

Canadian Intellectual  
Property Council



Conseil canadien de  
la propriété intellectuelle

# THE TRUE PRICE OF PEER TO PEER FILE-SHARING

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

*February 2011*





## THE CANADIAN INTELLECTUAL PROPERTY COUNCIL (CIPC)

- An arm of the Canadian Chamber of Commerce.
- Presses for the adoption of stronger intellectual property rights (IPR) protection both in Canada and throughout the world.
- Lobbies the government to adopt the necessary legislation and provides the resources to combat the rampant infringement of IPR in Canada.
- Represents a broad spectrum of industries, all of which rely on IPR for their success.
- Promotes a better understanding of the importance of IPR for continued economic prosperity and competitiveness.

Canada lags in terms of the protection of IPR, a trend that has resulted in negative economic impacts and poses a threat to the health and safety of Canadian consumers. It is essential that the Canadian government adopt policies that will stimulate Canada's knowledge-based economy, thereby facilitating job growth and promoting innovation in these industries. Canada must provide a competitive IPR environment which will attract investment and allow Canadian businesses to grow and flourish. The adoption of stronger protection for IPR in Canada is also essential to protect Canadian consumers from the dangers of counterfeit goods.

Every year that passes without the adoption of the proper legislation, more Canadians are exposed to harmful counterfeit products, which in some cases have been linked to organized crime, serious illness and death.

# BACKGROUND

There is a growing consensus in Canada among government, business and the general public that a strong and competitive intellectual property rights (IPR) system is essential for Canada to contend in the global marketplace of ideas and innovation.

One of the steps taken in the last few years to address weaknesses in Canada's IPR system was the introduction of a modernized copyright bill. In introducing the Copyright Modernization Act on June 2, 2010, Minister of Industry, the Hon. Tony Clement, said the bill would "modernize Canadian copyright law for the digital age while protecting and creating jobs, promoting innovation and attracting new investment to Canada."

In order to support its policy decisions regarding the copyright regime in Canada, Industry Canada commissioned a survey by Decima Research in 2006 which was designed to measure the extent to which peer to peer (P2P) file-sharing activities act as substitutes or complements to music purchases. Analysis of this data, published in a 2007 report entitled, *Don't blame the P2P file-sharers: the impact of free music downloads on the purchase of music CDs in Canada*, ran contrary to international consensus on the link between file-sharing and music purchases and the authors of that study have since republished their work citing different conclusions.

The Canadian Intellectual Property Council (CIPC), an arm of the Canadian Chamber of Commerce, is a business coalition designed to provide a central voice for stronger IP protection in Canada and around the globe. Periodically, the CIPC commissions research to review previously published reports on intellectual property.

For this report, Dr. George Barker, director for the Centre for Law and Economics at the Australian National University, analyzed original data from the Decima survey that was previously overlooked. His analysis produced strong evidence that if P2P file-sharing were not available, three out of four file-sharers would purchase music instead, either as CDs or from paid music sites.

Therefore, Industry Canada's own data provides strong support for its efforts to modernize Canada's copyright laws and to give copyright owners legal tools to combat copyright infringement. This report shows that efforts to combat file-sharing will have a positive impact on the creative industry, helping to sustain and create jobs in Canada.

## Key findings

As the purpose of the survey was to determine the extent to which P2P file-sharing activities act as substitutes or complements to music purchases, Dr. Barker's analysis focused on one important survey question that captured the survey's objective and that was not analyzed by the researchers hired by Industry Canada. The Decima survey asked respondents to comment on their behaviour in the absence of P2P file-sharing, as follows:

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

- a) what % would you have purchased at 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

After analyzing the answers to this question, Dr. Barker discovered two key findings:

1. three out of every four respondents said that if P2P were not available they would have purchased some or all of the music; and
2. almost two-thirds of the "hardcore" P2P downloaders (those who indicated in the survey that they acquired music by P2P only) said they would have purchased one-third of the tracks they downloaded if the songs were not available on P2P networks—this amounts to an average expense of \$168 per person, adding up to hundreds of millions of dollars in extra revenue for the music industry per year from this group alone.

Based on this data, Dr. Barker concluded "that P2P downloads have strong negative effects on legitimate music purchases" and, contrary to the original analysis of the data, P2P downloading acts as a substitute for legitimate music purchases. Dr. Barker's analysis infers 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."



# EXECUTIVE SUMMARY

This report, *The True Price of Peer to Peer File Sharing*, re-examines the data and results recently published by Birgitte Andersen and Marion Frenz (AF) in the report, *Don't blame the P2P file-sharers: the impact of free music downloads on the purchase of music CDs in Canada*, featured in the March 2010 issue of the *Journal of Evolutionary Economics* (JEE).<sup>1</sup> The AF study purports to measure the extent to which P2P file-sharing activities act as substitutes or complements to music purchases in markets for CDs.

*Don't blame the P2P file-sharers: the impact of free music downloads on the purchase of music CDs in Canada* analyzes Canadian survey data, derived from direct survey responses from a sample which the paper claims is representative of the Canadian population aged 15 and older. The survey was designed by Birgitte Andersen with support from Industry Canada, and data collection was conducted by Decima Research in 2006.<sup>2</sup>

From a public choice or political economy point of view the support, funding and role of Industry Canada in this work is of particular interest. Thus as AF note in their JEE paper:

“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.”<sup>3</sup>

The recently published JEE paper by AF is in fact a revised version of an earlier study for Industry Canada, published in 2007<sup>4</sup>, which has influenced policy decisions around the design of copyright law in Canada over the past three years.

