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Don't blame the P2P file-sharers: the impact of free music downloads on the purchase of music CDs in Canada

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Abstract This study measures the extent to which P2P file-sharing activities act as substitutes or complements to music purchases in markets for CDs. The paper breaks with the mainstream economics approach which dominates the music file-sharing discussion. Whereas such models *assume* relationships at the micro level (e.g. between file-sharing and purchases) based on observations made at the macro level, our evolutionary economics approach measures the *direct effects* using micro data representative of the Canadian population. The behavioral incentives underpinning free music downloading, novel to this paper, are the multiple effects of: 'unwillingness to pay' (market substitution), 'hear before buying' (market creation), 'not wanting to buy a whole album' (market segmentation), and 'not available in the CD format or on electronic pay-sites' (market creation). Although the two first mentioned incentives significantly influence CD album purchases—i.e. there is a negative and significant market substitution effect and a positive and significant market creation effect—on the whole, these two effects 'cancel' one another out, leading to no association between the number of P2P files downloaded and CD album sales.

Keywords Technological change · Consumption · Music industry · P2P file-sharing · The Internet

JEL Classification O12 · O32 · O33 · O34

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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 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 and music royalties in copyright-based markets (Andersen et al. 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 consuming 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 the economic status of the musical expression (Gallaway and Kinnear 2001; Romer 2002). When music is provided as a service through a live performance, the problems of joint consumption and (imperfect) excludability are reasonably easy to manage. The market is restricted and the market-control on the creative expression is reasonably secure.

Problems occur when music more easily acquires the properties of a non-rival public good/product via the evolution of (1) 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 (2) 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 may 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 recordings or films, where the investments made in establishing and promoting an artist are very specific and where short product cycles mean that profitability relies on explosive but ephemeral market growth.

However, despite the increased 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.

1.1 Objective of study

The primary objective of this paper is to analyze the effects of P2P file-sharing on pre-recorded music purchases in CD markets. The focus is, in particular, on whether such downloading and P2P file-sharing displaces (substitutes) or increases/stimulates music purchases. P2P file-sharing is a phenomenon characterized by the exchange of digital information between two members of a network connected via the Internet. Popular P2P protocols include Gnutella and BitTorrent. Any digitally stored information can be exchanged via P2P networks, but this paper is concerned only with the exchange of music files.

The paper analyzes Canadian survey data[1] and the results are representative of the Canadian population aged 15 and older. To our knowledge, this is the first large scale empirical study to employ representative microeconomic data derived from direct survey responses.

The analysis aims to assess the behavioral patterns associated with music consumption, as well as the motivations behind such behavior. Previous large scale studies examining the impact of P2P file-sharing on music purchasing/sales have employed macroeconomic (i.e. aggregated) data and assumed certain relationships.[2] Our micro study has a strong advantage over such existing studies, as the data are collected by asking individuals directly about how much music 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

[1] 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.

[2] See, for example, Liebowitz (2008), 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).

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 need to understand the manner in which the micro behavior underpin the creation of the situation at the aggregate level. (This will be elaborated upon in Section 3.) Thus, this paper is based upon measuring direct effects at the micro level in order to explain the macro situation, rather than assuming relationships at the macro level.

The paper is organized in the following way. Section 2 reviews the theoretical and empirical literature and develops the relevant hypotheses. Section 3 introduces the survey data, variables and estimation techniques employed to test the hypotheses developed in Section 2. Section 4 discusses the results of the estimations in the context of the hypotheses; answers are obtained regarding the effects of P2P file-sharing on pre-recorded music purchases of CDs. 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 key concepts related to music demand which are relevant to our analysis. As highlighted in economic textbooks (e.g. Begg et al. 1994, Chapter 3), the demand for a particular good is directly related to four key concepts: (1) price of the good, (2) price of related goods (whether substitutes or complements), (3) consumer income, and (4) 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 (2), while at the same time testing for the relationships in (1), (3) and (4). Demographic factors such as age, gender, occupation and region are also expected to influence the structure of engagement in music CD markets versus free music downloading and P2P file-sharing, so these factors will also be controlled for in the analysis (see Section 3 on data description and the analysis in Section 4).

In the rest of this Section 2, we introduce several hypotheses about the determinants of music CD consumption, as defined in relation to the above four key concepts. The discussion is supported by the literature on P2P file-sharing behavior, adding to the design and arguments in this paper.

2.1 The effect of the price of CDs

When explaining the CD sales, the first hypothesis is based on traditional economic theory, which suggests that the higher the price of a particular

good, the lower the demand for this good. This leaves us with the following hypothesis:

H1. *There is a negative relationship between the perceived price of CD albums and number of CD albums bought.*

There are reasons that suggest that the price of CD albums varies across individuals. For instance, the price of newly released CDs is typically lower so as to increase the chances of the album entering the charts. Thus, people who predominantly purchase current albums should experience lower average prices. Prices also differ according to where the album is purchased (e.g., Anderson 2007). CD albums bought at concerts or on-line are typically sold at a lower price, while CD albums bought in brick and mortar shops are more expensive. With respect to the latter, supermarkets such as Wal-Mart and Asda, which sell a high volume of a limited range of albums, do so at a lower price compared with, for example, HMV. Many people buy albums second-hand—online or at street bazaars. Compilation albums, "best of" albums or special/rare editions yield different prices. This price difference is also confirmed by the prices reported by the respondents, which have a somewhat high variation (see Section 3.1.2).

