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The Impact of Music Downloads and P2P File-Sharing on the Purchase of Music in Canada

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ABSTRACT

This study measures the extent to which free music downloads, including the use of P2P file sharing networks, act as substitutes or complements to music purchase in markets for CDs and electronic delivered music (such as MP3). The analysis uses representative micro-data from the Canadian population. We find that those who participate in free music downloading and P2P file-sharing do not purchase more or less music compared with those who do not engaged in such activities, but that, indeed, very active file-sharers purchase more music relative to file-sharers who download fewer songs. Thus, the market substitution effect between freely acquired music and purchased music is smaller than the market creation and market segmentation effect from free music downloading. In essence, the behavioural incentives underpinning free music downloading are the effects of ‘unwilling to pay’ (market substitution), ‘hear before buying’ (market creation), ‘not wanting to buy whole album’ (market segmentation), ‘not available in the CD format or on electronic pay-sites (market creation)’.

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 (Galloway 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 and 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.

However, despite the increasing enforcement against unauthorized downloading in most countries, the extent to which P2P file-sharing and music downloading activities displace/substitute or increase/stimulate music purchasing is uncertain.

Objective of study

The primary objective of this paper is to analyze the effects of P2P file-sharing and music downloading activities on pre-recorded music purchases in CD and paid electronically-delivered music markets.¹ The focus is in particular on whether such downloading and P2P filesharing 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 paper analyzes Canadian survey data³ 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.

The analyses aim to assess the behavioural patterns associated with music consumption, as well as the motivations behind such behaviour. Most previous studies examining the impact of P2P file-sharing on music purchasing/sales have employed macroeconomic (i.e. aggregated) data and assumed certain relationships. See for example Liebowitz (forthcoming) which is based on city-level data, and where a relationship is assumed between record sales measured for an entire city and Internet penetration in a city (used as a proxy for file sharing). Our micro study has a huge advantage over such existing studies, as the data are collected by asking households directly about how much music (CD and electronically delivered) they purchase and how much they download for free, and what their incentives are when they engage in free downloading. In our view, macro data can describe a situation or some relationships at the aggregate level, but such data are limited when it comes to shedding light on explanations of the situation. For this we need micro-data, as we

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.

need to understand how the micro behaviour underpin the creation of the situation at the aggregate level.

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. Answers are obtained regarding the effects of music downloading and P2P file-sharing on pre-recorded music purchases of CDs and paid electronically-delivered music tracks. 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 relevant variables in this framework address some key concepts related to music demand that are relevant 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*.

The following section aims to integrate these four determinants into the design of our analysis. In doing so, the emphasis is on the above mentioned (ii), while controlling for the relationships in (i), (iii) and (iv). We introduce several hypotheses about the determinants of music consumption, as defined in relation to music substitutes or complements. The discussion is supported by the literature on P2P file-sharing behaviour, adding to the design and arguments in this paper. Finally, we will also make a case for taking into account the role of demographic factors such as Internet skills, age, gender, occupation and education.

The effect of direct music substitutes or complements on CD sale and electronically purchased music

When measuring the direct effect of music substitutes or complements on CD sales and electronically purchased music some hypotheses can be developed, based upon theoretical economic assumptions established within the economic literature (e.g., Begg, Fischer and Dornbusch, 1994).

H1. 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.

Such markets for downloading include:

- 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
- Ripping CDs and copying them onto computers
- Downloading free music from promotional websites;
- Download music from peoples' private Internet websites.
- Copy MP3 from friends

We test this hypothesis in two ways. First, we examine the cross-price elasticity between CDs and MP3 purchases. To do so, we include a variable capturing the perceived CD price when estimating purchases of electronically-delivered music. Second, we test for a 'substitution effect', motivation to download free music because albums are perceived to be expensive. The following paragraphs explain the substitution effect in greater depth.

The substitution effect: 'Album too expensive':

A substitution effect occurs when a downloaded copy directly substitutes for the purchased original (Liebowitz, 2005). 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, substitution is expected where marginal cost are essentially zero; e.g. P2P file-sharing. 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. Moreover, our data enables us to test if individuals engage in music downloading or P2P file-sharing because they feel that the price of music CDs is too high, because all file-shares were asked if their motivation to download was because they felt that the price of CD albums was too high.

Liebowitz (2004, 2005) argued that P2P file-sharing decreases 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 analyze survey data from 15,000 European respondents and find 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.

Sampling (market creation and market segmentation) as an alternative to market substitution:

In an analysis of 200 US college students, Gopal, Bhattacharjee and Sanders (2006) find a strong positive association between downloading music 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 *et al.* (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. Thus, when an overall negative impact of file-sharing is experienced in the analysis of Blackburn (2004), this 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 distribution within the music industry. For this reason, many superstars oppose P2P file-sharing. However, in an 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.

Bounie (2005) also 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. The following hypothesis can be tested in this context:

H2. *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 (2005) 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 other things 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 so 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 3 states the following:

H3. People who engage in P2P file-sharing or music downloading are less likely to purchase music in traditional markets, because they prefer the digital single file, or because they look for music which is not available elsewhere.

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 relates 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’.