In the 2007 study, the key claim emphasized by AF was counter-intuitive and highly controversial at the time, being 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.” This was both a very strong claim (i.e. “strong positive relationship”) and a very precise claim (i.e. “one additional P2P download per month is to increase music purchasing by 0.44 CDs per year”).

The 2010 report now significantly revises this conclusion from 2007. (It is important to note that the 2007 study is the only one available on the Industry Canada website.) Andersen and Frenz now make the weaker claim that their research finds “no association between the number of P2P files downloaded and CD album sales.”<sup>5</sup> Nevertheless AF go on to comment: “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.”<sup>6</sup>

The fact that AF’s work was commissioned to support or inform and influence the design of copyright law in Canada warrants a careful review of their methodology

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1 Birgitte Andersen and Marion Frenz, “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 (March 2010): 715–740.

2 Research material feeding into the Andersen and Frenz study includes:

- 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.

3 Andersen and Frenz, “Don’t blame the P2P file-sharers: the impact of free music downloads on the purchase of music CDs in Canada,” (March 2010): 734

4 Birgitte Andersen and Marion Frenz, “The Impact of and P2P File-Sharing on the Purchase of Music: A Study for Industry Canada,” [http://www.ic.gc.ca/app/cmmn/srch/vSearch;jsessionid=00014ELsvBcbtwElilT7caeicMr:-GCJQEU?V\\_TOKEN=1297072362550](http://www.ic.gc.ca/app/cmmn/srch/vSearch;jsessionid=00014ELsvBcbtwElilT7caeicMr:-GCJQEU?V_TOKEN=1297072362550) (accessed February 2007).

5 Andersen and Frenz, “Don’t blame the P2P file-sharers: the impact of free music downloads on the purchase of music CDs in Canada,” (March 2010): abstract, p. 715.

6 Ibid., 735.

and results especially since their results have changed over time—suggesting they may be unstable, not robust and unreliable—and are contradicted by other reputable empirical studies showing a negative relationship between P2P downloads and music sales.<sup>7</sup> The view that their work may warrant more investigation is further reinforced by the fact that both the conclusion reported in the JEE article and their earlier one seem very counter-intuitive and contrary to standard economic analysis. Indeed the author's themselves claim "the paper breaks with the mainstream economics approach which dominates the music file-sharing discussion."<sup>8</sup>

*The True Price of Peer to Peer File Sharing* re-examines AF's report and outlines the standard theory of consumer behaviour relevant to the analysis of AF's data and presents the results of our direct analysis of their actual survey data.

The main conclusion arising from our analysis is that, contrary to the much publicized results from both the AF studies outlined above, their own survey data showed that individuals would increase their consumption of paid music if songs were not available on P2P downloads.

We used the data from the same survey relied on by AF which was commissioned by Industry Canada and created by Decima Research. We have, however, conducted analysis of a question in the Industry Canada commissioned survey on which AF did not report. The relevant question not reported on by AF is question 4.4 which asked:

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

- a) what % would you have purchased at 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

“...their own survey data showed that individuals would increase their consumption of paid music if songs were not available on P2P downloads. ”

It is quite remarkable that AF did not conduct any analysis of this question as it seeks to directly obtain an answer to the question of whether removing or reducing the availability of free music downloads on P2P networks (e.g. by tougher copyright laws) would lead those who are using P2P networks to download pirated copies for free to buy music instead. Moreover, the answers provided by respondents to this question strongly contradict AF's main conclusions, including their original or earlier "strong" conclusion, published by Industry Canada, which reads as follows: "we find ... that P2P file-sharing tends to increase rather than decrease music purchasing" and their more recent "weak" conclusion reported in the JEE report, that their study now finds "no association between the number of P2P files downloaded and CD album sales."<sup>9</sup>

On the contrary, our analysis of the respondents' answers to question 4.4 of the survey suggests quite the opposite: P2P downloads have strong negative effects on legitimate music purchases. If we examine the responses to question 4.4, we find that, overall, 75% of P2P downloaders responded that if P2P were not available they would have purchased music through CDs and pay sites (49%), through paid sites only (9%) or through CDs only (17%). Only 25% of people said they would not have bought the music they downloaded for free if it were not available on P2P for free. This clearly suggests P2P network availability is reducing the music demand of 75% of music downloaders. Indeed, for some categories of respondents the percentages were as high as 85%.

<sup>7</sup> See for example, Liebowitz (2008), which is based on city-level data.

<sup>8</sup> Andersen and Frenz, "Don't blame the P2P file-sharers: the impact of free music downloads on the purchase of music CDs in Canada," (March 2010): abstract.

<sup>9</sup> Ibid., 734.

These results indicate that removing P2P file-sharing, for example through stronger copyright laws, would increase music purchasing, music industry sales, artist revenues and, by implication, increase industry employment, economic growth and government tax revenues. Conversely, these results show that allowing P2P file-sharing through weak copyright law reduces music purchases, music industry sales, artist revenues, industry employment, GDP and government tax revenues.

The results clearly refute or contradict both AF's strong and weak conclusions and imply that allowing P2P file-sharing would not tend to increase music purchasing (as AF claimed in their Industry Canada publication), nor have no effect at all (as AF claimed in their JEE publication).

