanaka, Tatsou (2004): Does file-sharing reduce CD sales?: A Case of Japan, Conference paper prepared for <u>Conference on IT Innovation</u>, Hitotsubashi University, Tokyo.

Varian, Hal R. "Buying, Sharing and Renting Information Goods". <u>Journal of Industrial Economics</u>. Volume 48(4). December 2000.

Wooldridge, Jeffrey M (2000). <u>Introductory Econometrics</u>. Southwestern Publishing.

Zentner, Alejandro (2004). <u>Measuring the Effect of Music Downloads on Music Purchases</u>. University of Chicago. Unpublished Manuscript, Draft.

Tables

Table 3.1: Summary of basic demographics across the dataset based on 2005 data

Variable	Number of observations n		Weighted population N	
	Number	Percent	Number	Percent
Women	1,065	50.7	12,615,189	52.0
Men	1,035	49.3	11,666,415	48.0
Age group 15 and 19	523	25.1	2,860,611	11.8
Age group 20 to 24	298	14.2	1,586,431	6.5
Age group 25 to 34	339	16.2	4,429,441	18.2
Age group 35 to 44	322	15.4	4,933,076	20.3
Age group 45 to 54	277	13.3	4,412,018	18.2
Age group 55 to 64	194	9.3	3,402,099	14.0
Age group 65 plus	134	6.4	2,535,992	10.4
French Canadian	1,006	47.9	5,945,875	24.5
English Canadian	1,094	52.1	18,335,729	75.5
P2P downloads	1,005	47.9	7053251	29.0
No P2P downloads	1,095	52.1	17228353	71.0
Total	**2,100**		**24,281,604**	

Source: own calculations based on Decima Research survey data.

Table 3.2: Patterns of acquiring music within the Canadian population based on 2005 data

Ways to acquire music	Number of population	Percent of population	Standard error in percent
Buy music CDs	18,748,389	77.2	1.3
Buy music tracks from pay-sites	3,311,519	13.6	1.0
Download free music, e.g. promotion websites	5,624,353	23.2	1.1
Download free music from P2P networks	7,053,251	29.0	1.1
Copy MP3s from friends	4,974,705	20.5	1.1
Rip songs from CDs	7,096,634	29.2	1.3
Download music from peoples free music websites	2,074,280	8.5	0.8

Source: own calculations based on Decima Research survey data.

Table 3.3: Summary of variables used for estimating the extent and determinants of music consumption in CD and MP3 pay-markets based on 2005 information

Concept	Variable	Relevance	Type of data
Demand and price in pay markets	• Number of CDs purchased by respondents • Number of MP3s purchased (i.e. buying music tracks from online pay-sites like iTunes or Archambault)	Whole sample	Count
	• Experienced average price of music CDs in $ Canadian • Experienced average price of MP3 music files	Whole sample	Interval
Relative price	• Percentage of P2P downloads due to 'album too expensive'.	P2P file sharers	Percent
Other free	• Downloading free music from P2P file-sharing networks,	Whole	Count

music markets	like Kazaa, LimeWire, eDonkey, BearShare or Gnutella • Ripping CDs and copying them onto computers • Downloading free music from promotional website • Download music from peoples' private Internet websites • Copy MP3 from friends	sample	and Binary (yes/no)
Substitute entertainment goods	• Number of purchased DVDs • Number of purchased video games • Number of movie tickets • Number of live concerts	Whole sample	Count
Availability	• Percentage of P2P downloads due to music 'not elsewhere available' • Percentage of P2P downloads due to wishing to buy 'whole album'	P2P file sharers	Percent
MP3 ownership	• MP3 player ownership.	P2P file sharers	Binary (yes/no)
Music exploring	• Percentage of P2P downloads to 'hear before buying'	P2P file sharers	Percent
Income	• Household income in $ Canadian under 10K • Household income in $ Canadian: income 10K to 20K • Household income in $ Canadian: income 20K to 40K • Household income in $ Canadian: income 40K to 60K • Household income in $ Canadian: income 60K and higher	Whole sample	Interval
Music quality	• Experience of increased 'quality' of music (= more taste for current music) • Experience of decreased 'quality' of music (= less taste for current music) • Experience of same 'quality' of music (= neutral taste for current music)	Whole sample	Binary (yes/no)
Music interest	• Music interest very limited • Music interest somewhat limited • Music interest moderate • Music interest somewhat strong • Music interest very strong	Whole sample	Binary (yes/no)
Internet skills	• Internet skills: not at all skilled • Internet skills: not very skilled • Internet skills: somewhat skilled • Internet skills: skilled • Internet skills: very skilled	Whole sample	Binary (yes/no)
Age	• Age group 15-19 • Age group 20-24 • Age group 25-34 • Age group 35-44 • Age group 45-54 • Age group 55-64 • Age group 65-plus	Whole sample	Binary (yes/no)
Gender	• Male • Female	Whole sample	Binary (yes/no)
Region	• Quebec • Rest of Canada	Whole sample	Binary (yes/no)

Table 4.1: Determinants of CD album purchases in the Canadian population for the year 2005

Dependent variables	Number of CD albums			Log number of CD albums			Square root no of CD albums		
Estimation model	OLS			OLS			OLS		
Independent variables	*b*	*t-value*	*sig*	*b*	*t-value*	*sig*	*b*	*t-value*	*sig*
Price of CDs	-0.019	-0.19		-0.003	-0.50		-0.004	-0.37	
P2P (yes/no)	-2.510	-1.80	*	-0.076	-1.29		-0.206	-1.62	
Rip CD (yes/no)	3.127	2.28	**	0.089	1.39		0.259	1.90	*
Promotional (yes/no)	-0.039	-0.03		-0.103	-1.63	*	-0.114	-0.92	
Private Web (yes/no)	6.513	2.60	***	0.236	2.42	**	0.591	2.66	***
Copy MP3 (yes/no)	-2.658	-2.35	**	-0.130	-2.38	**	-0.291	-2.57	***
Purchased MP3s (yes/no)	0.349	0.28		0.088	1.39		0.113	0.88	
Number of DVDs	0.873	2.06	**	0.080	3.88	***	0.136	3.15	***
Number of videogames	2.129	2.70	***	0.106	3.49	***	0.226	3.28	***
Number of cinema tickets	0.331	0.79		0.043	1.80	*	0.063	1.38	
Number of concert tickets	3.032	3.43	***	0.152	4.78	***	0.320	4.25	***
Income 10 to 20	-0.704	-0.47		-0.032	-0.23		-0.082	-0.38	
Income 20 to 40	0.843	0.55		0.087	0.72		0.126	0.64	
Income 40 to 60	1.071	0.76		0.150	1.25		0.207	1.08	
Income 60 plus	1.112	0.88		0.159	1.39		0.215	1.20	
Quality increase	-0.550	-0.58		0.007	0.12		-0.028	-0.27	
Quality decrease	1.458	0.99		0.074	1.05		0.149	1.02	
Interest very strong	5.760	3.70	***	0.532	3.73	***	0.877	4.03	***
Interest somewhat strong	3.157	2.49	***	0.427	3.08	***	0.621	3.09	***
Interest moderate	-0.087	-0.08		0.144	1.05		0.140	0.73	
Interest somewhat low	-1.423	-1.00		-0.012	-0.08		-0.099	-0.42	
Internet: very skilled	-3.059	-1.49		-0.150	-1.34		-0.329	-1.48	
Internet: skilled	-5.447	-3.01	***	-0.214	-2.12	**	-0.524	-2.65	***
Internet: somewhat skilled	-3.324	-1.88	*	-0.104	-1.03		-0.297	-1.52	
Internet: not very skilled	-5.205	-3.03	***	-0.241	-2.31	**	-0.541	-2.78	***
Age 15 to 19	3.075	1.87	*	0.165	1.35		0.351	1.68	*
Age 20 to 24	3.024	1.88	*	0.188	1.55		0.375	1.82	*
Age 25 to 34	5.036	2.72	***	0.236	1.91	*	0.532	2.44	**
Age 35 to 44	5.184	2.73	***	0.298	2.45	***	0.599	2.74	***
Age 45 to 54	3.770	2.62	***	0.250	2.20	**	0.474	2.50	***
Age 55 to 64	4.432	2.72	***	0.266	2.27	**	0.521	2.61	***
Gender (men =0, women=1)	-1.241	-1.74	*	-0.090	-1.95	**	-0.169	-1.99	**
Region (Quebec=0, rest=1)	-1.683	-2.12	**	-0.102	-2.23	**	-0.200	-2.29	**
Constant	4.971	1.80	*	1.522	6.60	***	2.005	5.36	***
Number of observations	1,459			1,459			1,459		
Population size	15,962,300			15,962,300			15,962,300		
F-value		5.29	***		7.63	***		6.86	***
R-square	0.22			0.23			0.23		

* p<0.10; ** p<0.05; *** p<0.01. All regressions are estimated with a constant. The number of observations is smaller than the total number of respondents in the survey due to missing values; e.g. Price of CDs was answered by 1,575 survey participants.
Source: own calculations based on Decima Research survey.

Table 4.1: Determinants of CD album purchases in the Canadian population for the year 2005 (continued)

Dependent variables	Number of CD albums			Number of CD albums		
Estimation model	Poisson			Negative binomial		
Independent variables	M.E.	t-value	sig	M.E.	t-value	sig
Price of CDs	-0.008	-0.08		0.002	0.02	
P2P (yes/no)	-1.619	-2.01	**	-0.948	-1.40	
Rip CD (yes/no)	2.780	2.50	***	2.440	2.67	***
Promotional (yes/no)	-0.313	-0.41		-0.620	-0.88	
Private Web (yes/no)	4.300	3.49	***	3.686	2.85	***
Copy MP3 (yes/no)	-2.007	-2.64	***	-1.648	-2.45	***
Purchased MP3s (yes/no)	0.235	0.29		0.398	0.55	
Number of DVDs	0.701	2.35	**	0.694	2.95	***
Number of videogames	1.354	3.61	***	1.018	3.10	***
Number of cinema tickets	0.380	1.21		0.444	1.66	*
Number of concert tickets	1.946	4.42	***	1.518	4.17	***
Income 10 to 20	-1.208	-0.76		-0.897	-0.58	
Income 20 to 40	0.416	0.26		0.720	0.48	
Income 40 to 60	0.904	0.63		1.167	0.83	
Income 60 plus	0.868	0.66		1.322	1.02	
Quality increase	-0.359	-0.51		-0.480	-0.78	
Quality decrease	1.263	1.30		0.970	1.13	
Interest very strong	8.081	3.78	***	8.793	4.26	***
Interest somewhat strong	5.944	2.94	***	6.565	3.31	***
Interest moderate	1.651	0.91		2.231	1.24	
Interest somewhat low	-0.685	-0.34		0.278	0.14	
Internet: very skilled	-3.080	-2.14	**	-2.380	-1.83	*
Internet: skilled	-4.424	-3.41	***	-3.416	-2.98	***
Internet: somewhat skilled	-2.820	-2.11	**	-1.950	-1.64	*
Internet: not very skilled	-4.288	-3.54	***	-3.515	-3.20	***
Age 15 to 19	4.670	2.44	**	3.122	1.93	**
Age 20 to 24	5.003	2.61	***	2.870	1.79	*
Age 25 to 34	6.328	3.03	***	3.944	2.24	**
Age 35 to 44	6.742	3.36	***	4.412	2.76	***
Age 45 to 54	5.476	3.14	***	3.360	2.27	**
Age 55 to 64	6.353	3.05	***	4.006	2.42	**
Gender (men =0, women=1)	-0.889	-1.39		-1.046	-1.87	*
Region (Quebec=0, rest=1)	-1.389	-1.95	**	-1.862	-2.98	***
Constant	1.491	4.83	***	1.535	5.57	***
Number of observations	1,459			1,459		
Population size	15,962,300			15,962,300		
F-value		8.96	***		9.03	***

* $p<0.10$; ** $p<0.05$; *** $p<0.01$. All regressions are estimated with a constant. Marginal effects (M.E.) are given with the t statistics of the underlying coefficients. M.E. are calculated at the means of the regressors in the case of continuous data and for discrete change from 0 to 1 in the case of dichotomous variables. The number of observations is smaller than the total number of respondents in the survey due to missing values; e.g. Price of CDs was answered by 1,575 survey participants.
Source: own calculations based on Decima Research survey.