The effect of price on related entertainment goods

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

(ii) if a good is a substitute (such as a film/movie) then a positive relationship is expected, such that an increase in the price of films results in increased purchases of CD or electronically-delivered music files.

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:

H4. 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 activities, 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 the 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 in below section on the effect of demographic factors on music downloading 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 study 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 H4.

The effect of demographic factors

Demographic factors such as gender, age, income, region, occupation, educational level, degree of music interest and Internet skills, may also have an influence on music purchasing. Some effects can be expected 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 was on explaining why certain groups did not have, or did not choose to have, Internet access. In the context of this analysis, the Internet as a means of acquiring digital music (both through P2P file-sharing and purchasing of electronic tracks) should be considered in contrast to traditional CD purchasing and CD copying. We therefore control for such demographic factors in our analysis (see section 3).

3. METHOD

The dataset analysed in this paper is a large-scale survey of Canadians. This survey was designed by Birgitte Andersen with support from Industry Canada, and data collection was conducted by Decima Research in 2006. The data is scaled up using weights to be representative of the Canadian population. Our 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 utilized 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.

Table 3.1 here

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. Table 3.2 provides an overview of the variables used in our analysis.

Table 3.2 here

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 respondents estimated they 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 take the natural log of the number of CD albums in the case of OLS estimations. 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.⁴

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. 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 there are 85 percent (and in absolute terms 1,750) zero observations in this specific variable.

Independent variables

In relation to *Hypothesis 1* which states that there is a positive relationship between the price of CDs and the purchase of electronically-delivered music, as well as music downloading activities, we first 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).

Moreover, further we include the following variables capturing free music sources when predicting CD album sales and MP3 purchases: P2P file-sharing, 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

⁴ 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. We also transformed the dependent variable by taking the square root and found that the log transformation produced results closer to a normal distribution.

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.

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.

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.

Hypothesis 2 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 3 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 4 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.

Control variables

We include four sets of control variables. These relate to (i) the price of goods (CD albums), (ii) consumer income, (iii) consumer taste and (iv) a set of demographic indicators. To control for a negative association between CD sales and CD price we include 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.⁵

We control for the level of income is with five dummy variables representing five income bands.⁶ 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 control for the level of music taste matters. They are designed to capture music interest and the perception of change in 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

⁵ 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.

⁶ All monetary values are given in Canadian dollars.

are three dummy variables. The base group is the dummy coded as one if a participant perceived no change in the quality of music.

We control for Internet skills. 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 control for the following 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 estimate the following equation based on weighted data.

Equation [1]: based on the whole sample

$$y_i = \alpha + \beta_1 \text{Price of CDs}_i + \beta_2 \text{P2P}_i + \beta_3 \text{Rip CD}_i + \beta_4 \text{Promotional website}_i + \beta_5 \text{Private website}_i + \beta_6 \text{Copy MP3}_i + \beta_7 \text{Purchase MP3}_i + \beta_8 \text{Number of DVDs}_i + \beta_9 \text{Number of videogames}_i + \beta_{10} \text{Number of cinematickets}_i + \beta_{11} \text{Number of concerttickets}_i + \beta_{12} \text{Income}_i + \beta_{13} \text{Change in quality of music}_i + \beta_{14} \text{Interest in music}_i + \beta_{15} \text{Internet skills}_i + \beta_{16} \text{Age}_i + \beta_{17} \text{Gender}_i + \beta_{18} \text{Region}_i + \varepsilon_i$$

where y_i is (i) an indicator of music purchased measured by the number of CD albums and (ii) an indicator of music purchased based on the number of paid electronically-delivered music tracks. With respect to estimations predicting (ii), paid electronically-delivered music tracks, β_7 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 [2]: based on the sub-sample of P2P downloaders

$$y_i = \alpha + \beta_1 \text{Price of CDs}_i + \beta_2 \text{album too expensive}_i + \beta_3 \text{Number of P2P}_i + \beta_4 \text{Number of CDs ripped}_i + \beta_5 \text{Number promotional website}_i + \beta_6 \text{Number private website}_i + \beta_7 \text{Number copy MP3}_i + \beta_8 \text{Number of MP3s purchased}_i + \beta_9 \text{Number of DVDs}_i + \beta_{10} \text{Number of videogames}_i + \beta_{11} \text{Number of cinema tickets}_i + \beta_{12} \text{Number of concert tickets}_i + \beta_{13} \text{Not elsewhere available}_i + \beta_{14} \text{Not whole album}_i + \beta_{15} \text{MP3 player ownership}_i + \beta_{16} \text{Hear before buying}_i + \beta_{17} \text{Income}_i + \beta_{18} \text{Change in quality of music}_i + \beta_{19} \text{Interest in music}_i + \beta_{20} \text{Internet skills}_i + \beta_{21} \text{Age}_i + \beta_{22} \text{Gender}_i + \beta_{23} \text{Region}_i + \varepsilon_i$$

where y_i is again a measure of (i) CD album sales as discussed before and (ii) and 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).

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. 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. To address this, we estimate a negative binomial model.