Thus, and to repeat the basic message that has not been previously heard, the Industry Canada survey commissioned in 2005 clearly showed stronger copyright laws that effectively deter and reduce free P2P music file-sharing would increase music purchasing and music 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.

It is indeed possible to use the respondents' answers to survey question 4.4 to identify the likely forgone revenues of the Canadian music industry as a result of weak copyright laws that do not do enough to prevent P2P downloading. The revenue losses are many hundreds of millions of dollars.

Using the Industry Canada data, one can most clearly refute the claims of AF and others that P2P downloads do not harm the industry or even assist it, if one focuses on the "hard core" P2P downloaders, being those people who currently buy no music from pay sites nor as part of CDs but only acquire music by P2P free



downloads. These hard core downloaders constituted 17.0% of the total downloader population in the survey on a weighted basis—but downloaded 21.2% of total weighted downloads.

Given AF's strong claims in their Industry Canada publication that P2P downloading increases music sales and their weaker claims in the JEE study that it has no effect, one would certainly not expect this group to purchase any music if P2P networks were removed altogether.

The significant result, however, is that 63% of these hard core P2P downloaders said they would buy the tracks they downloaded if the songs were not available on P2P networks. This group's behaviour clearly disproves AF's and other's claims that P2P downloads and legitimate purchases are complements. It is confirming the classic

“ The significant result, however, is that 63% of these hard core P2P downloaders said they would buy the tracks they downloaded if the songs were not available on P2P networks. ”



economic view that P2P downloads and legitimate purchases are substitutes. If P2P downloading were not available then hard core downloaders indicated that they would substitute legitimate purchases of the songs for the downloads.

We can further use the question 4.4 responses of those 63% in the hard core group who said they would purchase music if it were not available on P2P networks to assess what proportion of the music they have previously downloaded would they have purchased either as a CD or on a pay site. This 63% sub-group of the hard core P2P downloaders (or the “reformable hard core”) indicated in response to question 4.4 that, on average, if P2P were not available, they would have replaced 33% of their free P2P downloads through legitimate purchases. Thus a member of the 63% reformable hard core downloaders, who downloaded 100 songs for free on P2P networks, would, on average, buy 33 songs in the absence of P2P. Of these purchases, they said, on average, two-thirds would have been as part of music CDs and one-third through paid track purchases.

“ Thus a member of the 63% reformable hard core downloaders, who downloaded 100 songs for free on P2P networks, would, on average, buy 33 songs in the absence of P2P. ”

Given we know how many free songs these reformable hard core downloaders downloaded, and what percentage they say they would have bought as CDs or through pay sites in the absence of P2P, then assuming that a pay site download costs 99 cents in 2005 and a CD track \$1.08<sup>10</sup>, we estimate that

eliminating free P2P downloading would have implied additional expenditure on music on average of \$168 per reformable hard core downloader. This implies hundreds of millions of dollars of extra revenue for the music industry from this group alone if P2P were not available. It also contradicts AF’s strong claim in the Industry Canada publication 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,”<sup>11</sup> and their weak claim in the recent JEE publication that there is “no association between the number of P2P files downloaded and CD album sales.” Rather the Industry Canada survey data they relied on clearly show that P2P file-sharing is a substitute for downloaded and CD album sales.

The problem is that Andersen and Frenz’ analysis of the survey data focused on the differences in behaviour observed between different individuals at a point in time – what economists call cross sectional analysis. They provide no analysis of answers to question 4.4 a) and b) which provide insight into the effect of changes in the availability of P2P downloads on the music purchasing behaviour of the same individual – what economists call longitudinal behaviour. Our analysis of question 4.4, providing information on the behaviour of the same individuals outlined above, is a more robust method of predicting individual behaviour than AF’s and clearly contradicts AF’s much publicized results.

The Industry Canada data therefore clearly suggest that stronger copyright laws in Canada which deterred P2P downloading and made it less available 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.

10 This estimated average price of a single track on CDs in 2005 assumes there were 13 tracks to a CD and CDs cost around \$14 in 2005.

11 Andersen and Frenz, “Don’t blame the P2P file-sharers: the impact of free music downloads on the purchase of music CDs in Canada,” (March 2010): 735.

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# INTRODUCTION

This report re-examines the data and results recently published by Anderson and Frenz (AF) in the *Journal of Evolutionary Economics* (JEE).<sup>12</sup> AF's study, *Don't blame the P2P file-sharers: the impact of free music downloads on the purchase of music CDs in Canada*, purports to measure the extent to which P2P file-sharing activities act as substitutes or complements to music purchases in markets for CDs. The paper's main controversial conclusion in this regard is that it finds "no association between the number of P2P files downloaded and CD album sales,"<sup>13</sup> claiming "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."<sup>14</sup>

This recently published paper by Andersen and Frenz is moreover a revised version of an earlier study for Industry Canada published in 2007, also titled *Don't blame the P2P file-sharers: the impact of free music downloads on the purchase of music CDs in Canada*, which used the same data. In the earlier study, the key claim emphasized by AF was even more counter-intuitive and highly controversial, being 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."