Table 4.2: Determinants of MP3 purchases in the Canadian population for the year 2005

Dependent variables	Number of MP3s			Log no of MP3s			Square root no of MP3s		
Estimation model	OLS			OLS			OLS		
Independent variables	b	t-value	sig	b	t-value	sig	b	t-value	sig
Price of CDs	-0.054	-1.66	*	-0.002	-0.61		-0.006	-0.92	
P2P (yes/no)	1.154	2.19	**	0.141	2.15	**	0.222	2.29	**
Rip CD (yes/no)	1.958	3.74	***	0.282	4.34	***	0.420	4.34	***
Promotional (yes/no)	-0.183	-0.29		0.002	0.02		-0.009	-0.08	
Private Web (yes/no)	-0.601	-0.88		-0.002	-0.01		-0.039	-0.26	
Copy MP3 (yes/no)	-0.416	-0.79		-0.031	-0.48		-0.056	-0.59	
Number of DVDs	0.401	1.77	*	0.058	2.30	**	0.085	2.19	**
Number of videogames	0.121	0.41		0.009	0.26		0.015	0.28	
Number of cinema tickets	0.454	2.79	***	0.047	2.23	**	0.077	2.50	***
Number of concert tickets	-0.011	-0.05		0.009	0.32		0.010	0.24	
Income 10 to 20	-0.631	-0.86		-0.073	-0.75		-0.112	-0.78	
Income 20 to 40	-0.219	-0.33		-0.068	-0.79		-0.086	-0.68	
Income 40 to 60	-0.017	-0.02		0.000	0.00		0.000	0.00	
Income 60 plus	0.380	0.55		0.021	0.24		0.046	0.36	
Quality increase	1.173	2.10	**	0.113	1.77	*	0.184	1.91	*
Quality decrease	-0.562	-1.22		-0.109	-1.82	*	-0.152	-1.72	*
Interest very strong	0.164	0.39		0.057	1.04		0.075	0.93	
Interest somewhat strong	0.484	0.94		0.123	1.98	**	0.165	1.78	*
Interest moderate	-0.053	-0.13		0.021	0.40		0.024	0.30	
Interest somewhat low	0.133	0.25		0.074	0.83		0.090	0.72	
Internet: very skilled	1.078	1.92	*	0.181	2.60	***	0.259	2.50	***
Internet: skilled	0.293	0.84		0.150	2.43	**	0.185	2.20	**
Internet: somewhat skilled	-0.038	-0.13		0.026	0.65		0.027	0.47	
Internet: not very skilled	0.093	0.31		0.005	0.13		0.010	0.18	
Age 15 to 19	-0.712	-0.83		-0.145	-1.39		-0.199	-1.28	
Age 20 to 24	0.329	0.30		-0.140	-1.30		-0.137	-0.81	
Age 25 to 34	-1.109	-1.81	*	-0.096	-1.04		-0.164	-1.26	
Age 35 to 44	-1.008	-1.74	*	-0.122	-1.48		-0.186	-1.58	
Age 45 to 54	-0.730	-1.61		-0.053	-0.64		-0.095	-0.86	
Age 55 to 64	-0.357	-0.67		-0.092	-1.31		-0.119	-1.17	
Gender (men =0, women=1)	0.095	0.30		0.025	0.58		0.032	0.52	
Region (Quebec=0, rest=1)	0.044	0.13		0.020	0.52		0.023	0.40	
Constant	0.221	0.25		-0.073	-0.57		-0.073	-0.40	
Number of observations	1,458			1,458			1,458		
Population size	15,984,496			15,984,496			15,984,496		
F-value		2.49	***		4.52	***		4.08	***
R-square		0.08			0.12			0.11	

* p<0.10; ** p<0.05; *** p<0.01. All regressions are estimated with a constant. The number of observations is smaller than the total number of respondents in the survey due to missing values; e.g. Price of CDs was answered by 1,575 survey participants.

Source: own calculations based on Decima Research survey.

Table 4.2: Determinants of MP3 purchases in the Canadian population for the year 2005 (continued)

Dependent variables	Purchased MP3s (yes/no)			Purchased MP3s (yes/no)		
Estimation model	Probit			Logit		
Independent variables	*M.E.*	*t-value*	*sig*	*M.E.*	*t-value*	*sig*
Price of CDs	0.001	0.52		0.001	0.53	
P2P (yes/no)	0.063	2.59	***	0.053	2.41	**
Rip CD (yes/no)	0.140	5.43	***	0.128	5.20	***
Promotional (yes/no)	-0.008	-0.33		-0.008	-0.38	
Private Web (yes/no)	0.015	0.43		0.014	0.45	
Copy MP3 (yes/no)	0.024	1.00		0.022	1.03	
Number of DVDs	0.009	0.98		0.009	1.18	
Number of videogames	0.005	0.35		0.004	0.35	
Number of cinema tickets	0.019	1.82	*	0.018	1.91	*
Number of concert tickets	0.007	0.64		0.007	0.66	
Income 10 to 20	-0.055	-1.13		-0.051	-1.22	
Income 20 to 40	-0.068	-1.47		-0.063	-1.58	
Income 40 to 60	-0.033	-0.67		-0.033	-0.76	
Income 60 plus	-0.025	-0.50		-0.024	-0.55	
Quality increase	0.048	1.81	*	0.044	1.84	*
Quality decrease	-0.030	-0.98		-0.024	-0.86	
Interest very strong	0.145	1.55		0.172	1.41	
Interest somewhat strong	0.210	2.01	**	0.248	1.75	*
Interest moderate	0.140	1.41		0.180	1.35	
Interest somewhat low	0.132	1.01		0.174	1.00	
Internet: very skilled	0.263	4.05	***	0.324	3.64	***
Internet: skilled	0.278	4.42	***	0.328	3.86	***
Internet: somewhat skilled	0.145	2.62	***	0.180	2.53	***
Internet: not very skilled	0.185	2.85	***	0.242	2.75	***
Age 15 to 19	-0.069	-1.24		-0.064	-1.11	
Age 20 to 24	-0.068	-1.24		-0.061	-1.10	
Age 25 to 34	-0.039	-0.60		-0.039	-0.59	
Age 35 to 44	-0.043	-0.68		-0.039	-0.57	
Age 45 to 54	-0.020	-0.29		-0.016	-0.22	
Age 55 to 64	-0.053	-0.82		-0.049	-0.72	
Gender (men =0, women=1)	0.046	2.32	**	0.041	2.24	**
Region (Quebec=0, rest=1)	-0.009	-0.46		-0.006	-0.31	
Constant	-3.135	-4.66	***	-6.216	-4.09	***
Number of observations	1,458			1,458		
Population size	15,984,496			15,984,496		
F-value		4.94	***		4.20	***

* p<0.10; ** p<0.05; *** p<0.01. All regressions are estimated with a constant. Marginal effects (M.E.) are given with the t statistics of the underlying coefficients. M.E. are calculated at the means of the regressors in the case of continuous data and for discrete change from 0 to 1 in the case of dichotomous variables. The number of observations is smaller than the total number of respondents in the survey due to missing values; e.g. Price of CDs was answered by 1,575 survey participants.
Source: own calculations based on Decima Research survey.

Table 4.3: Determinants of CD album purchases in the sub-sample of P2P downloaders for the year 2005

Dependent variables Estimation Model	Number of CD albums OLS			Log Number of CD albums OLS			Square root no of CD albums OLS		
Independent variables	b	t-value	sig	b	t-value	sig	b	t-value	sig
Price CD albums	0.021	0.12		-0.007	-0.60		-0.005	-0.24	
Album too expensive	-0.036	-1.89	*	-0.003	-2.34	**	-0.005	-2.22	**
Number P2P	1.238	2.04	**	0.094	2.50	**	0.169	2.37	**
Number CDs ripped	3.536	4.10	***	0.195	4.74	***	0.401	4.65	***
Number promotional sites	-0.544	-1.19		-0.013	-0.50		-0.043	-0.82	
Number private websites	1.966	1.45		0.075	1.63	*	0.186	1.60	
Number MP3s copied	-0.261	-0.45		-0.022	-0.67		-0.036	-0.57	
Number of MP3s purchased	0.299	0.54		0.039	1.06		0.060	0.88	
Number DVDs	0.066	0.14		0.027	0.89		0.030	0.53	
Number videogames	1.146	1.70	*	0.090	2.31	**	0.156	2.06	**
Number cinema tickets	0.827	1.33		0.054	1.18		0.103	1.28	
Number concert tickets	1.272	1.29		0.082	1.66	*	0.153	1.52	
Not elswhere available	0.032	1.71	*	0.003	2.20	**	0.005	2.06	**
Not whole album	-0.018	-0.92		-0.001	-0.53		-0.002	-0.86	
MP3 player ownership	-2.598	-1.98	**	-0.160	-1.97	**	-0.307	-2.03	**
Hear before buying	0.022	1.41		0.002	1.71	*	0.003	1.60	
Income 10 to 20	1.622	0.46		0.161	0.65		0.232	0.53	
Income 20 to 40	-0.713	-0.36		0.117	0.63		0.067	0.23	
Income 40 to 60	0.761	0.37		0.109	0.58		0.140	0.47	
Income 60 plus	0.984	0.49		0.147	0.79		0.197	0.67	
Quality increased	-0.106	-0.09		0.122	1.44		0.108	0.69	
Quality decreased	1.824	0.89		0.129	1.22		0.205	0.96	
Interest very strong	5.674	1.61		0.250	1.10		0.631	1.53	
Interest somewhat strong	4.424	1.60		0.172	0.85		0.469	1.35	
Interest moderate	1.189	0.40		-0.094	-0.45		0.013	0.04	
Interest somewhat low	-3.580	-0.96		-0.329	-1.35		-0.512	-1.17	
Internet: very skilled	3.780	0.80		0.518	1.76	*	0.708	1.33	
Internet: skilled	4.899	1.06		0.532	1.89	*	0.781	1.54	
Internet: somewhat skilled	4.735	1.02		0.596	2.06	**	0.837	1.61	
Internet: not very skilled	1.907	0.39		0.261	0.84		0.329	0.59	
Age 15 to 19	-1.374	-0.30		-0.151	-0.58		-0.249	-0.50	
Age 20 to 24	-1.584	-0.38		-0.095	-0.39		-0.193	-0.42	
Age 25 to 34	-0.608	-0.14		0.054	0.21		0.023	0.05	
Age 35 to 44	1.038	0.27		0.099	0.43		0.144	0.33	
Age 45 to 54	1.101	0.24		0.051	0.21		0.102	0.21	
Age 55 to 64	0.255	0.05		0.178	0.56		0.182	0.30	
Gender (men =0, women=1)	-1.955	-1.74	*	-0.017	-0.23		-0.145	-1.04	
Region (Quebec=0, rest=1)	-1.167	-1.05		-0.134	-1.81	*	-0.208	-1.52	
Constant	-3.209	-0.43		1.043	2.22	**	1.063	1.23	
Number of observations n	458			458			44582		
Population N	3,113,998			3,113,998			3,113,998		
F-statistic	5.67		***	10.04		***	7.82		***
R-square	0.30			0.30			0.31		

* p<0.10; ** p<0.05; *** p<0.01. All regressions are estimated with a constant. All estimation are based on the sub-sample of P2P downloaders only. There are 1,005 P2P downloaders in the survey. The number of observations in the regressions is 458 due to further missing values; e.g. only 759 participants gave information regarding the use of MP3 players. Furthermore, 246 observations were dropped from the regression. These are cases where participants answered that they downloaded from P2P networks yet estimated their number of downloads as zero.
Source: own calculations based on Decima Research survey.

