

EVIDENCE OF THE EFFECT OF FREE MUSIC DOWNLOADS ON THE PURCHASE OF MUSIC CDS IN CANADA

GEORGE R. BARKER

ABSTRACT. This paper examines data on the effects of Internet peer-to-peer (P2P) file sharing activities on music purchasing. The data was obtained from a survey commissioned by *Industry Canada* to “inform *Industry Canada*’s policy development work” regarding copyright law reform in Canada. The paper focuses on an important survey question which has not yet been analysed. Analysis of survey responses suggests that P2P file-sharing is a substitute for legitimate music purchases and has strong negative effects on legitimate music purchases. This contradicts the results of earlier analysis of the data commissioned by *Industry Canada* first published on *Industry Canada*’s website in 2007 (Andersen and Frenz, 2007), and then subsequently revised and republished as Andersen and Frenz (2010).

1. INTRODUCTION

This paper examines data on the music purchasing and internet peer-to-peer (P2P) file sharing activities of Canadians which was obtained from a survey commissioned by *Industry Canada* in 2006. The survey was designed to “inform *Industry Canada*’s policy development work”¹ and ultimately therefore support better policy decisions regarding copyright law in Canada.

In what follows I first outline the nature of the data. I then review the results of existing studies of the data. I then analyse a key survey question

I am grateful to Music Canada for facilitating this research and to Professor Tim Maloney, Dr Richard Watt, Professor Stan Liebowitz, Professor Steve Margolis and participants in the 2010 SERCI congress in Bilbao for comments on earlier versions of this paper. The views in this paper, and any errors however are my own.

¹Quote from project description from *Industry Canada*’s website at <http://www.ic.gc.ca/eic/site/ic1.nsf/eng/01464.html> downloaded 23 January 2012.

that has not been analysed to date but which throws light on the likely effect of peer-to-peer (P2P) file sharing on music purchases. The survey responses to the question suggest that P2P downloads have strong negative effects on legitimate music purchases and, P2P downloading acts as a substitute for legitimate music purchases. One can infer from this analysis that stronger copyright laws would substantially increase music purchases and music industry sales revenues and, by implication, increase artist income and industry employment and contribute to both economic growth and higher government tax revenues in Canada.

2. THE SURVEY AND THE RESULTING DATA

The survey was commissioned and funded by Industry Canada, with the assistance of *Decima Research* and Dr. Brigitte Andersen² in 2006. *Decima Research* conducted the survey by means of telephone interviews with 2,100 randomly selected Canadians (15 years and older) across the country between April and June 2006 – 1,000 who downloaded music files over the Internet and 1,100 who did not. The sample was scaled up using weights designed to be representative of the Canadian population and described as follows:

“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...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 0.24...

²Department of Management Birkbeck, University of London, UK.

The observations in the survey 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". (Andersen and Frenz, 2007, p.17).

Generally, the questionnaire contained two types of questions on current music acquisition behaviour or the different methods used for acquiring music (e.g. buying CDs and P2P downloads). The first type of questions (question 1.3) asked respondents whether they acquired music by a particular method, which gives rise to a binary variable (yes or no). We refer to these as "acquisition questions". The acquisition options were CDs, pay sites, free websites, P2P networks, friends' MP3 copies, rip songs from CDs, and private internet. The second type of questions were follow up questions (questions 2 and 4) which asked people to estimate the number of units they may have acquired by a particular method in an average month in 2005, giving rise to a quantitative variable. We refer to these as the "activity rate" questions.

In addition the survey also included a "behavioural" question, which asked how respondents would change their CD purchases if P2P were not available. This goes directly to *Industry Canada's* primary research question, whether CD's and P2P downloads are substitutes or complements. If CD's and P2P are substitutes then respondents would say they would increase their CD purchases, whereas if they were complements they would say they would reduce their CD purchases. This paper focuses on responses to this behavioural question as it is directly relevant to the question whether stricter copyright laws making P2P less available would increase legitimate music sales.

An initial problem that emerges from our analysis of the dataset is that people did not always provide consistent answers to the acquisition question

and the follow up activity rate questions. Focusing on P2P downloaders, the questionnaire should have identified P2P downloaders at the relevant acquisition question through a yes/no question (participation rate) and then identified how much they downloaded at the relevant activity rate question. The problem is there were people who responded they did acquire music from P2P networks in the acquisition question but who, in response to the activity rate question answered they downloaded zero tracks from P2P networks in 2005 or said they did not know how many tracks they downloaded.