As I outlined in an earlier paper<sup>15</sup> discussing their 2007 study, the primary problem with Andersen and Frenz's original study of the impact of music downloads and P2P networks on music sales was that the authors drew an incorrect conclusion from their results at that time. They observed a positive relationship between the amount of file-sharing and CD purchases among file-sharers. From this they concluded that file-sharing increases CD purchases. Thus in the abstract they made the provocative and strong claim that while;

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

This conclusion was further picked up in the summary on page 33 as follows:

"However, our analysis of the Canadian P2P file-sharing subpopulation suggests that there is a strong positive relationship between P2P file-sharing and CD purchasing. That is, among Canadians actually engaged in it, P2P file-sharing increases CD purchasing. We estimate that the effect of one additional P2P download per month is to increase music purchasing by 0.44 CDs per year."<sup>16</sup>

The key result emphasized by Andersen and Frenz then 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". This is a clearly both a very strong claim (i.e. "strong positive relationship") and a very precise claim (i.e. "one additional P2P download per month is to increase music purchasing by 0.44 CDs per year").

On the contrary, we and researchers of similar studies believed this positive relationship was more likely to be because, among file-sharers, those who want more music are both more likely to file-share and more likely to purchase CDs. The authors' error was similar to observing a positive relationship between the frequency of going to hospital and becoming very ill and concluding going to hospital is bad for one's health. Or on a rainy day concluding that the use of umbrellas causes puddles. Correlation does not imply causation.

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12 Birgitte Andersen and Marion Frenz, "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 (March 2010): 715-740.

13 Ibid., 734.

14 Ibid., 735.

15 ANU, *Centre for Law and Economics Working Paper* No. 2 (2007).

16 Based on estimates obtained from their negative binomial model in their table 4.3.

The results of the study were consistent with the view that among file-sharers, those who love music more will buy more CDs and download more music. This result was in turn consistent with prior studies that have found evidence that downloading harms CD sales.

This report revisits the Anderson and Frenz study and their most recent publication in the *Journal of Evolutionary Economics*, using the survey data they collected on behalf of Industry Canada. This enables us to cross check their work.

In what follows, I:

1. outline the theory of consumer behaviour relevant to the analysis of Andersen and Frenz's data; and,
2. analyze the data using this theory.

The main conclusions arising from this analysis are that, contrary to their reported results, AF's own survey clearly shows that individuals would increase their consumption of paid music if songs were not available on P2P downloads.



# ECONOMIC THEORY OF CONSUMER BEHAVIOUR AND MUSIC PIRACY

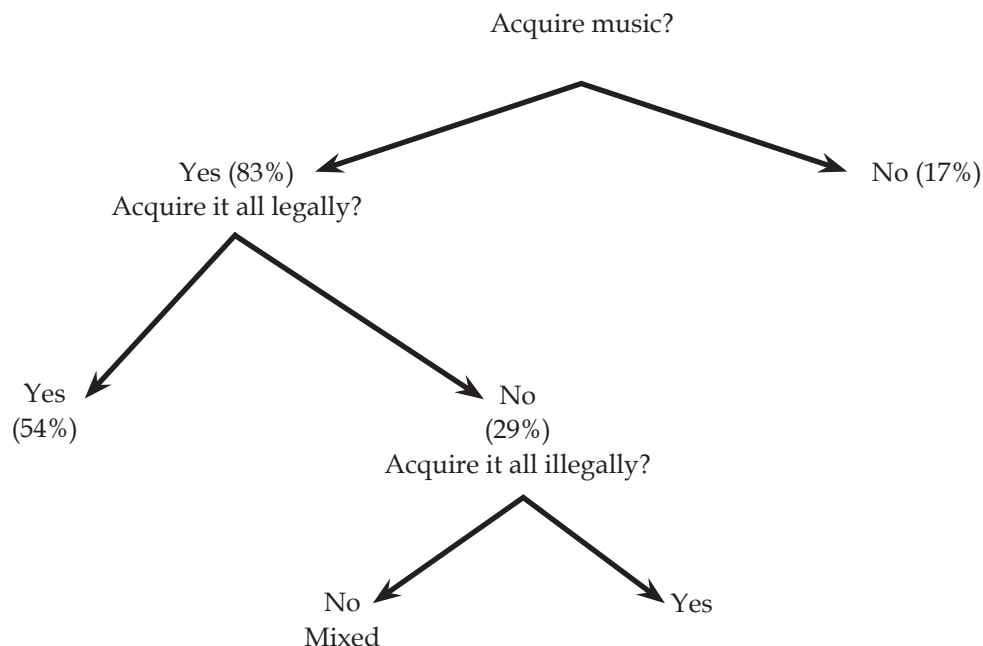
## The nature of the relevant decisions

An important point is that there are really two layered decisions here:

1. Whether to acquire music.
  - a) The study showed that 17% of people surveyed did not buy nor download music.
2. If one decides to acquire music, how to acquire it, including:
  - a) whether to acquire it legally – 54% of the population only buys music and does not download it from P2P file-sharing networks;
  - b) whether to acquire it illegally – 29% of the population acquires music through P2P networks and other means; and,
  - c) how much to acquire illegally.

The following diagram summarizes the decision tree. It also presents the percentage of the weighted population making different decisions reported by Andersen and Frenz based on their analysis of the survey data.