Table 4.3: Determinants of CD album purchases in the sub-sample of P2P downloaders for the year 2005

Dependent variables	Number of CD albums			Number of CD albums		
Estimation Model	Poisson			Negative binomial		
Independent variables	M.E.	t-value	sig	M.E.	t-value	sig
Price CD albums	0.021	0.15		0.012	0.10	
Album too expensive	-0.031	-2.10	**	-0.032	-2.65	***
Number P2P	1.092	2.34	**	1.212	2.94	***
Number CDs ripped	2.525	5.28	***	2.352	5.42	***
Number promotional sites	-0.325	-1.00		-0.212	-0.74	
Number private websites	0.790	1.72	*	0.737	1.59	
Number MP3s copied	-0.444	-1.21		-0.332	-0.94	
Number of MP3s purchased	0.339	0.82		0.465	1.11	
Number DVDs	0.060	0.16		0.120	0.38	
Number videogames	1.108	2.29	**	1.012	2.38	**
Number cinema tickets	0.852	1.61		0.918	1.82	*
Number concert tickets	1.028	1.57		0.905	1.68	*
Not elsewhere available	0.035	2.44	**	0.036	2.63	***
Not whole album	-0.015	-1.02		-0.017	-1.26	
MP3 player ownership	-2.141	-2.10	**	-1.851	-1.91	*
Hear before buying	0.016	1.30		0.013	1.15	
Income 10 to 20	1.712	0.49		1.501	0.46	
Income 20 to 40	-0.802	-0.40		-0.172	-0.09	
Income 40 to 60	0.458	0.22		0.190	0.09	
Income 60 plus	0.594	0.30		0.881	0.45	
Quality increased	-0.076	-0.07		0.458	0.47	
Quality decreased	0.843	0.64		0.379	0.32	
Interest very strong	6.591	2.31	**	7.054	2.85	***
Interest somewhat strong	5.914	2.29	**	5.876	2.46	***
Interest moderate	1.861	0.69		2.307	0.98	
Interest somewhat low	-2.223	-0.82		-1.599	-0.63	
Internet: very skilled	4.682	0.86		3.168	0.66	
Internet: skilled	5.851	1.05		3.921	0.80	
Internet: somewhat skilled	6.149	1.05		4.889	0.94	
Internet: not very skilled	2.434	0.42		0.980	0.19	
Age 15 to 19	-0.937	-0.27		-1.536	-0.50	
Age 20 to 24	-1.256	-0.40		-1.040	-0.36	
Age 25 to 34	-0.355	-0.10		-0.111	-0.04	
Age 35 to 44	1.031	0.33		0.608	0.22	
Age 45 to 54	0.924	0.26		0.206	0.07	
Age 55 to 64	-0.358	-0.09		0.725	0.18	
Gender (men =0, women=1)	-1.694	-1.70	*	-1.389	-1.62	*
Region (Quebec=0, rest=1)	-0.992	-1.01		-1.918	-2.09	*
Constant	0.857	1.35		0.991	1.69	*
Number of observations n	458			458		
Population N	3,113,998			3,113,998		
F-statistic		19.77	***		15.09	***

* p<0.10; ** p<0.05; *** p<0.01. All regressions are estimated with a constant. All estimation are based on the sub-sample of P2P downloaders only. There are 1,005 P2P downloaders in the survey. The number of observations in the regressions is 458 due to further missing values; e.g. only 759 participants gave information regarding the use of MP3 players. Furthermore, 246 observations were dropped from the regression. These are cases where participants answered that they downloaded from P2P networks yet estimated their number of downloads as zero. M.E. are calculated at the means of the regressors in the case of continuous data and for discrete change from 0 to 1 in the case of dichotomous variables.
Source: own calculations based on Decima Research survey.

Table 4.4: Determinants of MP3 purchases in the sub-sample of P2P downloaders for the year 2005

Dependent variables	Number of MP3s			Log no of MP3s			Square root no of MP3s		
Estimation model	OLS			OLS			OLS		
Independent variables	*b*	*t-value*	*sig*	*b*	*t-value*	*sig*	*b*	*t-value*	*sig*
Price CD albums	-0.283	-1.99	**	-0.032	-2.20	**	-0.050	-2.18	**
Album too expensive	-0.015	-0.86		-0.001	-0.42		-0.002	-0.57	
Number P2P	-0.183	-0.43		-0.036	-0.76		-0.049	-0.68	
Number CDs ripped	1.243	2.09	**	0.147	2.24	**	0.230	2.23	**
Number promotional sites	-0.039	-0.09		0.029	0.71		0.033	0.50	
Number private websites	-1.133	-1.72	*	-0.102	-1.51		-0.177	-1.70	*
Number MP3s copied	0.524	0.78		-0.015	-0.28		0.012	0.13	
Number DVDs	-0.149	-0.37		0.027	0.61		0.023	0.33	
Number videogames	0.910	1.08		0.044	0.71		0.091	0.85	
Number cinema tickets	2.166	3.57	***	0.247	4.18	***	0.389	4.11	***
Number concert tickets	-0.052	-0.11		0.000	-0.01		-0.003	-0.04	
Not elsewhere available	0.005	0.33		0.002	0.88		0.002	0.74	
Not whole album	0.006	0.41		0.000	0.07		0.001	0.21	
MP3 player ownership	-0.030	-0.03		0.172	1.22		0.194	0.89	
Hear before buying	0.032	1.98	**	0.003	1.96	**	0.005	2.00	**
Income 10 to 20	-0.566	-0.37		-0.163	-0.79		-0.201	-0.68	
Income 20 to 40	0.710	0.48		-0.096	-0.48		-0.064	-0.22	
Income 40 to 60	0.267	0.18		-0.002	-0.01		0.019	0.06	
Income 60 plus	1.996	1.39		0.117	0.61		0.243	0.88	
Quality increased	3.329	1.79	*	0.133	0.86		0.316	1.24	
Quality decreased	-2.383	-2.49	**	-0.327	-2.67	***	-0.484	-2.66	***
Interest very strong	0.386	0.15		-0.011	-0.03		-0.003	-0.01	
Interest somewhat strong	0.279	0.10		0.006	0.02		0.017	0.03	
Interest moderate	0.989	0.41		0.045	0.13		0.099	0.19	
Interest somewhat low	2.161	0.47		0.306	0.47		0.449	0.47	
Internet: very skilled	1.814	0.79		0.157	0.70		0.276	0.77	
Internet: skilled	1.803	0.79		0.206	0.93		0.327	0.92	
Internet: somewhat skilled	0.850	0.39		0.083	0.37		0.140	0.40	
Internet: not very skilled	0.873	0.32		0.178	0.67		0.239	0.58	
Age 15 to 19	-5.417	-0.98		-0.599	-0.93		-0.950	-0.97	
Age 20 to 24	-3.234	-0.69		-0.506	-0.82		-0.736	-0.80	
Age 25 to 34	-5.006	-0.95		-0.436	-0.68		-0.742	-0.77	
Age 35 to 44	-3.188	-0.65		-0.331	-0.54		-0.530	-0.57	
Age 45 to 54	-4.335	-0.90		-0.555	-0.90		-0.843	-0.92	
Age 55 to 64	-4.218	-0.83		-0.587	-0.90		-0.886	-0.91	
Gender (men =0, women=1)	0.185	0.19		0.086	0.78		0.110	0.66	
Region (Quebec=0, rest=1)	-0.943	-1.01		-0.117	-1.19		-0.182	-1.19	
Constant	2.567	0.42		0.485	0.61		0.667	0.56	
Number of observations n	458			458			458		
Population N	3,113,998			3,113,998			3,113,998		
F-statistic	1.47		**	3.01		***	2.76		***
R-square	0.13			0.17			0.16		

* p<0.10; ** p<0.05; *** p<0.01. All regressions are estimated with a constant. All estimation are based on the sub-sample of P2P downloaders only. There are 1,005 P2P downloaders in the survey.

The number of observations in the regressions is 458 due to further missing values; e.g. only 759 participants gave information regarding the use of MP3 players. Furthermore, 246 observations were dropped from the regression. These are cases where participants answered that they downloaded from P2P networks yet estimated their number of downloads as zero.
Source: own calculations based on Decima Research survey.

Table 4.4: Determinants of MP3 purchases in the sub-sample of P2P downloaders for the year 2005 (continued)

Dependent variables	Purchased MP3s (yes/no)			Purchased MP3s (yes/no)		
Estimation model	Probit			Logit		
Independent variables	*M.E.*	*t-value*	*sig*	*M.E.*	*t-value*	*sig*
Price CD albums	-0.017	-2.93	***	-0.017	-2.85	***
Album too expensive	0.000	0.58		0.000	0.61	
Number P2P	-0.005	-0.26		-0.005	-0.32	
Number CDs ripped	0.060	2.51	***	0.057	2.39	**
Number promotional sites	0.020	1.30		0.021	1.36	
Number private websites	-0.034	-1.39		-0.034	-1.40	
Number MP3s copied	-0.012	-0.74		-0.014	-0.86	
Number DVDs	0.026	1.57		0.024	1.50	
Number videogames	0.033	1.55		0.032	1.57	
Number cinema tickets	0.088	3.98	***	0.082	3.76	***
Number concert tickets	0.014	0.56		0.017	0.69	
Not elsewhere available	0.001	1.42		0.001	1.44	
Not whole album	0.000	-0.05		0.000	-0.15	
MP3 player ownership	0.165	3.68	***	0.162	3.53	***
Hear before buying	0.001	1.56		0.001	1.54	
Income 10 to 20	0.098	0.71		0.119	0.77	
Income 20 to 40	-0.034	-0.34		-0.035	-0.36	
Income 40 to 60	0.043	0.42		0.046	0.44	
Income 60 plus	0.124	1.34		0.125	1.35	
Quality increased	0.020	0.40		0.022	0.46	
Quality decreased	-0.147	-2.67	***	-0.135	-2.48	***
Internet: very skilled	0.137	0.60		0.232	0.85	
Internet: skilled	0.176	0.75		0.279	0.97	
Internet: somewhat skilled	0.131	0.54		0.228	0.76	
Internet: not very skilled	0.116	0.42		0.201	0.58	
Gender (men =0, women=1)	0.130	2.81	***	0.127	2.73	***
Region (Quebec=0, rest=1)	-0.164	-3.60	***	-0.147	-3.18	***
Constant	-2.103	-2.28	***	-4.270	-2.25	***
Number of observations n	474			474		
Population N	3,256,621			3,256,621		
F-statistic	3.27		***	2.59		***

* p<0.10; ** p<0.05; *** p<0.01. All regressions are estimated with a constant. Marginal effects (M.E.) are given with the t statistics of the underlying coefficients. M.E. are calculated at the means of the regressors in the case of continuous data and for discrete change from 0 to 1 in the case of dichotomous variables.

The number of observations in the regressions is 458 due to further missing values; e.g. only 759 participants gave information regarding the use of MP3 players. Furthermore, 246 observations were dropped from the regression. These are cases where participants answered that they downloaded from P2P networks yet estimated their number of downloads as zero. Variables measuring the interest in music and age of participants are omitted from the regression due to problems of multicollinearity. *Source*: own calculations based on Decima Research survey.