As it happens, 95 people, representing 5% of the population responded “yes” to the acquisition question which asked whether they downloaded tracks from P2P networks, but then in response to the activity rate question, answered they had downloaded zero tracks.³ If we add the 61 people (3% of the population) who also answered “yes” to the acquisition question but then said they did not know how many tracks they downloaded in response to the activity rate question, then 8% of the weighted sample did not provide directly useable answers.

In our analysis that follows the next section, we shall focus on those who either responded to the activity rate question with the amount they downloaded or provided a “don’t know” response. We excluded the 5% group who answered “yes” to the acquisition question but answered “zero” to the activity rate question for two main reasons. First, we prefer the more precise numeric activity rate question as it is more reliable, making the acquisition question redundant. Second, on cross-checking, most of the group who answered “zero” to the activity rate question for 2005 also answered “zero” in relation to the activity rate for the prior year 2004, thus suggesting they were not responding inadvertently to the activity rate for 2005.

³Although this group may be only 5% of the sample they are significant in size at 16% of the 29% who said they engaged in P2P downloads – the subgroup which Andersen and Frenz (2007) based their whole analysis on.

3. EARLIER STUDIES

In 2006 Industry Canada commissioned an analysis of the survey data by Birgitte Andersen and Marion Frenz. In their report Andersen and Frenz (2007), state that

“The primary objective of this paper is to determine what influence P2P file-sharing and music downloading activities have on the purchasing of CDs and paid electronically-delivered music . . . in particular . . . whether such downloading and P2P file-sharing displaces (substitutes) or increases/stimulates music purchases. (Andersen and Frenz, 2007, pg. 5).

Theoretically they claim there are two primary offsetting effects to be tested:

“The existing literature identifies two competing effects associated with the P2P music file-sharing: the sampling and substitution effects. The sampling effect is characterized both by individuals downloading music in order to listen to it before buying it as well as by individuals downloading music that is not available in stores, while the substitution effect is characterized by individuals downloading music instead of purchasing it.” (Andersen and Frenz, 2007, pg. 3).

As the authors themselves note, most empirical studies confirmed the substitution effect dominated; “Our review of existing econometric studies suggests that P2P file-sharing tends to decrease music purchasing.” (Andersen and Frenz, 2007, pg. 3). However, they note; “However, we find the opposite, namely that P2P file sharing tends to increase rather than decrease music purchasing.” (Andersen and Frenz, 2007, pg. 3).

The specific result that received most emphasis and attention at the time was that:

“Our analysis of the Canadian P2P file-sharing subpopulation suggests that there is a strong positive relationship between P2P file-sharing and CD purchasing. . . one additional P2P download per month is to increase music purchasing by 0.44 CDs per year”. (Andersen and Frenz, 2007, pg. 33). “That is, downloading the equivalent of approximately one CD increases purchasing by about half of a CD.” (Andersen and Frenz, 2007, pg. 3).⁴

These are very strong and precise claims that as noted were contrary to other evidence at the time. They were also somewhat counterintuitive,⁵ and highly controversial claims. As Stan Liebowitz noted at the time it was hard to believe this result as it was impossible to reconcile with the actual survey data, let alone with country-wide data (Liebowitz, 2007). The result was inconsistent both with the number of CD’s P2P downloaders bought in the sample, and the amount of sales of CD’s in the whole country. It implied much greater CD purchasing than actually observed both in the sample, and in the whole country.

Andersen and Frenz however recently reported different results in 2010, after further analysis, in the *Journal of Evolutionary Economics* concluding that unlike the 2007 study they could find “. . . no association between the number of P2P files downloaded and CD album sales,” (Andersen and Frenz, 2010, pg. 374). They nevertheless however claimed in 2010 (pg. 375) that “. . . this paper show (sic) 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.”

⁴Since there are 14 songs on a typical CD, this means that for each CD equivalent of song downloaded, sales of CDs would increase by one half of a CD.

⁵Although theoretically possible, intuitively the sampling effect seems unlikely to outweigh the substitution effect for two reasons. First any sampling effect must be marginal, or net of existing means of sampling through listening to music on the radio, and in store sampling for example. Second having downloaded the song for free it is not clear why one would then incur the cost of buying the full priced CD.

The authors claim that they have found evidence of both a negative market substitution and positive market creation effect, which largely offset one another, with the net result that there was no statistically significant relationship between P2P file downloads and CD music sales.⁶

Andersen and Frenz however do not appear to specifically mention in their 2010 study why their latest results differ from the earlier 2007 publication. However a major reason may be that in 2010 Andersen and Frenz employ an instrumental variable estimation procedure to address endogeneity issues, whereas in 2007 they claimed that they decided not to use instrumental variable techniques as useful instruments were inherently difficult to find (Andersen and Frenz, 2007, p. 25).