**Figure 1: The Decision Tree**

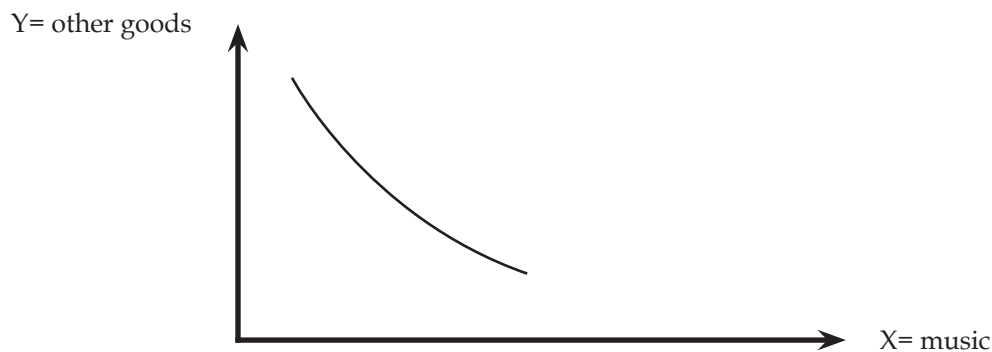


## The decision to acquire music

On the first decision of whether to acquire music, one might reasonably assume that individual interest in music varies and may be related to factors such as age, gender and income. This is confirmed by a preliminary analysis of the decision whether to buy music. For example, of the 17% of people surveyed who did not acquire (buy nor download) music, it turns out that the median age is 45-54, while the median for those that do buy and/or download music is 25-34. Clearly the younger you are, the more inclined to acquire music. This reduces variation in age and in age-related factors, of course, and this in turns limits the scope for any analysis of the determinants of behaviour if, like AF, one examines only the music buying subgroup.

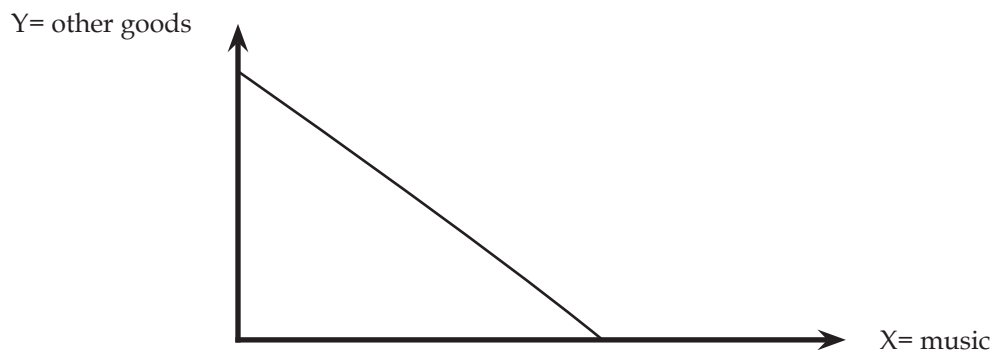
In the diagram below we present a simple economic model of the decision-making of individuals, where consumption of music is on the x axis and consumption of other goods is on the y axis. The indifference curve drawn in the graph is assumed to connect points of constant utility. Thus, as a person's use of music falls, he/she can maintain his/her level of satisfaction though an increase in the amount of other goods.

**Figure 2**



Individuals can further be understood to be subject to a budget constraint within which they need to decide what to buy. The individual's budget limits consumption opportunities. A resource cost or "full" budget line similar to that drawn below thus divides the feasible consumption set from the infeasible. Those points which are feasible are below the budget line and those which are infeasible above it, as they exceed the budget available.

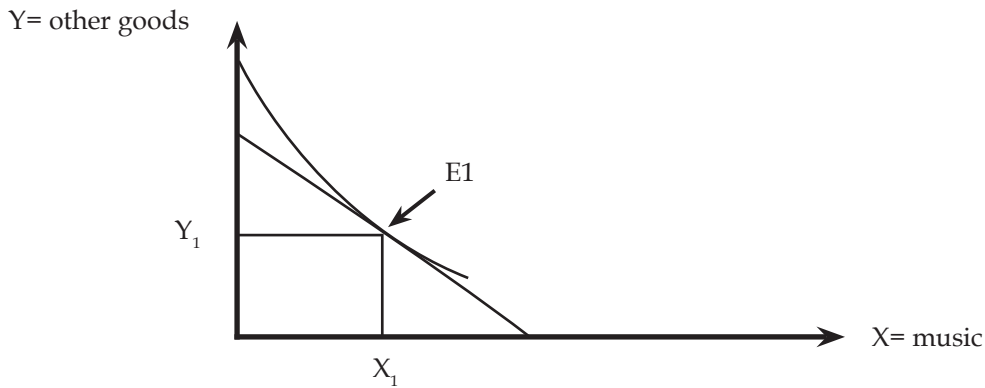
**Figure 3**





Economics assumes individuals seek to attain their highest level of utility or satisfaction for a given budget. Bringing the analysis above together then, figure 4 below illustrates an equilibrium outcome - E1.

**Figure 4**



In the above model people attain their highest level of utility or satisfaction at the point of tangency (E1) between their budget line and their highest feasible indifference curve. At this equilibrium the consumer buys  $Y_1$  other goods and  $X_1$  units of music.

The foregoing model then explains the behaviour of the 83% of people in the survey who acquired music.

## Decision on how to acquire music

On the second decision, or how to acquire music, of particular concern is the decision whether to acquire music illegally. In this regard we can distinguish:

1. the participation rate in illegal behaviour (or the frequency of the act of piracy across the population); and,
2. the activity rate of those participating in illegal behaviour.

It is important to recognize the distinction between the participation rate and the activity rate by those who participate, as the total amount of piracy and its effects depend on the piracy participation rate of the population, as well as the activity rate by those who participate.

Thus, the amount of piracy may be high because a small number of people (low participation rate) are very active downloaders (high activity rate) or because a large number of people (high participation rate) are engaged in a small amount of piracy (low activity rate).