We compare the estimates of the negative binomial model with OLS estimates. This is done because OLS estimations often compare rather favourably with the results of more complicated models, because the classic linear model is less prone to problems caused for example by errors in variables. Since the variable ‘number of CD albums bought in 2005’ exhibits a positive skew we log transform the variable after adding a value of 0.1.

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 (1,750⁷ out of the total of 2,100) did declare that they purchased no electronic music tracks, thus there are 1,750 zero

⁷ 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 subsequently reported zero as the number of purchases. These regressions yielded extremely similar results compared with the ones reported here.

observations in this variable. As a result the negative binomial model did not converge.

For the purpose of OLS estimations we use the ‘number of MP3s’ after log transformation. 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 a Probit.

In the case of four variables we test the linear hypotheses of equal coefficients using a Wald test. The difference in coefficients we are 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 report marginal effects, and, in the case of the non-linear estimations, these are estimated at the means of the regressors or for changes from zero to one in the case of binary independent variables. We compute robust standard errors to account for heteroskedasticity.

A problem which may arise with respect to our estimates is that we assume that the independent variables are exogenous and that all important variables are included in the estimation. If, however, 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). The use of P2P downloads may be determined by CD purchases or, in fact, by other independent variables. In reality almost every variable carries some degree of endogeneity. As far as our analysis is concerned, Monte Carlo studies suggest that estimators of single equation regressions compare favourably with simultaneous equation techniques, because they are less sensitive to the presence of other estimation problems, such as errors in variables or misspecifications of equations (Greene, 2003).

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 3.2 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 and probit are chosen over OLS for the following reasons: (i) the model specification is the most appropriate in terms of the dependent variable and (ii) they have the highest model fit. Some results are discussed in footnotes in order to qualify our findings, but the full set of results is presented in the appendices.

Our results regarding the determinants of music purchases are presented in Table 4.1 CD albums and Table 4.2.

Table 4.1 and 4.2 here

Table 4.3 and 4.4 give the results of regression equation [2] based on downloaders.

Table 4.3 and 4.4 here

In accordance with *Hypothesis 1* ('cross-price elasticity) 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 is negative support for this hypothesis, the price of CDs being negatively associated with the number of paid electronically-delivered music tracks purchased. 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.

Results: the effect of music substitutes on music consumption, including discussion of the sampling (market creation and market segmentation) effect

Our results regarding the effect of P2P file-sharing and music downloading on music purchases are mixed. *Hypothesis 1* asserts 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.⁸

However, 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 (M.E.=1.212; p<0.01). At the mean of the independent variable P2P downloads (i.e. around 13 downloads per month) we find that, for an increase in the monthly average number of P2P downloads of 1 digital file, the number of CD purchases per year will increase by

⁸ 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. Similar results emerge when using the number of P2P downloads instead of the binary variable.

1.212/2.718282 or 0.44. However, it should be noted that this is a point estimate. We compute marginal effects at the means of the regressors, and, thus, the point estimate refers to those people who claim to download approximately 13 P2P files in an average month and not to downloaders who claim more or less downloads in an average months. This is because the assumed relationship is non-linear (negative binomial distribution plus log transformation of the number of P2P downloads).

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 our Probit regression (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 (see Table 4.3).

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.

Our discussion now turns to the market creation effect and *Hypothesis 2*, 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 for the P2P file-sharing subpopulation when examining the negative binomial model; however, the coefficient of the classic linear model is positive and statistically significant. Moreover, the ‘hear before buying’ effect is positively and significantly related to the number of MP3s purchased.

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 (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 2 and 3 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 computed the relevant Wald statistic testing the 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 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.⁹

The effect of entertainment substitutes and complements on music consumption

With respect to *Hypothesis 4*, 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.

⁹ There is some indication of a positive and statistically significant association with the ‘hear before buying’ variable in the OLS model in Table 4.4, suggesting a market creation effect.

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 4*, people who own an MP3 player appear to be less likely to purchase CD albums.

In relation to the *control variables*, we find no statistically significant relationship between the price of CDs and the purchase of CDs for the entire population (Table 4.1). 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.

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 level of music interest is relevant in music purchasing (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.

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).

In the aggregate, age variables are only found to be statistically significant in the results shown in Table 4.1. 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. CONCLUSION

We are in the midst of a technological revolution changing and challenging the economic status of music. New ways in which music is created, delivered and consumed, affect both market and industry structures. There are many different

stakeholders affected by this change, including the major and independent music publishers, the artists and the consumers. This article, building upon a major study conducted for Industry Canada between 2005-08, was initially aimed at supporting policy decisions in relation to the internal review of the copyright regime in Canada.

When analysing the effects of P2P file-sharing and free music downloading activities on pre-recorded music purchases in CD and electronically-delivered music markets, the focus was in particular on whether such free downloading and P2P filesharing displaces/substitutes or increases/stimulates music purchases. Based on our findings we argue that free music downloading and P2P filesharing behaviour may not be bad news for the industry, because such activities create a range of new business opportunities.

Comparing P2P fileshares with those not engaging in such activities, we found overall, that people engaged in P2P file-sharing do not purchase more or less CD albums than those not engaged in such activities. However, they were more likely to purchase MP3s.