There however remain a number of serious problems with the 2010 study that call into question the reliability of the results. These problems include the choice of instruments;⁷ reliance on the cross sectional data from the survey⁸ when rich longitudinal data on actual individual CD purchases and P2P downloading existed for both 2004 and 2005;⁹ the use of price variables;¹⁰ and the exclusion from the subsample of anyone who had zero CD purchases

⁶Andersen and Frenz further claim this finding is in line with the results reported in Oberholzer-Gee and Strumpf (2007). By comparison, Zentner (2004), whose study also uses direct survey responses, found a negative and significant association between P2P activity and music purchases.

⁷The key with an instrumental variable approach is to find variables that are correlated with the independent variable (P2P downloading) but uncorrelated with the dependent variable (CD purchases). Andersen and Frenz use self-reported personal internet skill levels as instruments. The problem is that internet skill levels are likely to affect the implicit price of P2P downloads facing any individual, and thereby not only affect P2P downloads, but also CD purchases if one allows for the likelihood of a substitution between CD's and P2P downloads.

⁸Andersen and Frenz (2007) noted that a problem with their work was that "regressions based on cross-sectional data cannot prove causality; instead they only show an association between variables. Thus, with respect to this paper causality may only be inferred on the basis of theoretical reasoning." (pg. 24). They however wrongly then claimed that "panel data with an equivalent richness of information and the same level of disaggregation (i.e. individual responses) compared to our dataset are not available." (Andersen and Frenz, 2007, pg. 25).

⁹I am currently examining using this panel data and a first differences approach with a colleague Dr Tim Maloney.

¹⁰Andersen and Frenz relied on the self-reported variation in CD prices paid by individuals. This variation in self reported CD prices results from prices varying between different outlets (e.g., speciality music stores, lower-priced supermarkets, on-line vendors, second-hand sales) and by the type of music purchased (e.g., latest hits, older music, obscure bargain-basement recordings). However, these are approximately the same price ranges that everyone faces and thus they do not reflect the kind of price variation that can be used to estimate own or cross price elasticities.

in 2005, on the basis that they are not part of the music market. This latter group however may have been the most sensitive to P2P file sharing to the extent that they have stopped buying CD's.

Most fundamental is their use of the single equation set up for their analysis of CD and P2P demand. AF in both papers are modelling P2P and CD's as outputs, and asking whether they are complements or substitutes in demand. This is made explicit in the first sentence of their abstract for the 2010 JEE publication, where they state; "This study measures the extent to which P2P file-sharing activities act as substitutes or complements to music purchases in markets for CDs."

Andersen and Frenz (2010) however don't then specify a true demand system for the two goods: CDs and P2P downloads. Instead in both their 2007 and 2010 they use a highly simplified single equation model that specifies the number of CDs purchased by respondents as the dependent variable, and regressed this against the respondents P2P downloads as an independent variable, plus a number of other variables collected in the survey, including respondent's age, income etc. This is however fundamentally problematic because it implies a one-way causal connection between CD demand and P2P demand.¹¹ A conventional demand system approach would instead model demand for the two commodities using two separate, but interdependent demand equations, with interest focusing on the own and cross-price demand elasticities for the two goods. The cross-price elasticity between the CD and P2P demand equations would be the typical way of estimating the degree of 'substitutability' between the two sources of music.

To see the problem with the single equation set up here one need only think of an analogy, like the consumption of beer and wine. For a given cross-sectional sample, (or survey of consumers) there would probably be a strong

¹¹I am very grateful to Dr Tim Maloney for his contribution to the critique of the single equation set up of Andersen and Frenz (2010).

positive correlation in the annual consumption of beer and wine. But this would probably largely hinge on differences across the population in basic tastes for alcohol consumption. If we regressed annual beer consumption against annual wine consumption, we would probably get a positive slope coefficient (correlation). But this doesn't imply that they aren't seen as substitutes by consumers. To know this, we'd have to look at the cross-price effect. Does a fall in the price of beer lead to less wine consumption? In our case the question in effect is does a fall in the cost of piracy or theft (due to P2P) lead to lower legitimate demand or consumption in CD's. To the extent the two means of acquiring music are substitutes, rational consumers will respond to relative price changes. In a standard economic model then if one assumes the introduction of peer to peer digital downloads has the effect of reducing the cost or implicit price of piracy, it will enable individuals to consume more pirated copies and most likely lead them to purchase less CD's for a given budget. The problem with the analysis of Andersen and Frenz is that individuals may also increase their demand for music as a whole, i.e., both P2P and legitimate consumption. People who love music may thus buy more music and do more P2P downloads. These fixed effects bias Andersen and Frenz's results.