Economics predicts the decisions whether to acquire music illegally (participation decision) and how much (activity decision) will depend on access to relevant resources including computers and broadband. It will also depend on the legal sanctions for piracy and preferences or attitudes to criminal behaviour. In this regard, the economic analysis of criminal behaviour assumes piracy is a function of the probability of being caught ( $p$ ) and the sanction applying if one is caught ( $s$ ). This determines the expected sanction or penalty which one can describe as the implicit or “shadow price” of illegal downloading.<sup>17</sup> This can be summarized as:

$$P_i = p*s$$

Where,

$P_i$  = expected sanction (price of illegal downloading or piracy)

$p$  = probability of being caught

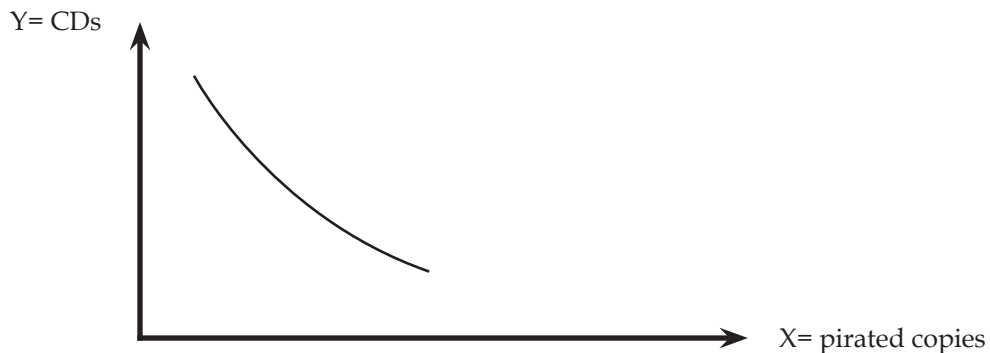
$s$  = the sanction

<sup>17</sup> In this regard, the question arises of the extent to which the expected sanction price of piracy is a function of the frequency of the activity and/or the amount one downloads. This seems likely as the more frequently one downloads the more likely one is to be caught. While the more one downloads in any incident the greater the sanction to the extent the sanction is set commensurate to the harm caused.

Relevant economic theory would suggest that CD purchases and pirated music are substitutes. However, given there are important differences in their nature, they are best thought of as imperfect substitutes. This means individuals can compensate for a reduction in their use of CDs by an increase in the use of pirated music copies.

A simple economic model of the decision making of individuals is presented below, where consumption of CDs is on the y axis and consumption of pirated copies is on the x axis. The indifference curve drawn in the graph is assumed to connect points of constant utility. Thus, as a person's use of CDs falls, he/she can maintain his/her level of satisfaction through an increase in the amount of pirated copies. This may be similar to a situation where an individual's satisfaction can be maintained if his/her consumption of legal drugs (e.g. alcohol) is reduced so long as his/her use of illegal drugs (e.g. marijuana) is increased.

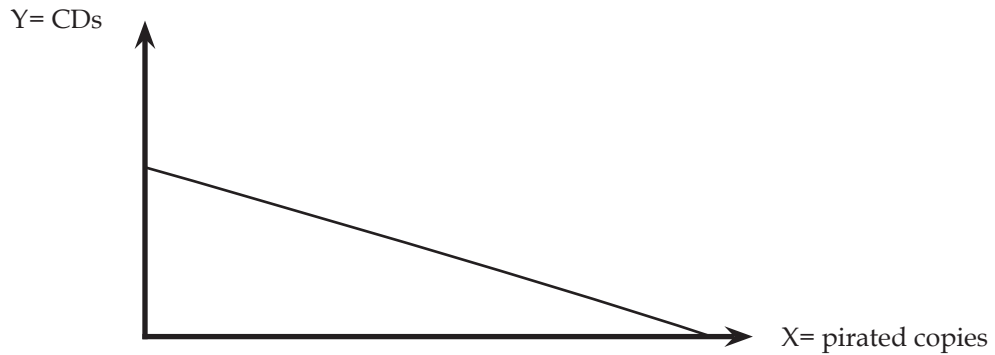
**Figure 5**



Individuals that value music may further be understood to set a budget on what they are willing to spend on music as outlined in our discussion of the decision to acquire music above. This involves a trade off with consumption of other goods. Within their chosen music budget, they then need to decide what to buy and how to acquire it. It may be suggested that a key difference between legal CD purchases and pirated music is that pirated copies are “free”. However, it seems likely there is a “shadow price” to piracy, involving the cost of time and resources required to pirate the copy, the expected value of any threat of legal sanction and the inconvenience, including advertising costs of pirated delivery. The “shadow price” would thus be similar to what one would have to pay a third party to acquire pirated copies for one.