Thus, the hypothesis is tested by a variable capturing the perceived CD price. There are advantages of 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 consumers are facing.

2.2 The effect of direct music substitutes on CD sales

In this Section 2.2, we review factors that explain how free music downloads and P2P file-sharing affect CD sales. Traditional economic theory suggests that substitution occurs where the good is a direct substitute, and this leads to the following overarching hypothesis, which is further discussed based on recent literature on the effects of P2P activities on music sales:

H2. *There is a negative relationship between 'free music downloads and P2P file-sharing' and CD sale.*

2.2.1 The substitution effect: 'album too expensive' or 'unwillingness to pay'

In principle, a substitution effect occurs when a downloaded copy directly substitutes for the purchased original (Liebowitz 2005). Important issues regarding perfect substitution include whether (1) the quality of music of the original when compared with the substituted copy remains the same, (2) the information attached to the original and the downloaded file is the same, and

(3) 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 costs are essentially zero; e.g. P2P file-sharing. It can be tested whether there is a negative association between P2P file-sharing and music purchasing. This direct substitution effect is due to the unwillingness to pay for authorized copies. Our data enable us to test for this substitution effect, because all file-shares were asked what percentage of their downloaded electronic files were downloaded because they felt that the price of CD albums was too high. Thus, the substitution effect is in this paper measured by a variable called 'album too expensive'. Hypothesis 2.a follows:

H2a. *P2P file-sharing substitutes CD sales because the CD album is perceived as too expensive.*

Liebowitz (2004, 2005) argues 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 analyzes survey data from 15,000 European respondents and finds 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 of free music reduces music purchases by 0.2 albums. Finally, using data from the Global Market Information Database (CMID), Hui and Png (2003) finds that the demand for CDs decreases with (physical) CD piracy. He finds that each pirated album reduces music purchases by 0.42 albums, 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 to which he also refers.

2.2.2 Sampling (i.e. market creation and market segmentation) as an alternative to market substitution

In an analysis of 200 US college students, Gopal et al. (2006) find a strong positive association between downloading music from free MP3 sites and the intention subsequently to 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 online. 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 (unpublished

manuscript, 2004), who uses 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 (unpublished manuscript, 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 et al. (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. Thus the sampling effect is a complex one.

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 things other than music (Liebowitz 2005). Liebowitz draws the analogy to beer or wine tasting. When you are done with such tasting activities, you may be full and wish to have no more.

Liebowitz found that people generally belong to the latter category, resulting in decreased 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) investigates the means by which new music is discovered. The results show 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, but 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 life concerts may be available through P2P networks but may not be available for sale. However, whether such new markets are so similar to the existing markets that they in fact substitute in practice is difficult to guess.

Thus, in order to consider the relative importance of the 'sampling' and 'substitution' effects associated with P2P file-sharing, 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.

Market creation effects The market creation effect relates to situations in which 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 in which the music is not available in stores or from pay-sites. The relevant variable is called 'not available elsewhere', another motive identified by respondents. Thus, we can list two market creation hypothesis:

H2b. *There is a positive relationship between CD sale and P2P file sharing, where the motive is that file-sharers wish to hear a soundtrack or an artist before purchasing music.*

This reflects a direct market creation effect from P2P file sharing.

H2c. *There is no relationship between CD sale and P2P file-sharing, where file-sharers look for music which is not available elsewhere except in file-sharing networks.*

This reflects a market creation effect in which old and new music pay-markets need to supply the music and artists people demand.

Market segmentation effect The market segmentation effect refers to situations in which the respondent does not want to buy a whole album, that is, the whole bundle of songs, but prefers the single digital file. The relevant

variable is called 'not whole album'. We can list the following market creation hypothesis:

H2d. *There is a negative relationship between CD sale and P2P file-sharing, where file-sharers download because they prefer the digital, intangible and single file.*

This reflects a market segmentation effect of music carriers as a result of the emergence of electronic delivered music and P2P file-sharing. It is also evidence of a radical technological change in the standard of music carriers, and therefore reflects a new market potential or new business opportunity for electronically delivered music, such as MP3 pay-markets.

2.2.3 The effect of entertainment substitutes or complements on CD markets

This section considers the effects of indirect substitution goods to CD sales. Specifically, we consider the effect of related entertainment goods on demand for CD albums. Assuming people not only have limited money (i.e. they are constrained by income, see Section 2.3) but also limited time, other entertainment goods can be assumed to be in direct substitution for music purchasing. This is tested via the following hypothesis:

H2e. *Purchases of related entertainment goods (DVDs, cinema tickets, videogames, concert tickets) have a negative impact on CD album sales.*

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 (2005) considers the effect of substitute entertainment goods, and finds 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 discusses 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 finds 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 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 below in the section on the effect of demographic factors on music downloading, the survey also shows that girls tended 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 finds 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 suggests 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 are able to take this into account in our analysis, as we have data on the following: number of purchased DVDs, video games, movie tickets bought and live concerts attended.