Appendices

Appendix 1: Differences in acquiring music depending on gender, age and region

Appendix 1 explores whether gender, age and region matter with respect to how people acquire music; e.g. are women more likely to purchase music CDs than men and/or exhibit a lower propensity to download music from P2P sites.

Table A.1: Patterns of acquiring music across men and women

Ways to acquire music	Women			Men		
	Count of population	*Percent of population*	*Standard error*	*Count of population*	*Percent of population*	*Standard error*
Buy music CDs	10,102,159	80.1	1.8	8,646,230	74.1	1.8
Buy music tracks from pay-sites	1,560,718	12.4	1.3	1,750,802	15	1.4
Download free music, e.g. promotion websites	2,405,097	19.1	1.5	3,219,256	27.6	1.7
Download free music from P2P networks	2,955,254	23.4	1.4	4,097,997	35.1	1.8
Copy MP3s from friends	2,134,577	16.9	1.5	2,840,128	24.3	1.6
Rip songs from CDs	2,700,280	21.4	1.7	4,396,354	37.7	1.9
Download music from peoples free music websites	958,701	7.6	1.2	1,115,579	9.6	1.2
Total	**12,615,189**	**100**		**11,666,415**	**100**	

Table A.1 shows that women are more likely to purchase CD albums in shops with 80.1 percent of women buying CDs and 74.1 percent of men. However, women appear less likely than men to download music from the web, copy MP3s or rip songs from CDs.

Table A.2: Patterns of acquiring music across age groups

Ways to acquire music	Age group 15 to 19			Age group 20 to 24		
	Count of population	*Percent of population*	*Standard error*	*Count of population*	*Percent of population*	*Standard error*
Buy music CDs	10,102,159	80.1	2.1	8,646,230	74.1	2.7
Buy music tracks from pay-sites	1,560,718	12.4	2.0	1,750,802	15	2.4
Download free music, e.g. promotion websites	2,405,097	19.1	2.5	3,219,256	27.6	3.2
Download free music from P2P networks	2,955,254	23.4	2.6	4,097,997	35.1	3.4
Copy MP3s from friends	2,134,577	16.9	2.5	2,840,128	24.3	3.3
Rip songs from CDs	2,700,280	21.4	2.5	4,396,354	37.7	3.4
Download music from peoples' free music websites	958,701	7.6	1.3	1,115,579	9.6	2.0
Total	**12,615,189**	**100**		**11,666,415**	**100**	

Table A.2: Patterns of acquiring music across age groups (continued)

Ways to acquire music	Age group 25 to 34			Age group 35 to 44		
	Count of population	*Percent of population*	*Standard error*	*Count of population*	*Percent of population*	*Standard error*
Buy music CDs	3,504,201	79.1	2.8	3,837,173	77.8	3.0
Buy music tracks from pay-sites	841,236	19.0	2.7	775,595	15.7	2.4
Download free music, e.g. promotion websites	1,365,926	30.8	3.2	1,313,243	26.6	2.9
Download free music from P2P networks	1,802,373	40.7	3.2	1,515,105	30.7	2.9
Copy MP3s from friends	1,287,533	29.1	3.1	882,187	17.9	2.7
Rip songs from CDs	1,692,141	38.2	3.4	1,434,486	29.1	3.1
Download music from peoples' free music websites	366,956	8.3	1.9	507,163	10.3	2.2
Total	**4,429,441**	**100**		**4,933,076**	**100**	

Ways to acquire music	Age group 45 to 54			Age group 55 to 64		
	Count of population	*Percent of population*	*Standard error*	*Count of population*	*Percent of population*	*Standard error*
Buy music CDs	3,671,413	83.2	2.9	2,474,054	72.7	3.9
Buy music tracks from pay-sites	517,425	11.7	2.4	248,226	7.3	2.3
Download free music, e.g. promotion websites	666,448	15.1	2.5	333,203	9.8	2.5
Download free music from P2P networks	704,688	16.0	2.2	287,331	8.4	1.8
Copy MP3s from friends	655,609	14.9	2.5	284,788	8.4	2.2
Rip songs from CDs	1,007,073	22.8	3.1	395,815	11.6	2.7
Download music from peoples' free music websites	496,858	11.3	2.5	149,574	4.4	1.7
Total	**4,412,018**	**100**		**3,402,099**	**100**	

Ways to acquire music	Age group 65 plus		
	Count of population	*Percent of population*	*Standard error*
Buy music CDs	1,544,698	60.9	5.1
Buy music tracks from pay-sites	100,178	4.0	2.2
Download free music, e.g. promotion websites	60,635	2.4	1.3
Download free music from P2P networks	45,791	1.8	1.2
Copy MP3s from friends	108,765	4.3	2.1
Rip songs from CDs	207,083	8.2	2.7
Download music from peoples' free music websites	150,745	5.9	2.7
Total	**2,535,992**	**100**	

Table A.2 shows that around 80 percent of people purchased CD albums in the age groups 15 to 54. For the age group 55 to 64, 73 percent bought CD albums and in the age group 65 and above, 61 percent bought CD albums. Music downloading

behaviours differ across age groups. For example, people in the youngest age group (15 to 19) exhibit the highest propensity to download free music via P2P networks (62 percent) and download music from promotional websites (46 percent). Between 8 and 11 percent of people in the age groups 15 to 54 acquire music through peoples' private website.

The next table, Table A.3, examines differences in acquiring music across the French and English speaking regions of Canada.

Table A.3: Patterns of acquiring music across regions

Ways to acquire music	Quebec			Rest of Canada		
	Count of population	Percent of population	Standard error	Count of population	Percent of population	Standard error
Buy music CDs	4,641,306	78.1	1.7	14,107,083	76.9	1.6
Buy music tracks from pay-sites	717,355	12.1	1.1	2,594,165	14.1	1.2
Download free music, e.g. promotion websites	795,176	13.4	1.1	4,829,177	26.3	1.5
Download free music from P2P networks	1,707,249	28.7	1.5	5,346,002	29.2	1.4
Copy MP3s from friends	1,278,323	21.5	1.5	3,696,383	20.2	1.4
Rip songs from CDs	1,281,709	21.6	1.5	5,814,925	31.7	1.6
Download music from peoples' free music websites	374,816	6.3	0.8	1,699,464	9.3	1.1
Total	**5,945,875**	**100**		**18,335,729**	**100**	

Table A.3 shows that there are similar patterns in terms of buying CD albums in Quebec compared with the rest of Canada. Individuals residing in Quebec have a somewhat lower propensity to engage in free music downloads through promotional websites (13.4 percent) and are less likely to rip songs from CDs (21.6 percent). They are slightly less active in terms of purchasing music through pay-sites (12.1 percent).

Appendix 2: Descriptive statistics including all variables in Equations 1 and 2

	Variable	Number of observations	Weighted population	Mean	Standard deviation	Min	Max
1	Number of CD albums	2,097	24,224,658	8.36	12.25	0.00	100.00
2	Log of number of CDs	2,097	24,224,658	1.63	1.15	0.00	4.62
3	Square root of number of CDs	2,097	24,224,658	2.26	1.81	0.00	10.00
4	Number of MP3s	2,097	24,251,724	1.28	6.77	0.00	100.00
5	Log of number of MP3s	2,097	24,251,724	0.21	0.70	0.00	4.62
6	Square root of MP3s	2,097	24,251,724	0.30	1.09	0.00	10.00
7	Purchased MP3s (yes/no)	2,100	24,281,604	0.14	0.34	0.00	1.00
8	Price of CDs	1,575	17,282,842	17.45	4.24	1.00	45.00
9	P2P (yes/no)	2,100	24,281,604	0.29	0.45	0.00	1.00
10	Rip CD (yes/no)	2,100	24,281,604	0.29	0.45	0.00	1.00
11	Promotional (yes/no)	2,100	24,281,604	0.23	0.42	0.00	1.00
12	Private web (yes/no)	2,100	24,281,604	0.09	0.28	0.00	1.00
13	Copy MP3 (yes/no)	2,100	24,281,604	0.20	0.40	0.00	1.00
14	Number of P2P (ln)	2,098	24,273,817	0.80	1.40	0.00	6.22
15	Number of CDs ripped (ln)	2,044	23,789,113	0.34	0.77	0.00	4.62
16	Number of promotional (ln)	2,059	23,790,318	0.42	0.96	0.00	6.22
17	Number from private web (ln)	2,089	24,105,177	0.17	0.57	0.00	4.71
18	Number of copied MP3s (ln)	2,061	23,883,048	0.43	1.02	0.00	6.22
19	Number of DVDs (ln)	2,075	23,929,390	0.90	1.21	0.00	4.62
20	Number of videogames (ln)	2,091	24,195,622	0.38	0.78	0.00	3.93
21	Number of cinema tickets (ln)	2,061	23,911,201	1.41	1.08	0.00	4.65
22	Number of concert tickets (ln)	2,091	24,180,364	0.49	0.76	0.00	3.93
23	Income 10 to 20	2,100	24,281,604	0.07	0.26	0.00	1.00
24	Income 20 to 40	2,100	24,281,604	0.21	0.41	0.00	1.00
25	Income 40 to 60	2,100	24,281,604	0.21	0.41	0.00	1.00
26	Income 60 plus	2,100	24,281,604	0.46	0.50	0.00	1.00
27	Quality increase	2,005	22,777,262	0.19	0.39	0.00	1.00
28	Quality decrease	2,005	22,777,262	0.15	0.36	0.00	1.00
29	Interest very strong	2,090	24,147,546	0.30	0.46	0.00	1.00
30	Interest somewhat strong	2,090	24,147,546	0.24	0.43	0.00	1.00
31	Interest moderate	2,090	24,147,546	0.31	0.46	0.00	1.00
32	Interest somewhat low	2,090	24,147,546	0.08	0.27	0.00	1.00
33	Internet: very skilled	2,064	23,805,632	0.20	0.40	0.00	1.00
34	Internet: skilled	2,064	23,805,632	0.25	0.43	0.00	1.00
35	Internet: somewhat skilled	2,064	23,805,632	0.29	0.45	0.00	1.00
36	Internet: not very skilled	2,064	23,805,632	0.12	0.33	0.00	1.00
37	Age 15 to 19	2,087	24,159,670	0.12	0.32	0.00	1.00
38	Age 20 to 24	2,087	24,159,670	0.07	0.25	0.00	1.00
39	Age 25 to 34	2,087	24,159,670	0.18	0.39	0.00	1.00
40	Age 35 to 44	2,087	24,159,670	0.20	0.40	0.00	1.00
41	Age 45 to 54	2,087	24,159,670	0.18	0.39	0.00	1.00
42	Age 55 to 64	2,087	24,159,670	0.14	0.35	0.00	1.00
43	Gender (men =0, women=1)	2,100	24,281,604	0.52	0.50	0.00	1.00
44	Region (Quebec=0, rest=1)	2,100	24,281,604	0.76	0.43	0.00	1.00

Source: own calculations based on Decima Research survey.