Investigating only the behaviour of P2P filesharers we found that a strong market creation and segmentation effect as we found a positive and significant relationship between purchases of CD albums and high levels of P2P downloading due to 'hear before buying' and 'music not available elsewhere'. This suggests that, people who are engaged in a lot of P2P filesharing tend to buy more music than people who download comparatively fewer songs. We also found a market substitution effect, as we found a negative and significant association between CDs purchases and a high proportion of P2P downloading due to 'album too expensive'. Nonetheless, when we tested for the relative importance of the two effects, we found that the 'market creation and segmentation effect' is significantly greater than the market substitution effect.

In summary, based upon our average downloader (i.e. people who download around 13 files in an average month), an increase (or decrease) by one downloads per month is associated with an increase (or decrease) of 0.44 in annual CD album sales. (Please note that this is a point estimate of a non-linear relationship and that the number would be different for a more or less keen downloader).¹⁰

Thus, from the results we conclude that we cannot blame P2P filesharing for the decline in CD markets. Rather, it is most likely that it is the shift in the underlying technological paradigm which causes a decline in the sales of CD albums.

The results suggest that music markets are not necessarily undermined by free music downloading and P2P filesharing (especially due to the strong market creation effect, such as 'hear before buying', and the fact that people engaging in free music downloading and filesharing are more likely to purchase electronically delivered music). However, technological innovation (spurring the way in which music is now electronically delivered and consumed) pushes a need for the music industry to change their organization of such appropriation, in order to match the emerging new structures.

¹⁰ We compute marginal effects at the means of the regressors, and, thus, the point estimate refers to those people who claim to download approximately 13 P2P files in an average month and not to downloaders who claim more or less downloads in an average months. This is because the assumed relationship is non-linear (negative binomial distribution plus log transformation of the number of P2P downloads).

We even see a golden opportunity for new publishers and artists to enter music pay markets where copyright appropriation occurs. This involves the need to adopt to the evolving music preferences or taste and the new ways music users prefer their music to be delivered and consumed. Let us remind the industry that our results show that P2P is primarily motivated by consumers looking for music that is not available elsewhere or that they prefer the single digital and intangible electronic file. Thus, consumer incentives are as important as always.

Our results also indicate a strong entertainment cultures among music enthusiasts, as people of the entire Canadian population 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. Thus, music and other entertainment goods are not substitutes; instead the relationship is linked to a life-style choice of certain groups of society.

Furthermore, income level has no influence 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. However, and not surprisingly, music interest and the perception of music quality seem to be positively related to music purchasing.

Finally, our demographic variables show overall 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. However, there is no digital-divide with respect to gender and Canadian females are relatively active music downloaders of paid electronically-delivered music tracks.

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Tables

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

| <i>Variable</i> | <i>Number of observations n</i> | | <i>Weighted population N</i> | |
|---------------------|---------------------------------|----------------|------------------------------|----------------|
| | <i>Number</i> | <i>Percent</i> | <i>Number</i> | <i>Percent</i> |
| 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 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 | <ul style="list-style-type: none"> 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 |
| | <ul style="list-style-type: none"> Experienced average price of music CDs in \$ Canadian Experienced average price of MP3 music files | Whole sample | Interval |
| Relative price | <ul style="list-style-type: none"> Percentage of P2P downloads due to 'album too expensive'. | P2P file sharers | Percent |
| Other free music markets | <ul style="list-style-type: none"> Downloading free music from P2P file-sharing networks, 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 | Whole sample | Count and Binary (yes/no) |
| Substitute entertainment goods | <ul style="list-style-type: none"> Number of purchased DVDs Number of purchased video games Number of movie tickets Number of live concerts | Whole sample | Count |
| Availability | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> MP3 player ownership. | P2P file sharers | Binary (yes/no) |

| | | | |
|-----------------|---|------------------|-----------------|
| Music exploring | <ul style="list-style-type: none"> Percentage of P2P downloads to 'hear before buying' | P2P file sharers | Percent |
| Income | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Male Female | Whole sample | Binary (yes/no) |
| Region | <ul style="list-style-type: none"> Quebec Rest of Canada | Whole sample | Binary (yes/no) |

Table 4.1 The determinants of CD album purchases in the Canadian population for the year 2005