2.3 The effect of consumer income

Then there is the effect of consumer income. In accordance with economic theory, a higher income is associated with increased purchasing. Thus, any hypothesis and analysis of CD sales should also investigate, or take into account, the effect of income:

H3. *There is a positive relationship between income and CD album purchasing.*

Whereas a positive relationship between income and purchasing is relatively simple to understand with respect to CDs, one would not, at first glance, expect to find any effect on P2P file-sharing. However, other factors may come into play here. As higher income groups are also at the 'upper end of the digital divide,' having better Internet access and/or Internet skills (Castells 2001), a positive relationship between income and P2P file-sharing should be expected, which in turn may have an effect (positive or negative depending on the substitution versus sampling effect) on CD sales.

Using per capita GDP and CD sales data, Liebowitz (2005) finds that income has a *minor impact* on album sales ($1,000 increase would alter per capita sales by only 0.28 units). However, based on household income, Liebowitz (2005) demonstrates (counter-intuitively) that higher household income is more likely to lower per capita sales of albums. Again, this could be explained by the digital-divide argument—higher income groups are more likely to use the Internet, and such use leads to substitutions away from CD purchasing. However, contrary to Liebowitz (2004), Peitz and Waelbroeck (2004) find a strong positive effect of income (measured as GDP growth) on CD purchases.

2.4 The effect of consumer taste

Now we move on to the last part of the consumer demand function, as identified in the beginning of Section 2. In this context, the degree of music CD purchasing, free music downloading and P2P file-sharing is also expected to vary with consumer taste. People who have a stronger taste for music are expected to acquire more music. In accordance with economic theory, the following hypothesis is therefore listed.

H4. *A greater taste for music is positively associated with music acquiring (including both CD purchasing and P2P file-sharing).*

However, as we have no direct data on consumer taste, this paper considers a related proxy, 'music interest', in order to take this phenomenon into account. We believe that 'music interest' is related to music taste, where a person with a strong interest is assumed to have a strong taste for music. Thus, music interest is also expected to influence music purchasing and price tolerance in CD markets, and influence participation in P2P file-sharing networks. To take this into account, respondents were asked to describe their interest in listening to music as very strong, somewhat strong, moderate, somewhat limited and very limited.

3 Data and method

3.1 Data

This paper adds to the discussion on the effects of music downloading and P2P file-sharing by using microeconomic survey data representative of the Canadian population and by extending the analysis to account for a wider range of relevant factors underlying music purchasing. This survey was designed by Birgitte Andersen with support from Industry Canada, and data collection was conducted by Decima Research in 2006.

Most previous studies on the relationship between P2P file-sharing and CD sales have utilized aggregated (e.g. macroeconomic) data. Thus, the analyzes using those data merely indirectly explain the statistical relationships

on which micro-assumptions and conclusions are based. The analysis in this paper is based on direct answers (or micro-data) from which we can measure direct effects as opposed to assuming underlying relationships. For example, Canadian respondents were asked about how many CDs they purchased and the average prices they paid in 2005, as well as how many electronic files they acquired through P2P file-sharing networks and their incentives for such activities, etc.

The sampling technique used is 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). 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).

In terms of the sample size, the initial dataset contains 1,005 respondents who declared that they were P2P downloaders and 1,095 who declared not to have engaged in P2P downloading. When investigating the effect of P2P file-sharing, the paper includes all respondents also active in CD markets. We did not include people who did not report any activity in those markets, because the group may never have been active in CD purchasing. In this case, they can of course not be blamed for the downfall of the CD market. The analogy is that of the transition from LP to CD markets. Many entered the CD markets without having ever purchased an LP. Out of the 2,100 observations 1,676 respondents purchased CD albums (234 of them did not engage in P2P and 190 engaged in P2P downloading). The sample is further reduced by 246 respondents, 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.[3]

Table 1 provides an overview of the variables.

3.1.1 Dependent variable: CD album sales

Our dependent variable is designed to capture music purchases in the form of CD albums. The sales of singles is not included, as this has always only been a

[3]The information on the number of P2P downloads of these 246 observations was imputed by Decima Research. We computed estimations both with and without these 246 observations and found no significant difference. The results presented here exclude these 246 respondents.

Table 1 Summary of variables used for estimating the extent and determinants of music consumption in CD and MP3 pay-markets based on 2005 information

Variables	Variable description	Sample
Dependent variable		
	Number of CDs purchased by respondents	Whole sample
Independent variables		
Hypothesis 1	Experienced average price of music CDs in Canadian $	Whole sample
Hypothesis 2	Number of P2P downloads	Whole sample
	Motives:	
	Album to expensive	P2P sub-sample
	Hear before buying	
	Not available elsewhere	
	Not the whole album	
Hypothesis 3	Number of purchased DVDs	Whole sample
	Number of purchased video games	
	Number of movie tickets	
	Number of live concerts	
Hypothesis 4	Household income in Canadian $	Whole sample
	under 10,000	
	between 10,000 and 20,000	
	between 20,000 and 40,000	
	between 40,000 and 60,000	
	60,000 and above	
Hypothesis 5	Music interest very limited	Whole sample
	Music interest somewhat limited	
	Music interest moderate	
	Music interest somewhat strong	
	Music interest very strong	
Instruments		
Internet skills	Internet skill level: very skilled	Whole sample
	Internet skill level: skilled	
	Internet skill level: somewhat skilled	
	Internet skill level: not very skilled	
	Internet skill level: not at all skilled	
Control variables		
Age	15 to 19 years of age	Whole sample
	20 to 24 years	
	35 to 44 years	
	45 to 54 years	
	55 to 64 years	
	65 years and above	
Student	Respondent was a student (0, 1)	Whole sample
Gender	Gender (0 = male, 1 = female)	Whole sample
Region	Quebec = 1; rest of Canada = 0	Whole sample

niche market. The relevant variable is measured by the number of CD albums respondents estimated that they purchased in 2005. The variable has a positive skew, with relatively more participants reporting low numbers of CD album purchases. To address this, we use the natural log of the number of CD albums.