Appendix 2: Correlations including all variables in Equations 1 and 2 (continued)

Variables		1	2	3	4	5	6	7	8	9	10
1	Number of CD albums	1.00									
2	Log of number of CDs	0.85	1.00								
3	Square root of number of CDs	0.95	0.97	1.00							
4	Number of MP3s	0.09	0.11	0.11	1.00						
5	Log of number of MP3s	0.11	0.13	0.13	0.83	1.00					
6	Square root of MP3s	0.11	0.13	0.13	0.91	0.99	1.00				
7	Purchased MP3s (yes/no)	0.09	0.12	0.11	0.51	0.78	0.73	1.00			
8	Price of CDs	-0.02	-0.01	-0.02	-0.04	-0.02	-0.02	0.01	1.00		
9	P2P (yes/no)	0.05	0.06	0.06	0.14	0.18	0.18	0.18	0.01	1.00	
10	Rip CD (yes/no)	0.18	0.15	0.17	0.20	0.25	0.24	0.26	-0.05	0.32	1.00
11	Promotional (yes/no)	0.08	0.03	0.06	0.07	0.11	0.10	0.08	-0.05	0.45	0.26
12	Private web (yes/no)	0.22	0.15	0.19	0.01	0.06	0.05	0.09	-0.02	0.11	0.21
13	Copy MP3 (yes/no)	0.06	0.06	0.06	0.05	0.09	0.08	0.14	-0.02	0.22	0.32
14	Number of P2P	0.09	0.11	0.11	0.14	0.16	0.16	0.16	0.03	0.90	0.30
15	Number of CDs ripped	0.27	0.24	0.26	0.24	0.30	0.29	0.24	-0.03	0.28	0.73
16	Number of promotional	0.09	0.08	0.09	0.13	0.17	0.16	0.15	0.00	0.52	0.19
17	Number from private web	0.17	0.12	0.15	0.04	0.08	0.07	0.10	-0.01	0.30	0.19
18	Number of copied MP3s	0.17	0.13	0.16	0.12	0.15	0.15	0.16	0.04	0.37	0.33
19	Number of DVDs	0.18	0.22	0.21	0.15	0.18	0.18	0.14	-0.01	0.17	0.23
20	Number of videogames	0.21	0.19	0.21	0.08	0.09	0.09	0.07	0.01	0.22	0.21
21	Number of cinema tickets	0.07	0.13	0.11	0.13	0.14	0.15	0.14	0.05	0.20	0.14
22	Number of concert tickets	0.27	0.24	0.26	0.05	0.06	0.06	0.07	-0.03	0.06	0.09
23	Income 10 to 20	-0.06	-0.09	-0.08	-0.03	-0.04	-0.04	-0.04	0.05	0.00	-0.05
24	Income 20 to 40	-0.09	-0.11	-0.10	-0.05	-0.07	-0.06	-0.07	0.05	-0.02	-0.07
25	Income 40 to 60	0.04	0.04	0.04	-0.02	-0.02	-0.03	-0.03	-0.09	-0.02	0.01
26	Income 60 plus	0.08	0.12	0.10	0.07	0.10	0.09	0.10	0.02	0.03	0.08
27	Quality increase	0.03	0.05	0.04	0.08	0.08	0.08	0.07	0.01	0.07	0.05
28	Quality decrease	0.09	0.08	0.08	-0.04	-0.05	-0.05	-0.03	0.00	0.02	0.02
29	Interest very strong	0.23	0.22	0.24	0.05	0.06	0.06	0.06	0.00	0.15	0.24
30	Interest somewhat strong	0.01	0.07	0.04	0.02	0.03	0.03	0.04	0.05	0.00	-0.10
31	Interest moderate	-0.17	-0.20	-0.19	-0.05	-0.07	-0.06	-0.06	-0.03	-0.11	-0.08
32	Interest somewhat low	-0.10	-0.15	-0.13	-0.03	-0.02	-0.03	-0.04	-0.03	-0.05	-0.07
33	Internet: very skilled	0.18	0.15	0.17	0.13	0.16	0.15	0.15	-0.02	0.15	0.29
34	Internet: skilled	-0.04	-0.01	-0.03	0.02	0.07	0.06	0.10	0.02	0.05	0.09
35	Internet: somewhat skilled	-0.06	-0.03	-0.04	-0.06	-0.08	-0.08	-0.10	0.02	-0.01	-0.13
36	Internet: not very skilled	-0.10	-0.11	-0.11	-0.05	-0.09	-0.08	-0.08	-0.01	-0.11	-0.14
37	Age 15 to 19	0.01	0.00	0.01	0.07	0.06	0.07	0.04	0.06	0.24	0.19
38	Age 20 to 24	0.02	0.04	0.04	0.09	0.04	0.06	0.02	0.01	0.15	0.11
39	Age 25 to 34	0.04	0.03	0.04	0.02	0.08	0.06	0.10	0.09	0.12	0.09
40	Age 35 to 44	0.06	0.06	0.06	-0.02	-0.02	-0.02	-0.01	-0.06	0.01	0.00
41	Age 45 to 54	-0.03	-0.02	-0.03	-0.05	-0.04	-0.04	-0.02	-0.05	-0.15	-0.09
42	Age 55 to 64	-0.02	-0.02	-0.02	-0.03	-0.07	-0.06	-0.07	0.00	-0.19	-0.16
43	Gender (men =0, women=1)	-0.10	-0.10	-0.11	-0.06	-0.06	-0.07	-0.03	0.05	-0.14	-0.22
44	Region (Quebec=0, rest=1)	-0.03	-0.04	-0.04	0.02	0.03	0.03	0.01	-0.09	0.00	0.11

Source: own calculations based on Decima Research survey.

Appendix 2: Correlations including all variables in Equations 1 and 2 (continued)

Variables		11	12	13	14	15	16	17	18	19	20
11	Promotional (yes/no)	1.00									
12	Private web (yes/no)	0.19	1.00								
13	Copy MP3 (yes/no)	0.23	0.15	1.00							
14	Number of P2P	0.39	0.12	0.23	1.00						
15	Number of CDs ripped	0.25	0.19	0.32	0.31	1.00					
16	Number of promotional	0.61	0.12	0.20	0.56	0.22	1.00				
17	Number from private web	0.18	0.57	0.16	0.34	0.16	0.34	1.00			
18	Number of copied MP3s	0.25	0.18	0.65	0.45	0.39	0.39	0.37	1.00		
19	Number of DVDs	0.16	0.07	0.13	0.15	0.16	0.12	0.10	0.17	1.00	
20	Number of videogames	0.17	0.12	0.13	0.22	0.15	0.17	0.13	0.16	0.21	1.00
21	Number of cinema tickets	0.12	-0.01	0.09	0.19	0.12	0.15	0.03	0.13	0.17	0.09
22	Number of concert tickets	0.06	0.13	0.10	0.07	0.12	0.04	0.10	0.12	0.01	-0.02
23	Income 10 to 20	-0.03	0.00	-0.01	0.00	-0.04	0.02	-0.02	0.01	-0.02	-0.03
24	Income 20 to 40	-0.07	0.01	-0.04	0.00	-0.05	0.00	0.03	-0.01	-0.13	0.03
25	Income 40 to 60	-0.02	0.04	0.03	-0.01	0.03	0.00	0.00	0.01	0.00	0.02
26	Income 60 plus	0.08	-0.01	0.00	0.01	0.04	-0.01	0.00	-0.01	0.13	-0.02
27	Quality increase	0.04	0.07	0.10	0.08	0.07	0.06	0.01	0.05	0.00	0.09
28	Quality decrease	0.00	0.05	0.05	0.03	0.02	0.01	0.02	0.05	0.03	0.04
29	Interest very strong	0.15	0.11	0.18	0.16	0.23	0.15	0.09	0.19	0.08	0.12
30	Interest somewhat strong	-0.03	-0.03	-0.01	0.00	-0.07	-0.03	-0.03	-0.04	0.02	0.00
31	Interest moderate	-0.07	-0.08	-0.11	-0.13	-0.10	-0.08	-0.07	-0.11	-0.06	-0.09
32	Interest somewhat low	-0.05	0.01	-0.09	-0.05	-0.09	-0.04	0.01	-0.06	-0.04	-0.03
33	Internet: very skilled	0.12	0.08	0.12	0.14	0.23	0.09	0.09	0.15	0.20	0.13
34	Internet: skilled	0.06	0.02	0.10	0.06	0.07	0.05	0.04	0.08	0.07	0.04
35	Internet: somewhat skilled	-0.04	-0.01	-0.09	-0.03	-0.09	-0.03	-0.08	-0.08	-0.09	-0.03
36	Internet: not very skilled	-0.06	-0.05	-0.07	-0.10	-0.14	-0.02	0.01	-0.07	-0.15	-0.08
37	Age 15 to 19	0.14	0.00	0.19	0.27	0.18	0.18	0.03	0.23	0.06	0.19
38	Age 20 to 24	0.09	0.02	0.10	0.18	0.11	0.10	0.03	0.12	0.09	0.08
39	Age 25 to 34	0.13	0.00	0.07	0.12	0.06	0.15	0.04	0.15	0.13	0.13
40	Age 35 to 44	0.01	0.03	-0.06	-0.06	-0.03	-0.04	0.14	-0.08	0.00	0.02
41	Age 45 to 54	-0.09	0.04	-0.07	-0.14	-0.09	-0.14	-0.10	-0.13	-0.09	-0.13
42	Age 55 to 64	-0.14	-0.07	-0.11	-0.18	-0.11	-0.13	-0.10	-0.14	-0.06	-0.17
43	Gender (men =0, women=1)	-0.10	-0.05	-0.12	-0.14	-0.20	-0.06	-0.07	-0.15	-0.07	-0.20
44	Region (Quebec=0, rest=1)	0.15	0.05	-0.01	0.00	0.06	0.05	0.02	0.01	0.01	0.00

Source: own calculations based on Decima Research survey.

Appendix 2: Correlations including all variables in Equations 1 and 2 (continued)

Variables		21	22	23	24	25	26	27	28	29	30
21	Number of cinema tickets	1.00									
22	Number of concert tickets	0.12	1.00								
23	Income 10 to 20	-0.09	-0.04	1.00							
24	Income 20 to 40	-0.08	-0.09	-0.11	1.00						
25	Income 40 to 60	-0.02	-0.05	-0.13	-0.26	1.00					
26	Income 60 plus	0.14	0.15	-0.23	-0.48	-0.54	1.00				
27	Quality increase	0.04	0.03	0.05	0.01	0.03	-0.08	1.00			
28	Quality decrease	-0.07	0.09	0.01	-0.02	-0.01	0.03	-0.19	1.00		
29	Interest very strong	0.06	0.23	0.02	-0.06	0.04	-0.01	0.12	0.12	1.00	
30	Interest somewhat strong	0.04	-0.07	-0.02	0.01	0.01	0.00	-0.02	-0.01	-0.47	1.00
31	Interest moderate	-0.05	-0.11	-0.03	0.04	-0.02	0.00	-0.06	-0.09	-0.45	-0.40
32	Interest somewhat low	-0.08	-0.10	0.03	-0.01	-0.04	0.04	-0.08	-0.06	-0.18	-0.16
33	Internet: very skilled	0.18	0.09	-0.07	-0.11	-0.03	0.15	0.03	0.01	0.24	-0.06
34	Internet: skilled	0.04	0.03	-0.08	0.01	-0.06	0.07	-0.03	0.04	-0.01	0.01
35	Internet: somewhat skilled	-0.01	-0.07	0.05	0.01	0.03	-0.04	0.00	-0.02	-0.11	0.05
36	Internet: not very skilled	-0.08	-0.02	0.10	0.02	0.03	-0.09	-0.02	-0.02	-0.07	0.04
37	Age 15 to 19	0.21	-0.03	0.08	-0.02	-0.03	-0.02	0.07	0.00	0.12	-0.02
38	Age 20 to 24	0.13	0.05	0.02	0.03	0.00	-0.05	0.06	-0.01	0.08	-0.01
39	Age 25 to 34	0.13	-0.01	-0.04	0.07	0.01	-0.03	0.05	0.00	0.03	0.07
40	Age 35 to 44	-0.07	-0.02	-0.11	-0.05	-0.04	0.12	-0.07	-0.02	-0.02	0.04
41	Age 45 to 54	-0.12	-0.06	-0.09	-0.07	0.04	0.08	-0.03	-0.08	-0.07	-0.08
42	Age 55 to 64	-0.09	0.03	0.05	0.01	0.02	-0.03	0.00	0.03	-0.09	0.04
43	Gender (men =0, women=1)	-0.04	-0.06	0.02	0.07	0.02	-0.09	-0.01	-0.03	-0.06	0.09
44	Region (Quebec=0, rest=1)	-0.05	0.02	-0.02	-0.08	-0.03	0.09	-0.10	0.12	0.09	0.01