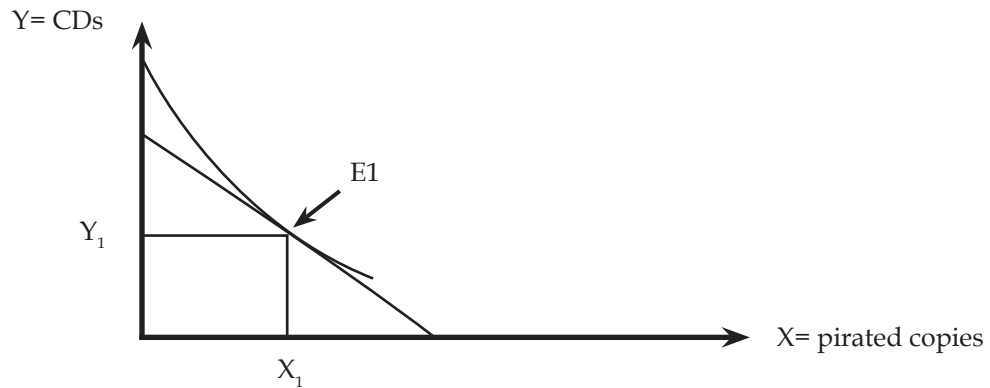
This enables us to draw a resource cost or “full” budget line similar to the one below which divides the feasible consumption set from the infeasible. To capture the fact that pirated copies are cheaper, the budget line is drawn flat indicating that by allocating their entire budget to pirated copies, considerably more can be bought.

**Figure 6**



Economics assumes individuals seek to attain their highest level of utility or satisfaction for a given budget. Bringing the analysis above together, the diagram below illustrates an equilibrium outcome - E1.

**Figure 7**

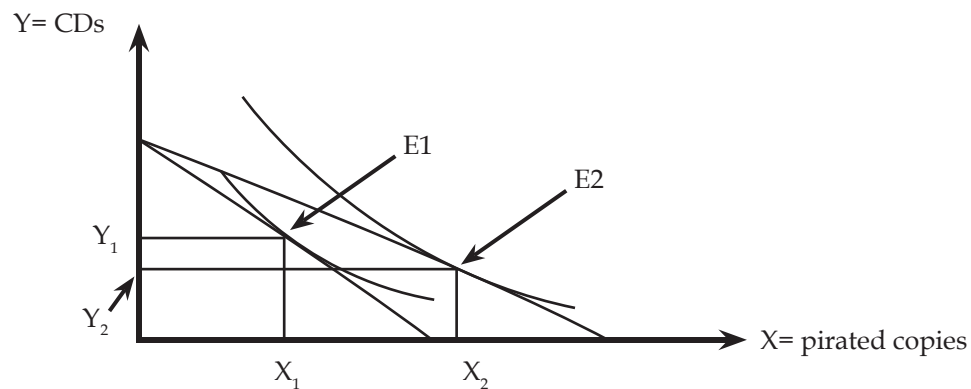


In the above model individuals attain their highest level of utility or satisfaction at the point of tangency (E1) between their budget line and their highest feasible indifference curve. At this equilibrium the consumer buys  $Y_1$  legitimate copies and  $X_1$  pirated copies.

## The predicted negative effect of P2P on music purchases

In the diagram below, we show the effect of digital downloads using the above model. The introduction of digital downloads has the effect of reducing the cost of piracy, enabling the individual to consume more pirated copies for a given budget. This implies the budget line rotates as shown below along the x axis, and the new equilibrium is E2 involving greater consumption of pirated copies  $X_2$  and less legitimate copies.

Figure 8



This is the underlying economic theory explaining why there is an increase in piracy with the introduction of digital downloads – it is rational behaviour of consumers responding to relative price changes. Given legitimate copies and pirated copies are assumed to be substitutes, the above model also leads to the prediction that consumption of legitimate copies will fall from  $Y_1$  to  $Y_2$  using normal assumptions about indifference curves.





# LONGITUDINAL ANALYSIS VERSUS CROSS SECTIONAL ANALYSIS

The mistake made by Andersen and Frenz seems to have been to use this prediction from economics in relation to the same individual's behaviour over time to predict differences in behaviour between different individuals at a point in time. The analysis of how the behaviour of the same individual changes over time involves longitudinal or time series analysis. The analysis of differences in behaviour between different individuals at a point in time entails cross sectional analysis.

Economic theory thus predicts that longitudinal analysis of individual behaviour over time would show increases in piracy activity to be correlated with decreases in legitimate purchases. Andersen and Frenz seem to extrapolate from this to assert that cross sectional analysis would show that increases in piracy across individuals would be correlated with decreases in legitimate purchases across individuals.

The problem, however, is that cross sectional data includes observations on different individuals at a point of time. In such data, one cannot observe the predicted behaviour of an individual over time in response to the onset of digital piracy. Rather, what one observes is the effect of differences between individuals after the onset of digital piracy. Thus, we are not analyzing the effects of changes in digital piracy on individual behaviour but rather the effect of observable differences between individuals on both their piracy and music purchasing behaviour.

Having said that, there is a question in the Industry Canada commissioned survey which does provide insight on possible individual behaviours in response to

changes in the availability of piracy. AF however do not report on participants' responses to this survey question which asked how they would behave were the songs they downloaded by P2P not available through P2P. This question then focuses on identifying individuals' likely responses to changes in the availability of digital piracy. The relevant question is question 4.4 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

When we examined the responses to this question, we find that 81% answered that they would have purchased music through paid music sites or as a part of a music CD if they were not available through P2P. This clearly means that removing P2P file-sharing would tend to increase music purchasing. Conversely, it also seems to imply that allowing P2P file-sharing must tend to decrease music purchasing.

Andersen and Frenz, however, do not actually comment on this result. Instead Andersen and Frenz ignore this contradictory direct result from their survey and claim, instead, on the basis of cross sectional analysis of the differences between individuals that "P2P file-sharing tends to increase rather than decrease music purchasing."