| <i>Dependent variables</i> | | Number of CD albums | | | Log number of CD albums | | |
|------------------------------|------------|---------------------|----------------|------------|-------------------------|----------------|------------|
| Estimation model | | Negative binomial | | | OLS | | |
| | Hypothesis | <i>M.E.</i> | <i>t-value</i> | <i>sig</i> | <i>b</i> | <i>t-value</i> | <i>sig</i> |
| <i>Independent variables</i> | | | | | | | |
| P2P (yes/no) | H1 | -0.948 | -1.40 | | -0.076 | -1.29 | |
| Rip CD (yes/no) | H1 | 2.440 | 2.67 | *** | 0.089 | 1.39 | |
| Promotional (yes/no) | H1 | -0.620 | -0.88 | | -0.103 | -1.63 | * |
| Private Web (yes/no) | H1 | 3.686 | 2.85 | *** | 0.236 | 2.42 | ** |
| Copy MP3 (yes/no) | H1 | -1.648 | -2.45 | *** | -0.130 | -2.38 | ** |
| Purchased MP3s (yes/no) | H3 | 0.398 | 0.55 | | 0.088 | 1.39 | |
| Number of DVDs | H4 | 0.694 | 2.95 | *** | 0.080 | 3.88 | *** |
| Number of videogames | H4 | 1.018 | 3.10 | *** | 0.106 | 3.49 | *** |
| Number of cinema tickets | H4 | 0.444 | 1.66 | * | 0.043 | 1.80 | * |
| Number of concert tickets | H4 | 1.518 | 4.17 | *** | 0.152 | 4.78 | *** |
| <i>Control variables</i> | | | | | | | |
| Price of CDs | | 0.002 | 0.02 | | -0.003 | -0.50 | |
| Income 10 to 20 | | -0.897 | -0.58 | | -0.032 | -0.23 | |
| Income 20 to 40 | | 0.720 | 0.48 | | 0.087 | 0.72 | |
| Income 40 to 60 | | 1.167 | 0.83 | | 0.150 | 1.25 | |
| Income 60 plus | | 1.322 | 1.02 | | 0.159 | 1.39 | |
| Quality increase | | -0.480 | -0.78 | | 0.007 | 0.12 | |
| Quality decrease | | 0.970 | 1.13 | | 0.074 | 1.05 | |
| Interest very strong | | 8.793 | 4.26 | *** | 0.532 | 3.73 | *** |
| Interest somewhat strong | | 6.565 | 3.31 | *** | 0.427 | 3.08 | *** |
| Interest moderate | | 2.231 | 1.24 | | 0.144 | 1.05 | |
| Interest somewhat low | | 0.278 | 0.14 | | -0.012 | -0.08 | |
| Internet: very skilled | | -2.380 | -1.83 | * | -0.150 | -1.34 | |
| Internet: skilled | | -3.416 | -2.98 | *** | -0.214 | -2.12 | ** |
| Internet: somewhat skilled | | -1.950 | -1.64 | * | -0.104 | -1.03 | |
| Internet: not very skilled | | -3.515 | -3.20 | *** | -0.241 | -2.31 | ** |
| Age 15 to 19 | | 3.122 | 1.93 | ** | 0.165 | 1.35 | |
| Age 20 to 24 | | 2.870 | 1.79 | * | 0.188 | 1.55 | |
| Age 25 to 34 | | 3.944 | 2.24 | ** | 0.236 | 1.91 | * |
| Age 35 to 44 | | 4.412 | 2.76 | *** | 0.298 | 2.45 | *** |
| Age 45 to 54 | | 3.360 | 2.27 | ** | 0.250 | 2.20 | ** |
| Age 55 to 64 | | 4.006 | 2.42 | ** | 0.266 | 2.27 | ** |
| Gender (men =0, women=1) | | -1.046 | -1.87 | * | -0.090 | -1.95 | ** |
| Region (Quebec=0, rest=1) | | -1.862 | -2.98 | *** | -0.102 | -2.23 | ** |
| Constant | | 1.535 | 5.57 | *** | 1.522 | 6.60 | *** |
| Number of observations | | | 1,459 | | | 1,459 | |
| Population size | | | 15,962,300 | | | 15,962,300 | |
| F-value | | | 9.03 | *** | | 7.63 | *** |
| R-square | | | | | | 0.23 | |

* 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 The determinants of MP3 purchases in the Canadian population for the year 2005