Variables		31	32	33	34	35	36	37	38	39	40
31	Interest moderate	1.00									
32	Interest somewhat low	-0.15	1.00								
33	Internet: very skilled	-0.15	-0.06	1.00							
34	Internet: skilled	0.02	-0.04	-0.33	1.00						
35	Internet: somewhat skilled	0.08	-0.04	-0.33	-0.39	1.00					
36	Internet: not very skilled	-0.01	0.07	-0.20	-0.24	-0.24	1.00				
37	Age 15 to 19	-0.08	-0.05	0.04	0.08	0.01	-0.09	1.00			
38	Age 20 to 24	-0.04	-0.04	0.08	0.04	-0.01	-0.08	-0.10	1.00		
39	Age 25 to 34	-0.06	-0.07	0.09	0.03	-0.01	-0.03	-0.18	-0.13	1.00	
40	Age 35 to 44	-0.01	0.03	0.01	0.08	-0.06	0.02	-0.19	-0.14	-0.26	1.00
41	Age 45 to 54	0.07	0.10	-0.05	-0.12	0.10	0.01	-0.18	-0.14	-0.24	-0.26
42	Age 55 to 64	0.04	-0.04	-0.09	-0.01	-0.02	0.08	-0.14	-0.11	-0.19	-0.20
43	Gender (men =0, women=1)	-0.02	-0.03	-0.16	-0.07	0.13	0.07	-0.10	-0.06	0.06	0.03
44	Region (Quebec=0, rest=1)	-0.12	0.03	0.06	0.02	0.00	-0.01	0.06	0.00	-0.01	-0.02

Variables		41	42	43	44
41	Age 45 to 54	1.00			
42	Age 55 to 64	-0.19	1.00		
43	Gender (men =0, women=1)	-0.01	0.02	1.00	
44	Region (Quebec=0, rest=1)	-0.05	-0.02	0.01	1.00

Source: own calculations based on Decima Research survey.

Appendix 3: Descriptive statistics including all variables in Equations 3 and 4

	Variable	Number of observations	Weighted population	Mean	Standard deviation	Min	Max
1	Number of CD albums	759	5,245,772	10	12.62	0.00	100.00
2	Log of number of CDs	759	5,245,772	2	1.14	0.00	4.62
3	Square root of number of CDs	759	5,245,772	3	1.84	0.00	10.00
4	Number of MP3s	758	5,228,315	3	10.07	0.00	100.00
5	Log of number of MP3s	758	5,228,315	0	1.00	0.00	4.62
6	Square root of MP3s	758	5,228,315	1	1.58	0.00	10.00
7	Purchased MP3s (yes/no)	759	5,245,772	0	0.42	0.00	1.00
8	Price of CDs	582	3,994,907	17	3.86	1.00	35.00
9	Album too expensive	732	5,023,728	40	37.92	0.00	100.00
10	Number P2P	759	5,245,772	3	1.27	0.00	6.22
11	Number CDs ripped	732	5,045,964	1	0.97	0.00	4.62
12	Number promotional sites	736	5,057,110	1	1.36	0.00	6.22
13	Number private websites	754	5,232,942	0	0.74	0.00	4.71
14	Number MP3s copied	740	5,151,973	1	1.36	0.00	5.99
15	Number DVDs	752	5,187,512	1	1.34	0.00	4.62
16	Number videogames	757	5,227,729	1	0.94	0.00	3.93
17	Number cinema tickets	746	5,122,926	2	1.02	0.00	4.62
18	Number concert tickets	757	5,225,216	1	0.81	0.00	3.93
19	Not elsewhere available	695	4,825,006	28	32.37	0.00	100.00
20	Not whole album	728	4,987,915	54	36.92	0.00	100.00
21	MP3 player ownership	741	5,013,259	1	0.48	0.00	1.00
22	Hear before buying	744	5,118,979	46	38.86	0.00	100.00
23	Income 10 to 20	759	5,245,772	0	0.22	0.00	1.00
24	Income 20 to 40	759	5,245,772	0	0.38	0.00	1.00
25	Income 40 to 60	759	5,245,772	0	0.40	0.00	1.00
26	Income 60 plus	759	5,245,772	1	0.50	0.00	1.00
27	Quality increased	745	5,138,030	0	0.42	0.00	1.00
28	Quality decreased	745	5,138,030	0	0.37	0.00	1.00
29	Interest very strong	758	5,244,104	0	0.50	0.00	1.00
30	Interest somewhat strong	758	5,244,104	0	0.45	0.00	1.00
31	Interest moderate	758	5,244,104	0	0.40	0.00	1.00
32	Interest somewhat low	758	5,244,104	0	0.21	0.00	1.00
33	Internet: very skilled	757	5,239,037	0	0.48	0.00	1.00
34	Internet: skilled	757	5,239,037	0	0.46	0.00	1.00
35	Internet: somewhat skilled	757	5,239,037	0	0.45	0.00	1.00
36	Internet: not very skilled	757	5,239,037	0	0.19	0.00	1.00
37	Age 15 to 19	754	5,227,540	0	0.45	0.00	1.00
38	Age 20 to 24	754	5,227,540	0	0.34	0.00	1.00
39	Age 25 to 34	754	5,227,540	0	0.44	0.00	1.00
40	Age 35 to 44	754	5,227,540	0	0.39	0.00	1.00
41	Age 45 to 54	754	5,227,540	0	0.29	0.00	1.00
42	Age 55 to 64	754	5,227,540	0	0.18	0.00	1.00
43	Gender (men =0, women=1)	759	5,245,772	0	0.48	0.00	1.00
44	Region (Quebec=0, rest=1)	759	5,245,772	1	0.42	0.00	1.00

Source: own calculations based on Decima Research survey.

Appendix 3: Descriptive statistics including all variables in Equations 3 and 4 (continued)

Variables		1	2	3	4	5	6	7	8	9	10
1	Number of CD albums	1.00									
2	Log of number of CDs	0.87	1.00								
3	Square root of number of CDs	0.96	0.97	1.00							
4	Number of MP3s	0.06	0.09	0.08	1.00						
5	Log of number of MP3s	0.05	0.09	0.08	0.83	1.00					
6	Square root of MP3s	0.05	0.10	0.08	0.91	0.98	1.00				
7	Purchased MP3s (yes/no)	0.05	0.10	0.08	0.52	0.81	0.75	1.00			
8	Price of CDs	-0.01	-0.03	-0.02	-0.08	-0.09	-0.09	-0.08	1.00		
9	Album too expensive	-0.09	-0.10	-0.10	0.02	0.05	0.04	0.08	0.04	1.00	
10	Number P2P	0.26	0.27	0.28	0.02	-0.03	-0.01	-0.01	0.03	-0.04	1.00
11	Number CDs ripped	0.37	0.32	0.35	0.11	0.11	0.12	0.07	-0.05	0.06	0.28
12	Number promotional sites	0.01	0.06	0.04	0.02	0.06	0.05	0.05	-0.01	0.01	0.18
13	Number private websites	0.23	0.18	0.21	-0.02	-0.03	-0.03	-0.04	-0.09	-0.05	0.20
14	Number MP3s copied	0.20	0.16	0.18	0.08	0.02	0.04	0.03	-0.09	0.05	0.26
15	Number DVDs	0.08	0.12	0.10	0.04	0.10	0.09	0.14	-0.04	-0.07	-0.01
16	Number videogames	0.10	0.12	0.11	0.06	0.02	0.03	0.01	0.00	-0.06	0.12
17	Number cinema tickets	0.05	0.07	0.06	0.21	0.25	0.24	0.24	0.05	0.11	0.07
18	Number concert tickets	0.20	0.19	0.20	0.02	0.01	0.01	0.04	0.00	0.00	0.10
19	Not elsewhere available	0.13	0.13	0.13	0.01	0.03	0.02	0.06	0.01	0.11	0.03
20	Not whole album	-0.12	-0.10	-0.12	0.04	0.07	0.06	0.08	0.03	0.36	-0.10
21	MP3 player ownership	-0.10	-0.10	-0.10	0.06	0.13	0.12	0.19	0.05	0.07	-0.03
22	Hear before buying	0.06	0.09	0.08	0.12	0.16	0.15	0.14	0.08	0.30	0.02
23	Income 10 to 20	0.00	-0.01	-0.01	-0.06	-0.07	-0.07	-0.01	0.07	0.01	-0.03
24	Income 20 to 40	-0.03	0.01	-0.01	-0.02	-0.06	-0.05	-0.09	0.02	0.04	0.09
25	Income 40 to 60	0.06	0.04	0.05	-0.02	0.00	-0.01	-0.03	0.01	-0.13	0.03
26	Income 60 plus	0.00	-0.01	-0.01	0.07	0.09	0.09	0.11	-0.03	0.08	-0.08
27	Quality increased	-0.01	0.07	0.03	0.14	0.07	0.09	0.03	0.10	-0.03	0.07
28	Quality decreased	0.12	0.10	0.11	-0.10	-0.12	-0.12	-0.13	-0.02	0.03	0.10
29	Interest very strong	0.19	0.18	0.20	-0.01	-0.03	-0.03	-0.05	0.03	0.03	0.11
30	Interest somewhat strong	-0.04	0.00	-0.02	0.00	0.01	0.01	-0.01	0.04	-0.01	0.06
31	Interest moderate	-0.16	-0.20	-0.19	0.00	0.01	0.01	0.08	-0.11	-0.04	-0.19
32	Interest somewhat low	-0.08	-0.08	-0.09	0.03	0.06	0.05	0.01	0.03	0.06	-0.02
33	Internet: very skilled	0.09	0.10	0.10	0.08	0.07	0.08	0.07	-0.07	-0.04	0.09
34	Internet: skilled	0.02	-0.01	0.00	0.00	0.01	0.01	-0.01	0.03	0.08	0.03
35	Internet: somewhat skilled	-0.09	-0.05	-0.07	-0.07	-0.07	-0.08	-0.05	0.09	-0.02	-0.12
36	Internet: not very skilled	-0.07	-0.07	-0.08	-0.02	-0.01	-0.02	-0.01	0.01	0.03	-0.04
37	Age 15 to 19	0.02	-0.05	-0.02	-0.02	-0.03	-0.03	-0.02	0.15	0.00	0.13
38	Age 20 to 24	-0.02	-0.02	-0.02	0.06	-0.02	0.01	-0.05	-0.01	-0.04	0.13
39	Age 25 to 34	0.04	0.14	0.10	0.00	0.06	0.04	0.07	0.04	-0.01	0.06
40	Age 35 to 44	-0.01	-0.04	-0.03	0.00	0.04	0.03	0.03	-0.12	0.01	-0.22
41	Age 45 to 54	-0.03	-0.05	-0.05	-0.03	-0.04	-0.04	-0.01	-0.10	0.04	-0.14
42	Age 55 to 64	-0.03	-0.01	-0.02	-0.04	-0.06	-0.05	-0.07	-0.04	0.04	-0.02
43	Gender (men =0, women=1)	-0.14	-0.07	-0.11	-0.03	0.02	0.00	0.08	0.04	-0.02	-0.01
44	Region (Quebec=0, rest=1)	-0.01	-0.04	-0.03	0.00	-0.01	-0.01	-0.08	-0.15	0.10	-0.01

Source: own calculations based on Decima Research survey.