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]

3.1.2 Independent variables

The perceived price, self-assessed by the respondent, is used to test the first hypothesis, which states that price has a negative impact on sales. The variable is continuous and measured in Canadian $. This variable follows approximately a normal distribution. In total, 1,575 respondents reported their perceived CD album price. The mean price is Canadian $17.7 with a standard deviation of $4.1. The minimum price stated is $1 and the maximum price $45.

Hypothesis 2, and sub-hypotheses 2.a to 2.d, relate to the effects of P2P file-sharing, and the motives behind file-sharing, on CD album purchases. We use several variables to explore this complex relationship: First, the number of P2P files downloaded. The variable is log transformed, after adding 1, to normalize it. Additionally, we use five dummy variables that represent quintiles of the P2P downloading distribution. The first dummy selects respondents with up to 4 downloads in an average month, accounting for 20% of the downloading distribution with the lowest downloading activity. The fifth dummy selects respondents who had between 43 and 500 downloads accounting for the top 20% of downloading activity.

Second, in conjunction with the sub-hypotheses 2.a to 2.d, we use four variables to examine the motives behind P2P activities: (1) 'album too expensive', (2) 'hear before buying', (3) 'not available elsewhere', and (4) 'not the whole album'. These capture the substitution effect, market creation and market segmentation effects. The four variables are measured on a scale from 0 to 1 and are the proportion of P2P downloads out of total downloads which a person associated with each of the four motives.

Hypothesis 2.e links CD album purchases to purchases of alternative entertainment goods. The following four variables are used to test for a negative relationship between purchases of alternative entertainment goods and the purchase of CD albums: (1) number of DVDs purchased; (2) number of videogames purchased; (3) number of cinema tickets; and (4) number of concert tickets bought. The variables are log transformed—after adding 1—for normalization purposes.

Hypothesis 3 examines the impact of income on CD album sales. The income variables refer to household, rather than individual, income of survey participants. Moreover, household income data are imputed to overcome a

[4] Adding one, compared to any other value, is common practice within the area of economics and management studies (Tabachnick and Fidell 2007) 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.

high rate of non-response and, thus, our findings in relation to this variable should be treated with some caution. There are five dummies representing five different income bands, which are measured in Canadian $. The first dummy is an estimated household income below 10,000. This forms our base group against which the effects of all other income bands are compared. The remaining income groups are: 10,000 to 20,000; 20,000 to 40,000; 40,000 to 60,000; and 60,000 and above.

Hypothesis 4 links consumer taste to CD album purchases. As discussed in Section 2, we use variables designed to capture the degree of interest in listening to music as proxies for consumer taste. Four dummies, which group individuals according to their self-reported level of interest—very strong, somewhat strong, moderate, somewhat limited and very limited—are used. The individuals who report very limited interest in listing to music form our base group against which the effects of the other categories are compared.

3.1.3 Instruments for P2P file-sharing

Hypothesis 4 also expresses the idea that consumer taste determines P2P file-sharing, which leads to an issue of simultaneity in any estimations linking CD sales to P2P file-sharing. We use five variables measuring different levels of Internet skills, as self-assessed by the respondent as instruments, to address this problem. A similar instrument—Internet sophistication—is used in the study by Zentner (2004), albeit his proxy for Internet sophistication is self-assessed response to time spend online, number of years that a person has used the Internet and email. The dummies refer to Internet 'very skilled', 'skilled', 'somewhat skilled', 'not very skilled' and 'not at all skilled'. The latter is the base comparison group.

3.1.4 Control variables

We control for the following demographic factors. 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 1 for women and 0 for men. Moreover, we include a dummy variable identifying the students in the sample. Finally, we control for region (Quebec is coded as 1 and the rest of Canada is coded as 0).

3.2 Method

In order to examine the impact on CD album sales of our independent variables, we estimate the following equation:

$$Y_i = X_i\beta + \gamma D_i + \varepsilon_i$$

where i is the respondent, Y_i is the number of CD album sales. X_i is a vector of the characteristics of the respondent, including perceived price of music, interest in music, consumption of alternative goods, age, gender and region, and D_i denotes the number of P2P downloads. β and γ are the coefficients which are estimated using OLS and 2SLS. OLS is used to estimate γ with a positive bias because P2P file-sharing is determined by music interest. The issue is explored in Oberholzer-Gee and Strumpf (2007), Rob and Waldfogel (2004) and Zentner (2004), all of which use instrumental variable techniques.