| <i>Dependent variables</i> | | Purchased MP3s (yes/no) | | | Log number of MP3s | | |
|------------------------------|-------------------|-------------------------|----------------|------------|--------------------|----------------|------------|
| Estimation model | | Probit | | | OLS | | |
| | <i>Hypothesis</i> | <i>M.E.</i> | <i>t-value</i> | <i>sig</i> | <i>b</i> | <i>t-value</i> | <i>sig</i> |
| <i>Independent variables</i> | | | | | | | |
| Price of CDs | H1 | 0.001 | 0.52 | | -0.002 | -0.61 | |
| P2P (yes/no) | H1 | 0.063 | 2.59 | *** | 0.141 | 2.15 | ** |
| Rip CD (yes/no) | H1 | 0.140 | 5.43 | *** | 0.282 | 4.34 | *** |
| Promotional (yes/no) | H1 | -0.008 | -0.33 | | 0.002 | 0.02 | |
| Private Web (yes/no) | H1 | 0.015 | 0.43 | | -0.002 | -0.01 | |
| Copy MP3 (yes/no) | H1 | 0.024 | 1.00 | | -0.031 | -0.48 | |
| Number of DVDs | H4 | 0.009 | 0.98 | | 0.058 | 2.30 | ** |
| Number of videogames | H4 | 0.005 | 0.35 | | 0.009 | 0.26 | |
| Number of cinema tickets | H4 | 0.019 | 1.82 | * | 0.047 | 2.23 | ** |
| Number of concert tickets | H4 | 0.007 | 0.64 | | 0.009 | 0.32 | |
| <i>Control variables</i> | | | | | | | |
| Income 10 to 20 | | -0.055 | -1.13 | | -0.073 | -0.75 | |
| Income 20 to 40 | | -0.068 | -1.47 | | -0.068 | -0.79 | |
| Income 40 to 60 | | -0.033 | -0.67 | | 0.000 | 0.00 | |
| Income 60 plus | | -0.025 | -0.50 | | 0.021 | 0.24 | |
| Quality increase | | 0.048 | 1.81 | * | 0.113 | 1.77 | * |
| Quality decrease | | -0.030 | -0.98 | | -0.109 | -1.82 | * |
| Interest very strong | | 0.145 | 1.55 | | 0.057 | 1.04 | |
| Interest somewhat strong | | 0.210 | 2.01 | ** | 0.123 | 1.98 | ** |
| Interest moderate | | 0.140 | 1.41 | | 0.021 | 0.40 | |
| Interest somewhat low | | 0.132 | 1.01 | | 0.074 | 0.83 | |
| Internet: very skilled | | 0.263 | 4.05 | *** | 0.181 | 2.60 | *** |
| Internet: skilled | | 0.278 | 4.42 | *** | 0.150 | 2.43 | ** |
| Internet: somewhat skilled | | 0.145 | 2.62 | *** | 0.026 | 0.65 | |
| Internet: not very skilled | | 0.185 | 2.85 | *** | 0.005 | 0.13 | |
| Age 15 to 19 | | -0.069 | -1.24 | | -0.145 | -1.39 | |
| Age 20 to 24 | | -0.068 | -1.24 | | -0.140 | -1.30 | |
| Age 25 to 34 | | -0.039 | -0.60 | | -0.096 | -1.04 | |
| Age 35 to 44 | | -0.043 | -0.68 | | -0.122 | -1.48 | |
| Age 45 to 54 | | -0.020 | -0.29 | | -0.053 | -0.64 | |
| Age 55 to 64 | | -0.053 | -0.82 | | -0.092 | -1.31 | |
| Gender (men =0, women=1) | | 0.046 | 2.32 | ** | 0.025 | 0.58 | |
| Region (Quebec=0, rest=1) | | -0.009 | -0.46 | | 0.020 | 0.52 | |
| Constant | | -3.135 | -4.66 | *** | -0.073 | -0.57 | |
| Number of observations | | | 1,458 | | | 1,458 | |
| Population size | | | 15,984,496 | | | 15,984,496 | |
| F-value | | | 4.94 | *** | | 4.52 | *** |
| R-square | | | | | | 0.12 | |

* 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 4.3 The determinants of CD album purchases in the sub-sample of P2P downloaders for the year 2005

| <i>Dependent variables</i> | | Number of CD albums | | | Log Number of CD albums | | |
|------------------------------|-------------------|---------------------|----------------|------------|-------------------------|----------------|------------|
| Estimation Model | | Negative binomial | | | OLS | | |
| | <i>Hypothesis</i> | <i>M.E.</i> | <i>t-value</i> | <i>sig</i> | <i>b</i> | <i>t-value</i> | <i>sig</i> |
| <i>Independent variables</i> | | | | | | | |
| Album too expensive | H1 | -0.032 | -2.65 | *** | -0.003 | -2.34 | ** |
| Number P2P | H1 | 1.212 | 2.94 | *** | 0.094 | 2.50 | ** |
| Number CDs ripped | H1 | 2.352 | 5.42 | *** | 0.195 | 4.74 | *** |
| Number promotional sites | H1 | -0.212 | -0.74 | | -0.013 | -0.50 | |
| Number private websites | H1 | 0.737 | 1.59 | | 0.075 | 1.63 | * |
| Number MP3s copied | H1 | -0.332 | -0.94 | | -0.022 | -0.67 | |
| Hear before buying | H2 | 0.013 | 1.15 | | 0.002 | 1.71 | * |
| Number of MP3s purchased | H3 | 0.465 | 1.11 | | 0.039 | 1.06 | |
| MP3 player ownership | H3 | -1.851 | -1.91 | * | -0.160 | -1.97 | ** |
| Not elsewhere available | H3 | 0.036 | 2.63 | *** | 0.003 | 2.20 | ** |
| Not whole album | H3 | -0.017 | -1.26 | | -0.001 | -0.53 | |
| Number DVDs | H4 | 0.120 | 0.38 | | 0.027 | 0.89 | |
| Number videogames | H4 | 1.012 | 2.38 | ** | 0.090 | 2.31 | ** |
| Number cinema tickets | H4 | 0.918 | 1.82 | * | 0.054 | 1.18 | |
| Number concert tickets | H4 | 0.905 | 1.68 | * | 0.082 | 1.66 | * |
| <i>Control variables</i> | | | | | | | |
| Price CD albums | | 0.012 | 0.10 | | -0.007 | -0.60 | |
| Income 10 to 20 | | 1.501 | 0.46 | | 0.161 | 0.65 | |
| Income 20 to 40 | | -0.172 | -0.09 | | 0.117 | 0.63 | |
| Income 40 to 60 | | 0.190 | 0.09 | | 0.109 | 0.58 | |
| Income 60 plus | | 0.881 | 0.45 | | 0.147 | 0.79 | |
| Quality increased | | 0.458 | 0.47 | | 0.122 | 1.44 | |
| Quality decreased | | 0.379 | 0.32 | | 0.129 | 1.22 | |
| Interest very strong | | 7.054 | 2.85 | *** | 0.250 | 1.10 | |
| Interest somewhat strong | | 5.876 | 2.46 | *** | 0.172 | 0.85 | |
| Interest moderate | | 2.307 | 0.98 | | -0.094 | -0.45 | |
| Interest somewhat low | | -1.599 | -0.63 | | -0.329 | -1.35 | |
| Internet: very skilled | | 3.168 | 0.66 | | 0.518 | 1.76 | * |
| Internet: skilled | | 3.921 | 0.80 | | 0.532 | 1.89 | * |
| Internet: somewhat skilled | | 4.889 | 0.94 | | 0.596 | 2.06 | ** |
| Internet: not very skilled | | 0.980 | 0.19 | | 0.261 | 0.84 | |
| Age 15 to 19 | | -1.536 | -0.50 | | -0.151 | -0.58 | |
| Age 20 to 24 | | -1.040 | -0.36 | | -0.095 | -0.39 | |
| Age 25 to 34 | | -0.111 | -0.04 | | 0.054 | 0.21 | |
| Age 35 to 44 | | 0.608 | 0.22 | | 0.099 | 0.43 | |
| Age 45 to 54 | | 0.206 | 0.07 | | 0.051 | 0.21 | |
| Age 55 to 64 | | 0.725 | 0.18 | | 0.178 | 0.56 | |
| Gender (men =0, women=1) | | -1.389 | -1.62 | * | -0.017 | -0.23 | |
| Region (Quebec=0, rest=1) | | -1.918 | -2.09 | * | -0.134 | -1.81 | * |
| Constant | | 0.991 | 1.69 | * | 1.043 | 2.22 | ** |
| Number of observations n | | | 458 | | | 458 | |
| Population N | | | 3,113,998 | | | | |
| F-statistic | | | 15.09 | *** | | 10.04 | *** |
| R-square | | | | | | 0.30 | |