55

Appendix 3: Correlations including all variables in Equations 3 and 4 (continued)

Variables		11	12	13	14	15	16	17	18	19	20
11	Number CDs ripped	1.00									
12	Number promotional sites	0.10	1.00								
13	Number private websites	0.15	0.08	1.00							
14	Number MP3s copied	0.36	0.13	0.26	1.00						
15	Number DVDs	0.03	0.03	0.10	0.09	1.00					
16	Number videogames	-0.05	0.01	0.05	-0.03	0.16	1.00				
17	Number cinema tickets	0.02	0.10	0.06	0.17	0.10	0.11	1.00			
18	Number concert tickets	0.14	0.01	0.12	0.25	0.01	-0.18	0.09	1.00		
19	Not elsewhere available	0.08	0.01	0.00	0.09	0.06	0.02	-0.07	0.11	1.00	
20	Not whole album	-0.04	-0.07	-0.06	-0.11	-0.01	0.01	0.08	-0.11	0.11	1.00
21	MP3 player ownership	0.05	0.01	-0.12	0.10	0.05	0.06	0.20	-0.08	-0.03	0.16
22	Hear before buying	0.04	0.08	0.03	0.00	0.14	-0.01	0.05	0.02	0.16	0.19
23	Income 10 to 20	-0.06	-0.02	-0.01	0.03	0.01	-0.01	0.02	0.03	-0.01	-0.04
24	Income 20 to 40	-0.03	0.11	0.09	0.03	-0.07	0.06	-0.05	0.05	0.04	-0.03
25	Income 40 to 60	0.01	-0.01	0.07	0.06	0.01	0.11	0.09	0.00	-0.07	-0.11
26	Income 60 plus	0.06	-0.07	-0.10	-0.09	0.04	-0.12	0.00	-0.01	-0.01	0.16
27	Quality increased	-0.02	0.04	-0.02	-0.07	-0.01	0.04	0.06	-0.01	-0.03	-0.05
28	Quality decreased	0.10	0.03	0.00	0.14	-0.03	0.07	0.01	0.06	0.13	-0.04
29	Interest very strong	0.15	0.06	0.07	0.25	-0.06	-0.04	-0.04	0.24	0.20	-0.05
30	Interest somewhat strong	-0.11	0.00	-0.10	-0.13	0.06	0.11	0.05	-0.15	-0.19	0.04
31	Interest moderate	-0.03	-0.06	-0.05	-0.13	0.00	-0.07	-0.04	-0.11	-0.05	-0.01
32	Interest somewhat low	-0.06	-0.03	0.18	-0.08	0.04	-0.01	0.05	-0.03	0.06	0.09
33	Internet: very skilled	0.14	0.06	0.11	0.16	0.10	0.05	0.14	0.12	0.00	-0.03
34	Internet: skilled	0.00	0.03	0.00	0.02	-0.03	-0.08	-0.01	0.01	0.13	0.08
35	Internet: somewhat skilled	-0.13	-0.07	-0.11	-0.16	-0.06	0.03	-0.07	-0.15	-0.14	-0.06
36	Internet: not very skilled	-0.07	-0.05	-0.01	-0.09	0.02	0.01	-0.09	0.03	-0.03	0.10
37	Age 15 to 19	0.08	0.01	-0.02	0.15	-0.06	0.09	0.15	-0.07	0.13	0.01
38	Age 20 to 24	-0.02	0.01	-0.04	0.11	-0.05	0.00	0.05	0.07	0.01	-0.03
39	Age 25 to 34	0.03	0.11	-0.02	-0.06	0.08	0.10	0.13	0.07	-0.03	0.03
40	Age 35 to 44	-0.05	-0.07	0.11	-0.12	-0.01	-0.12	-0.19	-0.07	-0.16	-0.05
41	Age 45 to 54	-0.10	-0.06	-0.01	-0.05	0.05	-0.04	-0.10	-0.07	0.02	0.06
42	Age 55 to 64	0.03	-0.06	-0.05	-0.10	0.00	-0.12	-0.21	0.07	0.09	0.01
43	Gender (men =0, women=1)	-0.13	0.08	-0.07	-0.12	-0.11	-0.24	0.04	-0.05	-0.06	-0.01
44	Region (Quebec=0, rest=1)	0.11	0.09	-0.04	0.04	0.01	0.07	-0.02	-0.04	0.06	0.07

Source: own calculations based on Decima Research survey.

Appendix 3: Correlations including all variables in Equations 3 and 4 (continued)

Variables		21	22	23	24	25	26	27	28	29	30
21	MP3 player ownership	1.00									
22	Hear before buying	0.06	1.00								
23	Income 10 to 20	-0.06	-0.07	1.00							
24	Income 20 to 40	-0.07	0.08	-0.10	1.00						
25	Income 40 to 60	0.04	-0.01	-0.11	-0.23	1.00					
26	Income 60 plus	0.06	-0.02	-0.23	-0.49	-0.55	1.00				
27	Quality increased	0.03	0.01	0.00	0.03	0.08	-0.07	1.00			
28	Quality decreased	-0.04	0.00	-0.01	-0.01	0.00	0.00	-0.24	1.00		
29	Interest very strong	0.09	0.01	-0.04	0.06	0.03	-0.05	-0.01	0.07	1.00	
30	Interest somewhat strong	-0.08	0.05	0.06	-0.09	-0.04	0.09	0.07	-0.03	-0.64	1.00
31	Interest moderate	-0.02	-0.12	0.00	-0.01	0.04	-0.05	-0.05	-0.09	-0.45	-0.31
32	Interest somewhat low	0.02	0.14	-0.04	0.09	-0.06	0.00	-0.03	0.07	-0.16	-0.11
33	Internet: very skilled	0.15	0.07	-0.08	-0.07	-0.01	0.11	-0.04	0.03	0.25	-0.17
34	Internet: skilled	-0.10	0.01	-0.03	0.11	-0.03	-0.06	-0.04	0.05	-0.01	-0.07
35	Internet: somewhat skilled	0.02	-0.08	0.12	-0.05	0.07	-0.09	0.08	-0.08	-0.19	0.18
36	Internet: not very skilled	-0.10	0.04	0.01	0.06	-0.06	0.02	0.04	-0.07	-0.15	0.17
37	Age 15 to 19	0.21	0.00	-0.01	0.02	0.00	-0.03	0.03	-0.02	0.13	-0.05
38	Age 20 to 24	-0.06	-0.06	0.11	0.01	-0.03	-0.06	0.06	0.01	0.05	-0.02
39	Age 25 to 34	-0.06	0.04	0.02	0.06	0.08	-0.10	0.11	0.06	-0.01	0.08
40	Age 35 to 44	-0.07	0.03	-0.07	-0.05	-0.07	0.12	-0.16	-0.10	-0.07	0.00
41	Age 45 to 54	-0.03	0.00	-0.03	-0.06	0.06	0.03	-0.06	0.04	-0.04	-0.07
42	Age 55 to 64	-0.01	-0.08	-0.04	-0.05	-0.09	0.14	-0.01	0.01	-0.16	0.06
43	Gender (men =0, women=1)	-0.08	0.00	0.00	0.00	-0.02	-0.02	0.01	-0.06	-0.07	0.16
44	Region (Quebec=0, rest=1)	0.09	0.05	-0.09	-0.10	-0.03	0.14	0.02	0.13	0.07	0.01

Variables		31	32	33	34	35	36	37	38	39	40
31	Interest moderate	1.00									
32	Interest somewhat low	-0.08	1.00								
33	Internet: very skilled	-0.14	0.05	1.00							
34	Internet: skilled	0.10	-0.01	-0.53	1.00						
35	Internet: somewhat skilled	0.04	-0.04	-0.45	-0.41	1.00					
36	Internet: not very skilled	-0.02	-0.03	-0.14	-0.13	-0.11	1.00				
37	Age 15 to 19	-0.06	-0.09	-0.03	0.07	-0.01	-0.09	1.00			
38	Age 20 to 24	-0.03	-0.02	0.04	0.01	-0.07	-0.01	-0.25	1.00		
39	Age 25 to 34	-0.04	-0.10	0.06	-0.08	0.02	0.05	-0.37	-0.27	1.00	
40	Age 35 to 44	0.04	0.13	-0.03	0.02	0.00	-0.02	-0.29	-0.21	-0.31	1.00
41	Age 45 to 54	0.05	0.12	-0.06	-0.03	0.10	0.01	-0.17	-0.13	-0.19	-0.15
42	Age 55 to 64	0.16	-0.03	0.01	0.00	-0.07	0.16	-0.10	-0.07	-0.11	-0.08
43	Gender (men =0, women=1)	-0.07	-0.09	-0.25	0.07	0.16	0.09	-0.03	0.02	0.09	-0.02
44	Region (Quebec=0, rest=1)	-0.10	0.03	0.07	-0.07	0.01	-0.04	0.07	-0.01	-0.03	-0.02

Variables		41	42	43	44
41	Age 45 to 54	1.00			
42	Age 55 to 64	-0.05	1.00		
43	Gender (men =0, women=1)	-0.05	-0.06	1.00	
44	Region (Quebec=0, rest=1)	-0.02	0.02	-0.04	1.00

Source: own calculations based on Decima Research survey.

Appendix 4: Determinants of CD album purchases in the Canadian population for the year 2005

Dependent variables	Number of CD albums			Log number of CD albums			Square root no of CD albums		
Estimation model	OLS			OLS			OLS		
Independent variables	*b*	*t-value*	*sig*	*b*	*t-value*	*sig*	*b*	*t-value*	*sig*
Price of CDs	-0.036	-0.36		-0.002	-0.30		-0.004	-0.34	
Number of P2P	-0.807	-1.31		-0.017	-0.80		-0.056	-1.11	
Number of CDs ripped	2.941	3.24	***	0.136	3.99	***	0.299	3.70	***
Number of promotional	0.115	0.20		-0.008	-0.28		-0.004	-0.07	
Number from private web	2.087	1.74	*	0.078	1.86	*	0.192	1.85	*
Number of copied MP3s	0.323	0.45		-0.007	-0.24		0.007	0.12	
Number of purchased MP3s	0.066	0.11		0.026	0.84		0.033	0.52	
Number of DVDs	0.866	2.15	**	0.071	3.41	***	0.125	2.93	***
Number of videogames	2.371	2.86	***	0.112	3.61	***	0.245	3.43	***
Number of cinema tickets	0.092	0.24		0.037	1.54		0.044	1.00	
Number of concert tickets	3.158	3.38	***	0.148	4.52	***	0.322	4.09	***
Income 10 to 20	-0.155	-0.10		-0.004	-0.03		-0.021	-0.09	
Income 20 to 40	-0.158	-0.13		0.056	0.46		0.041	0.22	
Income 40 to 60	1.425	0.96		0.162	1.30		0.240	1.19	
Income 60 plus	1.345	1.07		0.183	1.53		0.255	1.38	
Quality increase	-0.350	-0.36		0.018	0.33		-0.006	-0.06	
Quality decrease	1.933	1.31		0.100	1.42		0.202	1.39	
Interest very strong	4.370	3.10	***	0.463	3.28	***	0.730	3.47	***
Interest somewhat strong	3.118	2.45	**	0.422	3.03	***	0.614	3.03	***
Interest moderate	-0.003	0.00		0.135	0.98		0.136	0.70	
Interest somewhat low	-1.203	-0.91		-0.018	-0.11		-0.093	-0.41	
Internet: very skilled	-2.930	-1.38		-0.161	-1.41		-0.335	-1.46	
Internet: skilled	-5.230	-2.89	***	-0.217	-2.12	**	-0.517	-2.60	***
Internet: somewhat skilled	-3.387	-1.97	**	-0.110	-1.09		-0.307	-1.59	
Internet: not very skilled	-4.790	-2.75	***	-0.221	-2.08	**	-0.499	-2.52	**
Age 15 to 19	1.735	1.06		0.055	0.44		0.159	0.76	
Age 20 to 24	2.144	1.36		0.135	1.10		0.273	1.32	
Age 25 to 34	3.237	2.12	**	0.132	1.09		0.325	1.62	
Age 35 to 44	4.602	2.26	**	0.246	1.97	**	0.511	2.25	**
Age 45 to 54	4.048	2.72	***	0.247	2.13	**	0.486	2.50	**
Age 55 to 64	4.284	2.67	***	0.249	2.12	**	0.495	2.48	**
Gender (men =0, women=1)	-0.555	-0.83		-0.043	-0.93		-0.082	-0.99	
Region (Quebec=0, rest=1)	-1.632	-2.14	**	-0.115	-2.56	**	-0.211	-2.48	**
Constant	4.951	1.92	*	1.500	6.50	***	1.979	5.38	***
Number of observations	1,387			1,387			1,387		
Population size	15,291,433			15,291,433			15,291,433		
F-value		5.42	***		7.63	***		6.94	***
R-square	0.25			0.24			0.26		

* p<0.10; ** p<0.05; *** p<0.01. All regressions are estimated with a constant. The number of
observations is smaller than the total number of respondents in the survey due to missing values; e.g.
Price of CDs was answered by 1,575 survey participants.
Source: own calculations based on Decima Research survey.