There are then a number of problems with the Andersen and Frenz approach that make one sceptical of their results. In this paper we shall instead examine a question in the *Industry Canada* commissioned survey which does provide insight on possible individual behaviours in response to changes in the availability of free P2P downloads. This survey question, which we refer to as the "behaviour" question, asked how survey respondents would behave were the songs they downloaded by P2P not available through P2P. The behaviour question focuses on identifying individuals' likely responses

to changes in the availability or relative price of digital piracy. It was therefore directly relevant to decisions on whether to strengthen the enforcement of copyright law at the time, as from an economic point of view strengthening copyright enforcement would impact on the relative implicit price and availability of P2P downloading. Andersen and Frenz however do not report on participants' responses to this question.

From a public choice or political economy point of view given the support, funding and role of *Industry Canada* in their work, it is curious that Andersen and Frenz did not analyse this question as to how survey respondents would behave were the songs they downloaded by P2P not available through P2P. Particularly as it was of direct relevance to the policy questions facing *Industry Canada* at the time. Indeed as Andersen and Frenz (2010, pg. 734) note; "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."

To the extent the neglected or "orphaned" question informs us about the responsiveness of demand for CD's to the availability of P2P file sharing, it will also inform us about the ultimate effects of changes to copyright law enforcement aimed at limiting the availability of P2P file sharing. We therefore turn to analysis of this neglected survey question in the next section

4. THE IMPACT OF P2P AVAILABILITY ON PURCHASES

We are first interested in the P2P downloaders whose response to the activity rate question identifies how many tracks they downloaded. For this group, we want to examine their response to the behaviour question which asked:

Considering the songs that you downloaded for free through P2P networks during 2005

- a) what % would you have purchased as paid music sites if they were not available through P2P?
- b) what % would you have purchased as part of a music CD if they were not available through P2P?

We are in particular interested in the response to part b of the behaviour question as it goes directly to the question whether P2P downloaders' would buy more music on CDs, if P2P file sharing were banned, or the law against it more effectively enforced – and if so how much more? One of the problems with using answers to survey questions like this however is so called survey response bias. This may arise where respondents may feel under social pressure not to give an answer which may carry some opprobrium.¹² For example, respondents might be unwilling to admit to attitudes like racism or sexism, which carry some opprobrium, and thus polls might not reflect the true incidence of these attitudes in the population. In America this phenomenon is often referred to as the Bradley effect (less commonly called the Wilder effect).¹³ If the results of surveys are widely publicized this effect may be magnified – a phenomenon commonly referred to as “the spiral of silence”. To the extent downloading is known to be illegal, it seems likely that in this case people will under-report the extent and negative effects of their downloading behaviour. It is therefore that more interesting to see the strength of results we have obtained, recognising they may understate the true position.

We can use a decision tree as shown in Figure 1 below, to identify first those who acquire music at the top (83% weighted). Then second those who

¹²The same bias of course might have been present when respondents were asked if they had downloaded (yes or no), and if yes, how many tracks they had downloaded.

¹³It is a theory proposed to explain observed discrepancies between voter opinion polls and election outcomes in some United States government elections where a white candidate and a non-white candidate run against each other. The theory proposes that some voters will tell pollsters they are undecided or likely to vote for a black candidate, while on election day they vote for the white candidate. It was named the Bradley effect after Los Angeles Mayor Tom Bradley an African - American who lost the 1982 California governor's election despite being ahead in voter polls going into the elections.