* 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 The determinants of MP3 purchases in the sub-sample of P2P downloaders for the year 2005

| <i>Dependent variables</i> | | Log number of MP3s | | |
|------------------------------|-------------------|--------------------|----------------|------------|
| Estimation model | | OLS | | |
| | <i>Hypothesis</i> | <i>b</i> | <i>t-value</i> | <i>sig</i> |
| <i>Independent variables</i> | | | | |
| Price CD albums | H1 | -0.032 | -2.20 | ** |
| Album too expensive | H1 | -0.001 | -0.42 | |
| Number P2P | H1 | -0.036 | -0.76 | |
| Number CDs ripped | H1 | 0.147 | 2.24 | ** |
| Number promotional sites | H1 | 0.029 | 0.71 | |
| Number private websites | H1 | -0.102 | -1.51 | |
| Number MP3s copied | H1 | -0.015 | -0.28 | |
| Hear before buying | H2 | 0.003 | 1.96 | ** |
| MP3 player ownership | H3 | 0.172 | 1.22 | |
| Not elsewhere available | H3 | 0.002 | 0.88 | |
| Not whole album | H3 | 0.000 | 0.07 | |
| Number DVDs | H4 | 0.027 | 0.61 | |
| Number videogames | H4 | 0.044 | 0.71 | |
| Number cinema tickets | H4 | 0.247 | 4.18 | *** |
| Number concert tickets | H4 | 0.000 | -0.01 | |
| <i>Control variables</i> | | | | |
| Income 10 to 20 | | -0.163 | -0.79 | |
| Income 20 to 40 | | -0.096 | -0.48 | |
| Income 40 to 60 | | -0.002 | -0.01 | |
| Income 60 plus | | 0.117 | 0.61 | |
| Quality increased | | 0.133 | 0.86 | |
| Quality decreased | | -0.327 | -2.67 | *** |
| Interest very strong | | -0.011 | -0.03 | |
| Interest somewhat strong | | 0.006 | 0.02 | |
| Interest moderate | | 0.045 | 0.13 | |
| Interest somewhat low | | 0.306 | 0.47 | |
| Internet: very skilled | | 0.157 | 0.70 | |
| Internet: skilled | | 0.206 | 0.93 | |
| Internet: somewhat skilled | | 0.083 | 0.37 | |
| Internet: not very skilled | | 0.178 | 0.67 | |
| Age 15 to 19 | | -0.599 | -0.93 | |
| Age 20 to 24 | | -0.506 | -0.82 | |
| Age 25 to 34 | | -0.436 | -0.68 | |
| Age 35 to 44 | | -0.331 | -0.54 | |
| Age 45 to 54 | | -0.555 | -0.90 | |
| Age 55 to 64 | | -0.587 | -0.90 | |
| Gender (men =0, women=1) | | 0.086 | 0.78 | |
| Region (Quebec=0, rest=1) | | -0.117 | -1.19 | |
| Constant | | 0.485 | 0.61 | |
| Number of observations n | | | 458 | |
| Population N | | | 3,113,998 | |
| F-statistic | | | 3.01 | *** |
| R-square | | | 0.17 | |