The instruments Z_i used in this paper are different levels of Internet skills and γ becomes the 2SLS estimator. For instrumental variables to be valid, Z_i need to be sufficiently correlated with D_i and uncorrelated with ε_i. The paper reports a set of related statistics testing for (1) weak instruments and (2) overidentification restrictions. With respect to (1), we report the R^2 of the first stage equation and the F-statistic of the significance of Z_i with the associated p value. Stock et al. (2002) suggest that the F-statistics should exceed a value of 10 for 2SLS estimators based on one endogeneous regressor. With respect to (2), we report the p values of Sargan's and Basmann's chi-squared statistics.

In order to test sub-hypotheses 2.a to 2.d, which explore more complex relationships between P2P file-sharing and CD album sales by investigating the substitution, market creation and market segmentation effects in separation, estimations based on the sub-sample of P2P file-sharers are reported. Here, the P2P variable is replaced by four variables measuring the proportion of P2P downloads due to the four incentives: 'album too expensive'; 'hear before buying'; 'not available elsewhere'; and 'not the whole album'. Following on from this regression, we compute the Wald-statistic, testing the null hypothesis that the sum of the coefficients of the four 'motive' variables is equal to 0; in other words, that the combined substitution, market creation and segmentation effect is equal to 0.

4 Results

This section discusses the results of the regression estimations testing our hypotheses developed in Section 2. The set of regressions is designed to analyze a range of variables determining the number of CD album sales based a sample representative of the whole Canadian population. This section also integrates a distinct analysis and discussion on a subset of the survey that is based on all those respondents who declared that they participated in P2P file-sharing. This subset is analyzed because it enables us to include a wider range of variables that are derived from sections of the survey only applicable to the respondents who were downloaders; specifically, these relate to incentives to download and test hypotheses 2.a to 2.d. The results are presented in Table 2, with the underlying descriptive statistics and correlations in the Appendix.

Table 2 Impact of P2P file-sharing on CD album sales

	Hypothesis	(1) OLS	(2) 2SLS		(3) OLS	(4) OLS
			1st stage	2nd stage		
Price CD albums	H1	0.001 (0.005)	−0.002 (0.010)	0.002 (0.005)	0.000 (0.005)	−0.011 (0.011)
Log number of P2Ps	H2	0.008 (0.014)		−0.050 (0.089)		
1st quintile of P2P distribution	H2				0.160* (0.082)	
2nd quintile of P2P distribution	H2				−0.172* (0.091)	
3rd quintile of P2P distribution	H2				0.061 (0.098)	
4th quintile of P2P distribution	H2				−0.233** (0.105)	
5th quintile of P2P distribution	H2				0.000 (0.000)	
Album too expensive	H2.a					−0.235** (0.012)
Hear before buying	H2.b					0.196** (0.096)
Not available elsewhere	H2.c					0.047 (0.109)
Not the whole album	H2.d					−0.125 (0.106)
Log DVDs	H2.e	0.079*** (0.017)	0.081** (0.035)	0.084*** (0.019)	0.082*** (0.016)	0.047* (0.027)
Log videogames	H2.e	0.080*** (0.024)	0.077 (0.056)	0.084*** (0.025)	0.082*** (0.023)	0.083** (0.036)
Log cinema tickets	H2.e	0.057*** (0.020)	0.092** (0.042)	0.064*** (0.024)	0.054*** (0.019)	0.095** (0.039)
Log concert tickets	H2.e	0.166*** (0.028)	0.099* (0.051)	0.170*** (0.030)	0.166*** (0.024)	0.169*** (0.044)
Income 10,000 to 20,000	H3	−0.007 (0.111)	−0.038 (0.237)	−0.025 (0.113)	−0.008 (0.106)	0.055 (0.189)
Income 20,000 to 40,000	H3	0.028 (0.097)	0.059 (0.203)	0.034 (0.098)	0.024 (0.090)	0.018 (0.169)
Income 40,000 to 60,000	H3	0.073 (0.097)	0.087 (0.201)	0.079 (0.098)	0.071 (0.089)	0.013 (0.167)
Income 60,000 plus	H3	0.125 (0.094)	0.071 (0.199)	0.133 (0.095)	0.127 (0.086)	0.087 (0.160)
Interest very strong	H4	0.407*** (0.103)	0.433** (0.218)	0.434*** (0.115)	0.379*** (0.137)	0.571*** (0.135)
Interest somewhat strong	H4	0.236** (0.102)	0.233 (0.217)	0.247** (0.107)	0.221 (0.137)	0.409*** (0.133)
Interest moderate	H4	0.032 (0.100)	−0.010 (0.211)	0.035 (0.103)	0.014 (0.136)	0.222* (0.129)
Interest somewhat limited	H4	−0.192 (0.120)	0.134 (0.245)	−0.195 (0.122)	−0.217 (0.157)	0.005 (0.210)
Age 15 to 19		−0.102 (0.078)	0.787*** (0.172)	−0.059 (0.107)	−0.114 (0.071)	−0.265** (0.112)
Age 20 to 24		−0.075 (0.065)	0.604*** (0.151)	−0.039 (0.089)	−0.074 (0.065)	−0.183* (0.099)
Age 35 to 44		0.069 (0.061)	−0.267** (0.116)	0.053 (0.065)	0.078 (0.062)	−0.049 (0.114)
Age 45 to 54		0.109* (0.060)	−0.373*** (0.113)	0.080 (0.069)	0.109* (0.064)	0.041 (0.149)
Age 55 to 64		0.071 (0.071)	−0.517*** (0.111)	0.030 (0.089)	0.066 (0.074)	0.239 (0.191)