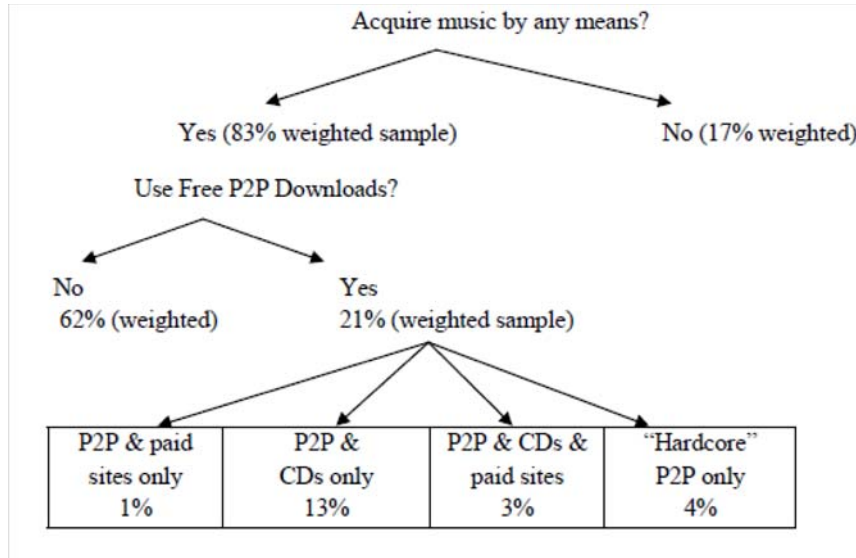


FIGURE 1. Music acquisition decision tree

acquire either some or all of it illegally through free P2P networks (21% weighted). In the next level or final stage of the decision tree, we identify the various mixes of P2P downloads and legitimate purchasing behaviour amongst the 21% of the population using P2P, including from left to right in four columns as follows: i) the 1% who use P2P and paid sites only; ii) the 13% who use P2P and CDs only; iii) the 3% who use P2P and CDs and paid sites; and iv) the 4% who use P2P only the last category we shall core the "hard core" P2P downloaders.

So far all we have discussed is the data drawn on and analysed by Andersen and Frenz. Table 1 shows the responses to the behaviour question which Andersen and Frenz ignored as to the effect of P2P availability on respondents behaviour. As shown in Table 2 only 15% of P2P downloaders say they would not have bought the music if it were not available on P2P for free. While 73% of P2P downloaders responded that if P2P were not available they would have purchased either through CDs and pay sites (60%)

or through CDs only (9%) or paid sites only (4%). A significant further percentage (11%) said they would have bought but did not know how much.

Table 1: Behavioural Question: Percentage of P2P Downloaders Who Would Buy Music (By Method) if The Music were not available free through P2P

Category Replacement Purchases	Percentage
None - No CDs nor paid sites replacement purchases	15%
CDs & paid sites replacement purchases	60%
CDs only replacement purchases	9%
Paid sites only replacement purchases	4%
Do Not Know	11%

This clearly suggests P2P network availability is reducing music demand, which is quite contrary to Andersen and Frenz's much published claims. As shown, in total 73% of P2P downloaders responded they would have purchased the music if P2P were not available. Only 15% of downloaders said they would not purchase the music they downloaded if P2P were not available. Indeed in the absence of P2P, survey participants responses imply that in total 50% of all the music downloaded by P2P would have been replaced by legitimate purchases on a weighted basis. As we show later, in the sample this would have lead to a 20% increase in total CD purchases, and a 130% increase in total paid site purchases overall in 2006. This all clearly suggests that the availability of free P2P downloads does significantly affect music sales, and warrants further investigation.

In what follows we analyse in greater depth the responses to the behavioural question as to the effect of P2P availability on music purchasing behaviour. We first do this for the four different groups identified in the last

row of the decision tree in Figure 1 above separately. Then we combine and summarize the analysis. Our discussion proceeds in the following order:

- (1) First, we review the behaviour of those who we call hard core P2P downloaders identified in the fourth column in the last row of the decision tree (i.e. on the extreme right hand side). These are those who currently acquire music by P2P only (i.e. with no CD, nor pay site purchases). If Andersen and Frenz are right and P2P has either a positive effect (as claimed in Andersen and Frenz, 2007), or no effect (as claimed in Andersen and Frenz, 2010) on CD demand then this group should say that if P2P were not available, they would not change their CD purchase behaviour, and so continue with no CD purchases.
- (2) Second, we review the behaviour of those who acquire music through a mixture of P2P downloads, CD and pay site (PS) purchases. These individuals are identified in the third column on the right of the last row of the decision tree in Figure 1 above.
- (3) Third, we review the behaviour of those who acquire music through a mixture of P2P downloads and CDs only. These individuals are identified in the second column in the last row of the decision tree in Figure 1.
- (4) Fourth, we review the behaviour those who acquire music through a mixture of P2P downloads and pay sites (PS) only. These individuals are identified in the first column in the last row of the decision tree in Figure 1.

4.1. Hard core P2P downloaders. A key result to focus on is the responses of the current hard core P2P downloaders, identified in the fourth column in the last row of the decision tree in Figure 1 (i.e. on the extreme

right hand side). These are those individuals who currently acquire music by P2P only (i.e. with no CD, nor pay site purchases). The questions are:

- (1) whether the removal of P2P networks would induce them to purchase music on CDs or through a pay site (PS) and if so,
- (2) what percentage of their downloads would be substituted by CD and PS purchases; and therefore,
- (3) how much music would they purchase as a result? And,
- (4) what would be their additional music spend?

As noted in their latest article, Andersen and Frenz (2010, pg. 715) claim, on the basis of cross sectional analysis of the differences between individuals, that there is “no association between the number of P2P files downloaded and CD album sales.” Instead, they claim “this paper show (sic) 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.” (Andersen and Frenz, 2010, pg. 735).