Appendix 4: Determinants of CD album purchases in the Canadian population for the year 2005 (continued)

Dependent variables	Number of CD albums			Number of CD albums		
Estimation model	Poisson			Negative binomial		
Independent variables	*M.E.*	*t-value*	*sig*	*M.E.*	*t-value*	*sig*
Price of CDs	-0.018	-0.19		-0.015	-0.20	
Number of P2P	-0.345	-1.30		-0.150	-0.70	
Number of CDs ripped	1.828	4.17	***	1.537	4.08	***
Number of promotional	-0.008	-0.03		0.003	0.01	
Number from private web	0.999	2.07	**	0.807	1.81	*
Number of copied MP3s	-0.021	-0.06		0.064	0.22	
Number of purchased MP3s	0.021	0.06		0.111	0.37	
Number of DVDs	0.692	2.46	***	0.745	3.20	***
Number of videogames	1.515	4.24	***	1.296	3.93	***
Number of cinema tickets	0.147	0.52		0.346	1.37	
Number of concert tickets	2.058	4.48	***	1.610	4.40	***
Income 10 to 20	-0.249	-0.15		-0.402	-0.24	
Income 20 to 40	-0.267	-0.20		-0.197	-0.15	
Income 40 to 60	1.591	1.07		1.596	1.05	
Income 60 plus	1.332	1.03		1.448	1.09	
Quality increase	-0.271	-0.41		-0.352	-0.56	
Quality decrease	1.660	1.75	*	0.975	1.22	
Interest very strong	6.817	3.44	***	7.242	3.80	***
Interest somewhat strong	5.757	2.97	***	6.071	3.24	***
Interest moderate	1.745	1.00		2.134	1.24	
Interest somewhat low	-0.459	-0.25		-0.116	-0.06	
Internet: very skilled	-2.748	-1.85	*	-2.200	-1.62	
Internet: skilled	-4.178	-3.26	***	-3.302	-2.93	***
Internet: somewhat skilled	-2.831	-2.19	**	-2.149	-1.87	*
Internet: not very skilled	-3.873	-3.14	***	-3.111	-2.79	***
Age 15 to 19	3.551	1.96	*	1.544	1.03	
Age 20 to 24	3.816	2.12	**	1.873	1.22	
Age 25 to 34	4.269	2.46	**	1.949	1.32	
Age 35 to 44	6.264	3.08	***	3.813	2.36	**
Age 45 to 54	5.730	3.22	***	3.417	2.31	**
Age 55 to 64	6.153	3.10	***	3.372	2.15	**
Gender (men =0, women=1)	-0.501	-0.84		-0.522	-0.97	
Region (Quebec=0, rest=1)	-1.449	-2.19	**	-1.742	-2.99	***
Constant	1.461	4.90	***	1.559	5.75	***
Number of observations	1,387			1,387		
Population size	15,291,433			15,291,433		
F-value		9.22	***		8.98	***
R-square	-			-		

* p<0.10; ** p<0.05; *** p<0.01. All regressions are estimated with a constant. Marginal effects (M.E.) are given with the t statistics of the underlying coefficients. M.E. are calculated at the means of the regressors in the case of continuous data and for discrete change from 0 to 1 in the case of dichotomous variables. The number of observations is smaller than the total number of respondents in the survey due to missing values; e.g. Price of CDs was answered by 1,575 survey participants.
Source: own calculations based on Decima Research survey.

Appendix 5: Determinants of MP3 purchases in the Canadian population for the year 2005

| Dependent variables | Number of MP3s | | | Log no of MP3s | | | Square root no of MP3s | | |
| Estimation model | OLS | | | OLS | | | OLS | | |
Independent variables	b	t-value	sig	b	t-value	sig	b	t-value	sig
Price of CDs	-0.043	-1.38		-0.002	-0.50		-0.004	-0.75	
Number of P2P	0.088	0.43		-0.004	-0.14		0.002	0.05	
Number of CDs ripped	1.586	3.87	***	0.229	4.57	***	0.340	4.53	***
Number of promotional	0.463	1.25		0.078	2.15	**	0.114	1.98	**
Number from private web	-0.309	-0.85		0.000	0.01		-0.018	-0.27	
Number of copied MP3s	-0.055	-0.15		-0.007	-0.18		-0.012	-0.21	
Number of DVDs	0.442	1.87	*	0.057	2.24	**	0.086	2.18	**
Number of videogames	0.144	0.45		0.016	0.47		0.024	0.45	
Number of cinema tickets	0.408	2.46	**	0.046	2.18	**	0.073	2.37	**
Number of concert tickets	0.002	0.01		0.003	0.12		0.005	0.12	
Income 10 to 20	-0.716	-0.97		-0.062	-0.63		-0.105	-0.73	
Income 20 to 40	-0.308	-0.46		-0.063	-0.72		-0.086	-0.66	
Income 40 to 60	-0.467	-0.65		-0.051	-0.55		-0.081	-0.58	
Income 60 plus	0.235	0.33		0.029	0.33		0.046	0.35	
Quality increase	1.065	1.96	**	0.109	1.79	*	0.172	1.89	*
Quality decrease	-0.562	-1.18		-0.105	-1.74	*	-0.148	-1.66	*
Interest very strong	-0.184	-0.44		0.024	0.46		0.020	0.26	
Interest somewhat strong	0.448	0.87		0.121	1.99	**	0.160	1.76	*
Interest moderate	-0.012	-0.03		0.035	0.69		0.041	0.54	
Interest somewhat low	0.304	0.58		0.110	1.25		0.140	1.13	
Internet: very skilled	0.924	1.62		0.171	2.58	***	0.242	2.40	**
Internet: skilled	0.244	0.69		0.139	2.28	**	0.171	2.05	**
Internet: somewhat skilled	-0.080	-0.27		0.025	0.60		0.023	0.39	
Internet: not very skilled	0.183	0.62		0.011	0.30		0.022	0.39	
Age 15 to 19	-0.673	-0.75		-0.148	-1.40		-0.201	-1.27	
Age 20 to 24	0.238	0.21		-0.140	-1.29		-0.145	-0.85	
Age 25 to 34	-1.110	-1.73	*	-0.072	-0.80		-0.138	-1.07	
Age 35 to 44	-0.841	-1.47		-0.117	-1.43		-0.171	-1.46	
Age 45 to 54	-0.685	-1.54		-0.053	-0.67		-0.094	-0.86	
Age 55 to 64	-0.388	-0.75		-0.095	-1.36		-0.126	-1.24	
Gender (men =0, women=1)	0.110	0.34		0.026	0.61		0.034	0.54	
Region (Quebec=0, rest=1)	0.151	0.50		0.018	0.49		0.026	0.48	
Constant	0.248	0.29		-0.062	-0.50		-0.059	-0.34	
Number of observations	1,388			1,388			1,388		
Population size	15,332,753			15,332,753			15,332,753		
F-value		2.48	***		4.42	***		4.03	***
R-square		0.09			0.15			0.14	

* $p<0.10$; ** $p<0.05$; *** $p<0.01$. All regressions are estimated with a constant. The number of observations is smaller than the total number of respondents in the survey due to missing values; e.g. Price of CDs was answered by 1,575 survey participants.
Source: own calculations based on Decima Research survey.

| Dependent variables | Purchased MP3s (yes/no) | | | Purchased MP3s (yes/no) | | |
Estimation model	Probit			Logit		
Independent variables	*M.E.*	*t-value*	*sig*	*M.E.*	*t-value*	*sig*
Price of CDs	0.000	0.10		0.000	0.10	
Number of P2P	0.009	1.17		0.007	1.01	
Number of CDs ripped	0.048	4.22	***	0.040	4.18	***
Number of promotional	0.017	1.81	*	0.016	1.89	*
Number from private web	0.011	0.66		0.007	0.51	
Number of copied MP3s	0.002	0.22		0.003	0.28	
Number of DVDs	0.011	1.22		0.010	1.26	
Number of videogames	0.005	0.40		0.005	0.45	
Number of cinema tickets	0.020	1.88	*	0.018	1.92	*
Number of concert tickets	0.007	0.58		0.006	0.60	
Income 10 to 20	-0.036	-0.60		-0.022	-0.41	
Income 20 to 40	-0.054	-0.99		-0.042	-0.85	
Income 40 to 60	-0.035	-0.60		-0.024	-0.46	
Income 60 plus	-0.012	-0.20		0.001	0.02	
Quality increase	0.039	1.49		0.039	1.65	*
Quality decrease	-0.030	-0.92		-0.024	-0.78	
Interest very strong	0.160	1.67	*	0.197	1.56	
Interest somewhat strong	0.217	2.04	**	0.265	1.83	*
Interest moderate	0.174	1.68	*	0.222	1.58	
Interest somewhat low	0.181	1.33		0.252	1.30	
Internet: very skilled	0.290	4.50	***	0.362	3.98	***
Internet: skilled	0.288	4.81	***	0.347	4.12	***
Internet: somewhat skilled	0.154	2.88	***	0.192	2.70	***
Internet: not very skilled	0.160	2.55	**	0.206	2.41	**
Age 15 to 19	-0.058	-1.03		-0.055	-0.95	
Age 20 to 24	-0.063	-1.14		-0.058	-1.04	
Age 25 to 34	-0.018	-0.28		-0.021	-0.30	
Age 35 to 44	-0.040	-0.61		-0.038	-0.55	
Age 45 to 54	-0.009	-0.13		-0.005	-0.07	
Age 55 to 64	-0.051	-0.79		-0.048	-0.71	
Gender (men =0, women=1)	0.031	1.53		0.026	1.43	
Region (Quebec=0, rest=1)	-0.013	-0.62		-0.008	-0.42	
Constant	-3.073	-4.38	***	-6.287	-3.98	***
Number of observations	1,390			1,390		
Population size	15,351,877			15,351,877		
F-value		4.41	***		3.74	***
R-square	-			-		

* p<0.10; ** p<0.05; *** p<0.01. All regressions are estimated with a constant. Marginal effects (M.E.) are given with the t statistics of the underlying coefficients. M.E. are calculated at the means of the regressors in the case of continuous data and for discrete change from 0 to 1 in the case of dichotomous variables. The number of observations is smaller than the total number of respondents in the survey due to missing values; e.g. Price of CDs was answered by 1,575 survey participants.
Source: own calculations based on Decima Research survey.