Table 2 (continued)

	Hypothesis	(1) OLS	(2) 2SLS		(3) OLS	(4) OLS
			1st stage	2nd stage		
Student		−0.065 (0.064)	−0.030 (0.146)	−0.064 (0.064)	−0.056 (0.059)	0.045 (0.096)
Gender ($f = 1$)		−0.116*** (0.038)	0.036 (0.080)	−0.118*** (0.038)	−0.109*** (0.038)	−0.104 (0.066)
Region		−0.075** (0.037)	−0.249*** (0.077)	−0.093** (0.042)	−0.073* (0.038)	−0.093 (0.067)
Internet: very skilled			0.790*** (0.142)			
Internet: skilled			0.536*** (0.123)			
Internet: somewhat skilled			0.374*** (0.118)			
Internet: not very skilled			0.101 (0.122)			
Constant		1.649*** (0.165)	0.037 (0.339)	1.671*** (0.169)	1.868*** (0.195)	1.748*** (0.301)
Observations		1,335	1,319	1319	1335	496
R^2		0.196	0.236	0.180	0.204	0.190
F-value on excludability of instruments			10.263			
Prob > F on excludability of instruments			0.000			
Sargan test (p value)			0.487			
Basmann test (p value)			0.495			
H_0: Sum of 1 to 4 = 0 (Prob > F)						0.47

Robust standard errors in parentheses

*$p < 0.1$

**$p < 0.05$

***$p < 0.01$

There is no support for hypothesis 1, which suggests that the price of CD albums is negatively associated with CD album sales with the relevant coefficients in Table 2 being close to zero. Our data (see Table 3 in the Appendix) indicate that the perceived price of CD albums ranges between Canadian $1 and $45. This could suggest that people have different music price elasticities, even within the same CD price category. This result is in line with the findings reported by Liebowitz (2004). He explains it by the fact that CD prices have remained stable over the last 30 years, which implies that a change in CD purchasing must be explained by a range of other factors. A related result (as reported in connection with hypothesis 2.a below) derives from the variable 'album too expensive' in column 3 of Table 2. We can interpret this as indirect evidence that CD purchasing does depend on price when price drops to zero, among those who engage in P2P file-sharing.

Turning to hypothesis 2, which suggests that P2P downloading has a negative impact on CD album sales, Table 2 shows no significant relationships in columns 1 and 2. While the coefficient γ is positive and almost zero in the OLS model (column 1), it is negative, yet still very close to zero, in the instrumented regression (column 2).

The first stage regression explains the number of P2P downloads. The instruments are highly significant and the tests support that they are valid, i.e. sufficiently correlated with P2P downloads ($F = 10.263$; $p < 0.001$) and uncorrelated to the error in stage 2 of the regression.

This finding is in line with the results reported in Oberholzer-Gee and Strumpf (2007). Zentner (2004), whose study, too, uses direct survey responses, finds a negative and significant association between P2P activity and music purchases, while using similar instruments for P2P activity to our study. The key differences between our and Zentner's study is that the results presented in Zentner's study are not based on the number of purchases or downloads, but simply on dummies (0, 1)—whether or not CDs were purchased or downloads took place on a regular basis.

Column 3 looks at dummies representing the quintiles of the downloading distribution. Positive associations arise with those downloaders who engaged in few downloads (up to four downloads in an average month), but there are negative associations with the second and fourth quintile (five to nine downloads and 25 to 42 downloads, respectively). This is important as it indicates that for some groups, the second and fourth quintile, displacement effects overweight a positive market creation effect, while at other levels the relationship is a positive one.

To explore the relation between P2P downloading and CD album purchases further, this paper examines the degree to which different motivations behind P2P file-sharing influence the number of CD sales (see column 4 of Table 2). The motives are: 'album too expensive'; 'hear before buying'; 'not available elsewhere' and; 'not whole album'. Hypothesis 2.a—capturing the substitution of CD sales due to CD albums being perceived as too expensive—is supported with ($b = -0.235$; $p < 0.001$). Hypothesis 2.b, testing a positive CD market

creation effect derived from hearing a song in P2P networks prior to buying it on CD, too, is supported with ($b = 0.196$; $p < 0.001$).

As suggested in Section 2, the results do not show an impact on CD album sales from downloads motivated because a song is not available elsewhere, but in the P2P network. Finally, there is no support for a negative market segmentation effect—hypothesis 2.d—P2P downloads because people prefer a single, digital file.

Following on from the four coefficients on the different motives behind P2P downloading, we test the null hypothesis that their joint effect is 0. In other words, that the sum of the four coefficients is 0. The relevant p value is 0.47, suggesting that—overall—the impact is not statistically different from 0, with the market substitution effect being cancelled out by the sampling effect. No association between the number of P2P downloads and CD purchases was also reported in connection with the two previous models discussed above.

Turning now to hypothesis 2.e, which looks at the impact of the consumption of goods alternative to CD albums—purchases of DVDs, videogames, cinema ticket and concert tickets—the results provide negative support, with positive and significant coefficients. This complementary effect of the entertainment goods 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 consuming more DVDs, concerts, cinema/movies and video games. Thus, music and entertainment is a life-style choice of certain groups of society.