In their earlier paper, Andersen and Frenz (2007) made the stronger claim “that P2P file-sharing tends to increase rather than decrease music purchasing.”

Taking this earlier 2007 conclusion first, this makes the hard core group a very curious category at the time the first study was published, in that they engage in P2P downloads but do not purchase any music. This is inconsistent with Andersen and Frenz’s initial 2007 prediction based on cross sectional analysis that P2P downloads had a positive relationship with music purchases. If P2P purchases increased music purchases as claimed in Andersen and Frenz’s initial study, then the hard core group must have a serious aversion to music purchases. This group does not purchase any music even though it downloads considerable P2P music files.¹⁴

¹⁴Of course, although the Andersen and Frenz result might technically be said to only hold in the aggregate, it tends to be implied by Andersen and Frenz that the results of their analysis applies,

Andersen and Frenz's analysis thus suggests two predictions in relation to this group:

- (1) Assuming the earlier Andersen and Frenz claims, one would certainly not expect this group to purchase any music if P2P networks were removed altogether – as the group doesn't purchase even when P2P networks are available, and according to Andersen and Frenz, P2P downloading increases music purchases.
- (2) Assuming the later Andersen and Frenz result is right or that there is “no association between the number of P2P files downloaded and CD album sales,” one would still not expect this group to purchase any music if P2P networks were removed altogether – as the group doesn't purchase even when P2P networks are available, and according to Andersen and Frenz, P2P downloading does not affect music purchases.

There were 76 of these hard core downloaders in the weighted sample. They constituted 17.0% of the total downloader population on a weighted basis – but downloaded 22% of total weighted downloads. The significant result is that 61% of these hard core P2P downloaders say they would buy the tracks they downloaded if the songs were not available on P2P networks.

On a weighted basis, this group of hard core P2P downloaders downloaded 3,107 songs. They then indicated in response to the behaviour question that if P2P were not available they would replace 33% of their P2P downloads through legitimate purchases. Of this total 33% substitution rate, 20% would be as part of music CDs and 13% through pay-site purchases.

at least on average, to all individuals engaged in P2P downloading, for example when they say that “Among Canadians who engage in P2P file-sharing, our results suggest that for every 12 P2P downloaded songs, music purchases increase by 0.44 CDs. That is, downloading the equivalent of approximately one CD increases purchasing by about half of a CD.” (Andersen and Frenz, 2007, pg. 3).

Assuming a pay-site download cost 99 cents in 2005, and a CD track \$1.08,¹⁵ this would have implied additional expenditure on music on average of \$168 per annum per hard core downloader – if P2P networks were not available.

4.2. P2P downloaders who also purchase through CDs and pay-sites. Let us now turn to those who acquire music through a mixture of P2P downloads, CDs and pay-site (PS) purchases as identified in the last row of the decision tree in Figure 1 above in the third column from the left.

There were 66 of these “fully mixed” downloaders in the weighted sample. They constituted 15.0% of the total downloader population on a weighted basis – but downloaded only 10% of the total weighted downloads. The significant result is that 86% percent of these “fully mixed” P2P downloaders say they would buy the tracks they downloaded if the songs were not available on P2P networks.

On a weighted basis, this group of “fully mixed” downloaders downloaded 1,388 songs. They then indicated in response to the behaviour question that if P2P were not available they would replace 70% of their P2P downloads through legitimate purchases. Of this total 70% substitution rate, 35% would be as part of music CDs and 35% through pay site purchases.

Again assuming a pay site download cost 99 cents in 2005, and a CD track \$1.08, this would have implied additional expenditure on music on average of \$182 per annum per “fully mixed” downloader – if P2P networks were not available.

4.3. P2P downloaders who also purchase but through CDs only. Turning to those who acquire music through a mixture of P2P downloads and CDs only as identified in the second column in the last row of the

¹⁵This estimated average price of a single track on CD's in 2005 assumes there were 13 tracks to a CD, and that CD's cost around \$14 in 2005.

decision tree in Figure 1, there were 276 of these “CD mixed” downloaders in the weighted sample. They constituted 62% of the total downloader population on a weighted basis – but downloaded only 59% of the total weighted downloads.

The significant result is that 73% percent of these “CD mixed” P2P downloaders said they would buy the tracks they downloaded if the songs were not available on P2P networks.

On a weighted basis, this group of “CD mixed” downloaders downloaded 8,397 songs as noted being 59% of the samples P2P downloading. They then indicated in response to question 4.4 that if P2P were not available they would replace 49% of their P2P downloads through legitimate purchases. Of this total 49% substitution rate, 26% would be as part of music CDs and 23% through pay-site purchases. Again assuming a pay site download cost 99 cents in 2005, and a CD track \$1.08, this would have implied additional expenditure on music on average of \$187 “CD mixed” downloader – if P2P networks were not available.