* 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 The determinants of MP3 purchases in the sub-sample of P2P downloaders for the year 2005 continued

| <i>Dependent variables</i> | | Purchased MP3s (yes/no) | | |
|------------------------------|-------------------|-------------------------|----------------|------------|
| Estimation model | | Probit | | |
| | <i>Hypothesis</i> | <i>M.E.</i> | <i>t-value</i> | <i>sig</i> |
| <i>Independent variables</i> | | | | |
| Price CD albums | H1 | -0.017 | -2.93 | *** |
| Album too expensive | H1 | 0.000 | 0.58 | |
| Number P2P | H1 | -0.005 | -0.26 | |
| Number CDs ripped | H1 | 0.060 | 2.51 | *** |
| Number promotional sites | H1 | 0.020 | 1.30 | |
| Number private websites | H1 | -0.034 | -1.39 | |
| Number MP3s copied | H1 | -0.012 | -0.74 | |
| Hear before buying | H2 | 0.001 | 1.56 | |
| MP3 player ownership | H3 | 0.165 | 3.68 | *** |
| Not elsewhere available | H3 | 0.001 | 1.42 | |
| Not whole album | H3 | 0.000 | -0.05 | |
| Number DVDs | H4 | 0.026 | 1.57 | |
| Number videogames | H4 | 0.033 | 1.55 | |
| Number cinema tickets | H4 | 0.088 | 3.98 | *** |
| Number concert tickets | H4 | 0.014 | 0.56 | |
| <i>Control variables</i> | | | | |
| Income 10 to 20 | | 0.098 | 0.71 | |
| Income 20 to 40 | | -0.034 | -0.34 | |
| Income 40 to 60 | | 0.043 | 0.42 | |
| Income 60 plus | | 0.124 | 1.34 | |
| Quality increased | | 0.020 | 0.40 | |
| Quality decreased | | -0.147 | -2.67 | *** |
| Internet: very skilled | | 0.137 | 0.60 | |
| Internet: skilled | | 0.176 | 0.75 | |
| Internet: somewhat skilled | | 0.131 | 0.54 | |
| Internet: not very skilled | | 0.116 | 0.42 | |
| Gender (men =0, women=1) | | 0.130 | 2.81 | *** |
| Region (Quebec=0, rest=1) | | -0.164 | -3.60 | *** |
| Constant | | -2.103 | -2.28 | *** |
| Number of observations n | | | 474 | |
| Population N | | | 3,256,621 | |
| F-statistic | | | 3.27 | *** |

* 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 474 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

| <i>Ways to acquire music</i> | Women | | | Men | | |
|---|----------------------------|------------------------------|-----------------------|----------------------------|------------------------------|-----------------------|
| | <i>Count of population</i> | <i>Percent of population</i> | <i>Standard error</i> | <i>Count of population</i> | <i>Percent of population</i> | <i>Standard error</i> |
| 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

| <i>Ways to acquire music</i> | Age group 15 to 19 | | | Age group 20 to 24 | | |
|--|----------------------------|------------------------------|-----------------------|----------------------------|------------------------------|-----------------------|
| | <i>Count of population</i> | <i>Percent of population</i> | <i>Standard error</i> | <i>Count of population</i> | <i>Percent of population</i> | <i>Standard error</i> |
| 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

| <i>Ways to acquire music</i> | Age group 25 to 34 | | | Age group 35 to 44 | | |
|--|----------------------------|------------------------------|-----------------------|----------------------------|------------------------------|-----------------------|
| | <i>Count of population</i> | <i>Percent of population</i> | <i>Standard error</i> | <i>Count of population</i> | <i>Percent of population</i> | <i>Standard error</i> |
| 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 | |

| <i>Ways to acquire music</i> | Age group 45 to 54 | | | Age group 55 to 64 | | |
|--|----------------------------|------------------------------|-----------------------|----------------------------|------------------------------|-----------------------|
| | <i>Count of population</i> | <i>Percent of population</i> | <i>Standard error</i> | <i>Count of population</i> | <i>Percent of population</i> | <i>Standard error</i> |
| 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 | |

| <i>Ways to acquire music</i> | Age group 65 plus | | |
|--|----------------------------|------------------------------|-----------------------|
| | <i>Count of population</i> | <i>Percent of population</i> | <i>Standard error</i> |
| 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

| <i>Ways to acquire music</i> | Quebec | | | Rest of Canada | | |
|--|----------------------------|------------------------------|-----------------------|----------------------------|------------------------------|-----------------------|
| | <i>Count of population</i> | <i>Percent of population</i> | <i>Standard error</i> | <i>Count of population</i> | <i>Percent of population</i> | <i>Standard error</i> |
| 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

| <i>Variable</i> | 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

| <i>Variables</i> | 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

| <i>Variables</i> | 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

| <i>Variables</i> | 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 |

| <i>Variables</i> | 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 |

| <i>Variables</i> | 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 2

| <i>Variable</i> | 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 2

| <i>Variables</i> | 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.

Appendix 3 Correlations including all variables in Equations 2

| <i>Variables</i> | 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 2

| <i>Variables</i> | 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 |

| <i>Variables</i> | 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 |

| <i>Variables</i> | 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.