The coefficients for household income—hypothesis 3—are insignificant, not dissimilar to the results of Rob and Waldfogel (2004). We, therefore, conclude that music purchasing in general takes up a too low share of households' income to have any effect on purchasing behavior. Finally, there is strong support for hypothesis 4, as respondents that declared their interest in music to be 'very strong' or 'somewhat strong' also bought more CD albums.

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 study, building upon a major study conducted for Industry Canada between 2005–2008 (see Andersen and Frenz 2007), was initially aimed at supporting policy decisions in relation to the internal review of the copyright regime in Canada.

When analyzing the effects of P2P file-sharing on pre-recorded music purchases in CD music markets, the focus was in particular on whether P2P file-

sharing displaces/substitutes or increases/stimulates music purchases. Based on our findings, we argue that P2P file-sharing behavior may not be bad news for the industry, because such activities create a range of new business opportunities.

When estimating the effect of P2P downloads on CD album purchases, we use instrumental variables techniques to address the issue of simultaneity (P2P downloads and CD sales are jointly determined by music interest). On the whole, the paper does not find that P2P downloads are associated with fewer CD album purchases.

Investigating the motivations behind P2P downloads in more detail, we found a positive sampling or market creation effect of P2P activity on CD album purchases. Downloads linked to a 'hear before buying effect' stimulate sales of CD albums. As expected, we also found a negative CD market substitution effect. Where P2P activity was motivated because CD albums were perceived as being too expensive, such downloads displaced CD sales. The positive sampling or market creation effect and the negative sampling effect cancel one another out; i.e. neither one of them is significantly large than the other.

Thus, this paper show that P2P file-sharing is not to blame for the decline in CD markets. Music markets are not simply undermined by free music downloading and P2P file-sharing, due to the sampling effect. However, technological innovation (spurring the way in which music is now electronically delivered and consumed) pushes a need for the music industry to change its organization of such appropriation, in order to match the emerging new structures that are able to supply music at cheaper prices, especially for those who download freely from P2P file-sharing networks, because they perceive the album price as too expensive.

The new technologies may offer golden opportunity for new publishers and artists to enter music pay markets in which copyright appropriation occurs. This also involves the need to adopt to the evolving music preferences or tastes and the new ways music users prefer their music to be delivered and consumed.

Furthermore, the results indicate a strong entertainment culture 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. Different income levels have no influence on CD purchasing. We, therefore, conclude that music purchasing in general takes up too low a share of peoples' income to have any effect on purchasing behavior. However, and not surprisingly, a strong taste for music, measured as the self-assessed interest in music, is positively related to music purchasing (and P2P file-sharing).

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Appendix: Descriptive and correlations between the dependent variable, independent variables and instruments

Table 3 Descriptive statistics summarizing the dependent variable, independent variables and instruments

Variable		Mean	SD	IQR	Minimum	Maximum
1	CD albums	11.10	12.24	7.00	1.00	100.00
2	P2P	15.51	39.47	19.00	0.00	500.00
3	Price of CD albums	17.67	3.91	5.00	1.00	45.00
4	DVD	6.08	11.42	7.00	0.00	100.00
5	Videogames	1.93	4.91	2.00	0.00	50.00
6	Cinema tickets	8.66	10.81	9.00	0.00	104.00
7	Concert tickets	1.81	4.06	2.00	0.00	50.00
8	Income 10,000 to 20,000	0.07	0.26	0.00	0.00	1.00
9	Income 20,000 to 40,000	0.21	0.41	0.00	0.00	1.00
10	Income 40,000 to 60,000	0.23	0.42	0.00	0.00	1.00
11	Income 60,000 plus	0.45	0.50	1.00	0.00	1.00
12	Interest very strong	0.38	0.49	1.00	0.00	1.00
13	Interest somewhat strong	0.28	0.45	1.00	0.00	1.00
14	Interest moderate	0.27	0.44	1.00	0.00	1.00
15	Interest somewhat limited	0.05	0.21	0.00	0.00	1.00
16	Age 15 to 19	0.24	0.43	0.00	0.00	1.00
17	Age 20 to 24	0.15	0.36	0.00	0.00	1.00
18	Age 35 to 44	0.16	0.37	0.00	0.00	1.00
19	Age 45 to 54	0.14	0.35	0.00	0.00	1.00
20	Age 55 to 64	0.09	0.28	0.00	0.00	1.00
21	Student	0.28	0.45	1.00	0.00	1.00
22	Gender	0.52	0.50	1.00	0.00	1.00
23	Region	0.51	0.50	1.00	0.00	1.00
24	Internet: very skilled	0.23	0.42	0.00	0.00	1.00
25	Internet: skilled	0.29	0.45	1.00	0.00	1.00
26	Internet: somewhat skilled	0.28	0.45	1.00	0.00	1.00
27	Internet: not very skilled	0.10	0.29	0.00	0.00	1.00

Table 4 Correlations among the dependent variable, independent variables and instruments