4.4. P2P downloaders who also purchase but through pay-sites only. Turning to those who acquire music through a mixture of P2P downloads and pay site purchases as identified in the third to last column in the last row of the decision tree in Figure 1, there were only 12 of these “pay-site mixed” downloaders in the weighted sample.

They constituted only 3% of the total downloader population on a weighted basis – and downloaded only 3% of the total weighted downloads. The significant result is that 80% percent of these “pay-site mixed” P2P downloaders said they would buy the tracks they downloaded if the songs were not available on P2P networks.

On a weighted basis, this group of “pay-site mixed” downloaders downloaded 292 songs as noted being 3% of the samples P2P downloading. They

then indicated in response to the behaviour question that if P2P were not available they would replace 73% of their P2P downloads through legitimate purchases. Of this total 73% substitution rate, 30% would be as part of music CDs and 43% through pay-site purchases.

Again assuming a pay site download cost 99 cents in 2005, and a CD track \$1.08, this would have implied additional expenditure on music on average of \$291 “pay-site mixed” downloader – if P2P were not available.

4.5. Summary of the effect of P2P availability on music purchases.

Tables 2a and 2b summarize the results identified to date and outlined above from respondents’ answers to the behaviour question which asked the amount of downloads respondents said they would replace by purchasing CDs or from pay sites, if P2P networks were not available.

Table 2a: Summary of the Effect of P2P availability on Music Purchases:

Replacement per month			
Original behaviour	Number of downloaders	Amount replaced per month	
		By PS	By CDs
P2P only	76	400	617
P2P,CD & PS	66	479	493
P2P,CD only	276	1960	2181
P2P,PS only	12	170	119
Don’t know	16		
Total	445	3009	3409

Table 2b: Summary of the Effect of P2P availability on Music Purchases:

Additional expenditure per year

Original behaviour	Number of downloaders	Additional expenditure per year			
		By PS	By CDs	Total	Average per person per year
P2P only	76	\$4,752	\$7,968	\$12,720	\$168
P2P,CD & PS	66	\$5,690	\$6,367	\$12,057	\$182
P2P,CD only	276	\$23,290	\$28,184	\$51,474	\$187
P2P,PS only	12	\$2,020	\$1,536	\$3,556	\$291
Don't know	16				
Total	445	\$35,751	\$44,055	\$79,806	\$179

Thus:

- In the first data column of table 2a we have the number of people in each downloader category, by row. Thus as shown in the last cell of that column, in total there were 445 downloaders in the weighted sample (of whom, for example, 76 of them were engaging in P2P downloading alone as shown in the first data row).
- In the second and third data columns of table 2a, we have the amount of downloads respondents said they would replace by purchasing CDs or from pay-sites per month, if P2P networks had not been available.
- In table 2b, we indicate the implications of the data in table 2a for expenditure per year. We use 99 cents as the average price of a

purchase from a paid music site and assume the average price of a single track on a CD would be \$1.08, which is derived by using \$14 as an estimate of the average price of a CD in 2005 and simply dividing that by 13 as the assumed average number of tracks on a CD (i.e. $14/13 = 1.08$).

Thus the last column of Table 2b shows the amount of “displaced spending” P2P networks may have caused on average amongst downloaders on P2P networks. On this basis, the survey responses suggest the average displaced spending would be \$179 per downloader per year using weighted data as shown in the bottom right cell.

Table 3, further indicates the total expenditure effects the above results imply, if no songs were available on P2P networks. The first row identifies Andersen and Frenz’s estimate of the size of the downloading population in 2005 at 7,053,251 (Andersen and Frenz, 2007, pg. 37). The second row identifies the amount of displaced spending on average per downloader on CD’s in column two (\$98.91), paid sites in column three (\$80.26) and in total in the last column (\$179), further to the analysis above. At this stage, under the assumptions outlined so far, if no songs were available for free on P2P networks, it appears there would have been a significant increase in spending on legitimate music purchases. In the second column, we identify the effect on CD sales implied by survey respondents answers was nearly \$700 million in 2006. As shown in the bottom two rows of column two in Table 4 this would have entailed an increase over actual 2006 CD sales in Canada of 145%. As is shown in the last column in table 4 an analysis of both CD and paid site sales effects suggests the failure to prohibit P2P music downloading could have cost the music industry in Canada as much as \$1.26 billion in total, using weighted data.

Table 3: The Implied Effect on Total Expenditure

	CD's only	Paid sites only	Total
Downloaders in total population	7,053,251	7,053,251	7,053,251
Average displaced spending	\$98.91	\$80.26	\$179.17
Total displaced spending	\$697,619,547	\$566,116,034	\$1,263,735,581
2006 CD sales in Canada ¹⁶	482,068,000		
% Increase	145%		

These implied effects may seem to be on the high side, suggesting respondents may have engaged in some double counting on the CD and paid site replacement sales effects. Nevertheless, the direction of the result is clear: if the songs were not available on P2P networks, the respondents to the survey indicated they would have purchased more music through legitimate means. This direction of change is moreover confirmed when one focuses on implied changes in reported behaviour in the survey data itself. In Table 4 the second row identifies the total increase in paid sites purchases and CD purchases per month survey respondents indicated they would engage in if P2P purchases were not available. The third row identifies the survey respondents paid site purchases and CD purchases per month at the time. As shown in the last row survey respondents' answers on how much music they would buy if P2P were not available suggests that they would increase their paid site purchases by 130% and CD purchases by 20%. The latter result on CD purchases is particularly interesting in that it is consistent with

¹⁶Obtained from *Music Canada* Website <http://www.musiccanada.com/statistic.aspx> November 2012

the fact that CD sales in Canada *fell* by around 20% from the time of the introduction of Napster in 1999 to 2006, or coincident with the expansion of online music piracy.

Table 4: The Implied Effect on Total Units Sold

	Paid Sites (PS)	CD's
Total Increase in PS and CD purchases	3,009	3,409
Current PS & CD Purchases	2,290	16,832
% Increase PS & CD Purchases	131%	20%

The problem for Andersen and Frenz's analysis then is that their conclusions are contradicted by the survey respondents' answers to the behaviour question, which suggests that the absence of P2P downloads would increase P2P downloaders' legitimate music purchases. This implies that the presence of P2P network reduces P2P downloaders' legitimate music purchases. It thus contradicts the assertion of Andersen and Frenz in their 2007 report published by *Industry Canada*, that P2P file-sharing tends to increase rather than decrease music purchasing, and their assertion in their 2010 article that there is "no association between the number of P2P files downloaded and CD album sales." (Andersen and Frenz, 2010, pg. 715). Contrary to Andersen and Frenz's claims, the results from the behaviour question suggest if music were not available on P2P networks, respondents would buy a significant positive percentage of the downloaded music no longer available.¹⁷

The *Industry Canada* commissioned 2005 survey thus clearly supports the view that stronger copyright laws that effectively reduce and deter free P2P music file-sharing would tend to increase music purchasing and music

¹⁷This in turn suggests the technical problems outlined earlier with the methodology used by AF in their statistical analysis of cross sectional data on the activity question responses may be biasing their results. Further statistical analysis of the panel data on survey participants responses to the activity question, using a first differences methodology might overcome these biases, and in turn reveal greater consistency between survey participants responses to the activity and behaviour questions. Such analysis of the panel data on the activity question responses is the subject of a separate paper I am working on with Dr Tim Maloney.

industry sales and, by implication, increase artist revenues and industry employment and contribute to both economic growth and higher government tax revenues. Whereas weaker copyright laws reduce music purchases, music industry sales, artist revenues, industry employment, GDP and government tax revenues.

REFERENCES

- Andersen, B. and M. Frenz (2007)**, *The Impact of P2P File-Sharing on the Purchase of Music: A Study for Industry Canada*, retrieved from http://www.ic.gc.ca/eic/site/ippd-dppi.nsf/eng/h_ip01456.html
- Andersen, B. and M. Frenz (2010)**, “Don’t Blame the P2P File-Sharers: The Impact of Free Music Downloads on the Purchase of Music CDs in Canada”, *Journal of Evolutionary Economics*, 20(5); 715-40.
- Liebowitz, S.J. (2007)**, “A Discussion of the Canadian Study Released by Industry Canada Authored by Birgitte Andersen and Marion Frenz (A/F)”, at <http://www.utdallas.edu/~liebowit/intprop/main.htm#canadian>, viewed 8 November 2012.
- Oberholzer-Gee, F. and K. Strumpf (2007)**, “The Effect of File Sharing on Record Sales: An Empirical Analysis”, *Journal of Political Economy*, 115(1); 1-42.
- Zentner, A. (2006)**, “Measuring the Effect of Music Downloads on Music Purchases”, *Journal of Law and Economics*, 49(1); 63-90.

DR GEORGE BARKER, DIRECTOR CENTRE OF LAW AND ECONOMICS, ANU COLLEGE OF LAW,
AUSTRALIAN NATIONAL UNIVERSITY, ACTON-0200 CANBERRA, AUSTRALIA. TEL. +61-261253396,
EMAIL: GEORGE.BARKER@ANU.EDU.AU