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Log CD albums	1.00												
2	Log P2P	0.11	1.00											
3	Price of CD albums	0.03	0.06	1.00										
4	Log DVD	0.20	0.16	0.03	1.00									
5	Log Videogames	0.14	0.17	0.07	0.20	1.00								
6	Log Cinema tickets	0.15	0.23	0.05	0.18	0.10	1.00							
7	Log concert tickets	0.26	0.11	0.00	0.03	−0.05	0.16	1.00						
8	Income 10 to 20	−0.08	−0.01	0.03	0.00	−0.03	−0.06	−0.07	1.00					
9	Income 20 to 40	−0.07	−0.03	0.03	−0.10	0.01	−0.08	−0.04	−0.14	1.00				
10	Income 40 to 60	0.00	0.00	−0.04	−0.03	0.02	0.00	0.00	−0.14	−0.28	1.00			
11	Income 60 plus	0.12	0.03	−0.01	0.12	0.00	0.12	0.10	−0.24	−0.46	−0.49	1.00		
12	Interest very strong	0.24	0.21	0.04	0.09	0.10	0.06	0.23	−0.02	−0.02	0.02	0.01	1.00	
13	Interest somewhat strong	0.00	0.00	0.04	0.00	−0.01	0.05	−0.04	−0.01	0.00	0.01	0.02	−0.51	1.00
14	Interest moderate	−0.17	−0.17	−0.06	−0.05	−0.07	−0.07	−0.15	0.02	0.00	0.00	−0.02	−0.47	−0.38
15	Interest somewhat limited	−0.15	−0.08	−0.03	−0.08	−0.02	−0.09	−0.09	0.00	0.00	−0.03	0.02	−0.17	−0.14
16	Age 15 to 19	−0.02	0.28	0.11	0.03	0.18	0.22	−0.03	0.07	−0.04	−0.02	0.01	0.15	−0.01
17	Age 20 to 24	0.01	0.18	0.01	0.09	0.04	0.11	0.07	0.02	0.01	0.00	−0.07	0.08	0.01
18	Age 35 to 44	0.03	−0.12	−0.04	−0.01	0.00	−0.10	−0.02	−0.09	−0.04	0.00	0.08	−0.05	0.02
19	Age 45 to 54	0.00	−0.19	−0.05	−0.09	−0.13	−0.15	−0.04	−0.07	−0.03	0.02	0.07	−0.08	−0.05
20	Age 55 to 64	−0.02	−0.19	−0.01	−0.09	−0.15	−0.13	0.01	0.01	0.02	0.00	0.00	−0.09	0.01
21	Student	−0.04	0.26	0.06	0.07	0.08	0.22	−0.02	0.09	−0.03	−0.04	−0.04	0.15	0.00
22	Gender	−0.12	−0.05	0.00	−0.06	−0.25	−0.01	−0.02	0.02	0.06	0.04	−0.12	−0.03	0.04
23	Region	−0.04	−0.03	−0.11	0.01	0.04	−0.07	−0.02	−0.04	−0.03	−0.03	0.08	0.12	−0.03
24	Internet: very skilled	0.11	0.21	0.01	0.17	0.14	0.17	0.08	−0.08	−0.05	−0.03	0.12	0.21	−0.05
25	Internet: skilled	−0.01	0.07	0.02	0.06	0.02	0.06	0.03	−0.06	−0.01	−0.02	0.04	0.03	−0.02
26	Internet: somewhat skilled	−0.04	−0.07	0.02	−0.11	−0.03	−0.04	−0.06	0.12	−0.01	0.01	−0.04	−0.11	0.07
27	Internet: not very skilled	−0.07	−0.14	−0.01	−0.11	−0.10	−0.10	−0.05	0.02	0.04	0.01	−0.06	−0.09	0.06

Table 4 (continued)

		14	15	16	17	18	19	20	21	22	23	24	25	26
1	Log CD albums													
2	Log P2P													
3	Price of CD albums													
4	Log DVD													
5	Log Videogames													
6	Log Cinema tickets													
7	Log concert tickets													
8	Income 10 to 20													
9	Income 20 to 40													
10	Income 40 to 60													
11	Income 60 plus													
12	Interest very strong													
13	Interest somewhat strong													
14	Interest moderate	1.00												
15	Interest somewhat limited	−0.13	1.00											
16	Age 15 to 19	−0.11	−0.10	1.00										
17	Age 20 to 24	−0.06	−0.06	−0.25	1.00									
18	Age 35 to 44	0.04	0.05	−0.24	−0.19	1.00								
19	Age 45 to 54	0.09	0.09	−0.23	−0.18	−0.18	1.00							
20	Age 55 to 64	0.07	−0.02	−0.17	−0.14	−0.13	−0.13	1.00						
21	Student	−0.11	−0.11	0.64	0.13	−0.23	−0.24	−0.18	1.00					
22	Gender	−0.02	0.00	−0.04	−0.02	0.00	0.02	0.01	−0.02	1.00				
23	Region	−0.11	0.01	0.08	−0.01	−0.05	−0.03	0.00	0.04	0.02	1.00			
24	Internet: very skilled	−0.14	−0.03	0.03	0.11	−0.03	−0.07	−0.09	0.08	−0.13	0.04	1		
25	Internet: skilled	0.01	−0.03	0.08	0.03	0.03	−0.11	−0.01	0.09	−0.02	0.03	−0.37	1	
26	Internet: somewhat skilled	0.08	−0.05	0.02	−0.05	−0.02	0.08	−0.04	0.00	0.08	0.00	−0.36	−0.42	1
27	Internet: not very skilled	0.01	0.04	−0.11	−0.06	0.02	0.06	0.08	−0.11	0.06	−0.01	−0.17	−0.2	−0.19

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