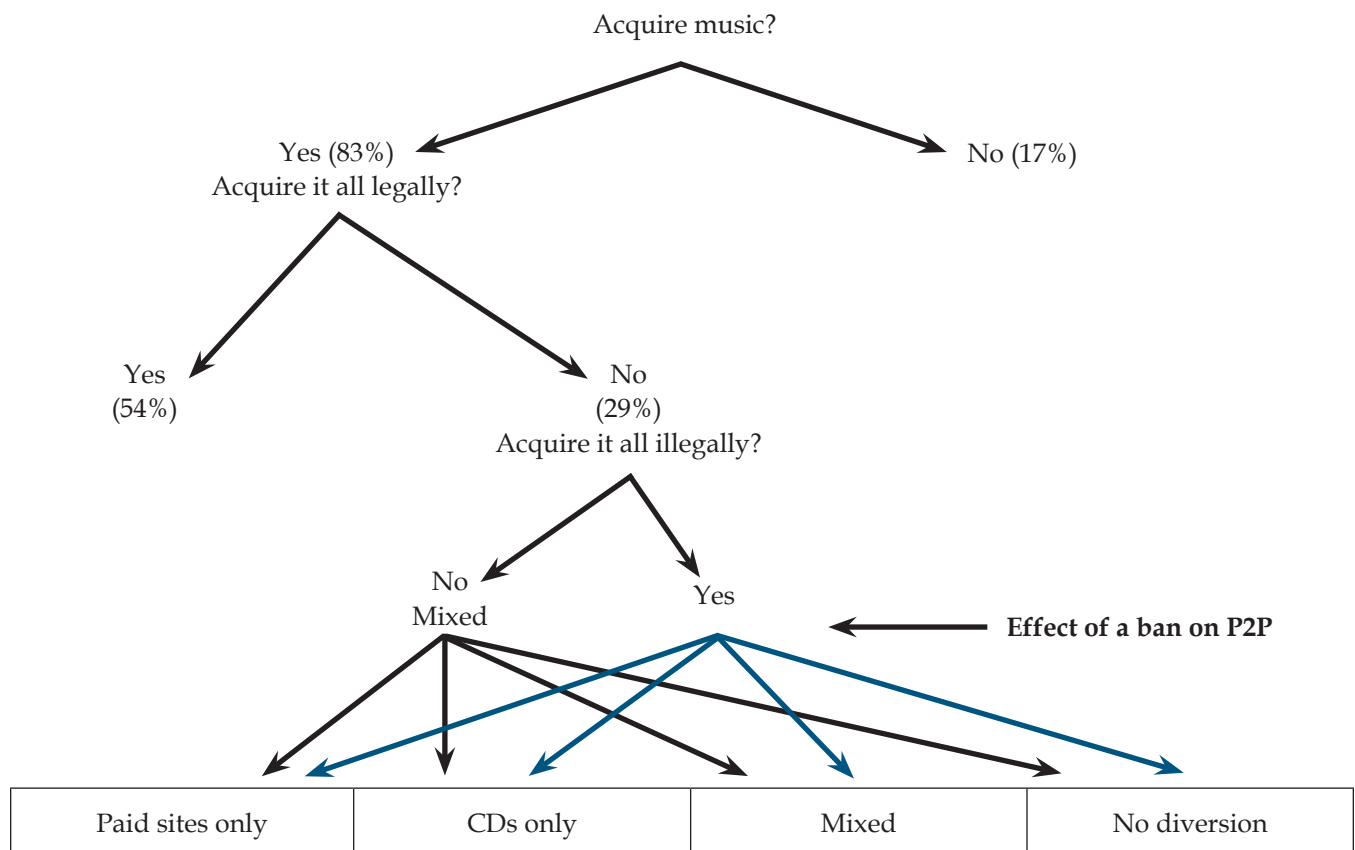
# LONGITUDINAL ANALYSIS OF THE IMPACT OF P2P ON MUSIC SALES

At this point, it is useful to revisit the decision tree from earlier. As shown in the decision tree presented below, the group whose decisions would be affected by a move to ban free downloads by P2P networks are those who first, as shown at the top of the diagram, decide to acquire music, but then choose not to acquire legally but rather illegally through P2P networks, either as shown:

1. through a mixed strategy (involving both legitimate and illegitimate P2P acquisition); or,
2. through purely illegal means – or solely through P2P networks.

At the bottom of the decision tree, we can identify the four terminating options for people if P2P downloads were banned. Broadly people may replace the P2P with either: i) paid sites purchases only; ii) CDs only; iii) a mix of paid sites purchases and CDs; or, iv) no replacement purchases. The last category indicates a ban would have no diversion effect, or fail to divert acquisition into paid purchases, suggesting for such individuals P2P downloading and purchasing behaviour are unrelated or are thus not substitutes (as suggested by standard economic theory), nor complements (as suggested by AF).

**Figure 9**



## Identifying the P2P downloaders

Our interest is in analyzing the behaviour of P2P downloaders, so first we have to identify them from their survey answers. This proves to be less straightforward than Andersen and Frenz’s report indicates.

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 whether you acquired music by a particular method which gives rise to a binary variable (yes or no).
- 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. In selected cases, there was some supplementary follow up questioning or information sought.

The table below summarizes the questionnaire’s structure on the key options for acquiring music.

Table 1: Music Acquisition Behaviour Questions						
Q1.3a) CDs	Q1.3b) Pay sites	Q1.3c ) Free websites	Q1.3d) P2P networks	Q1.3e) Friends’ MP3 copies	Q1.3f) Rip songs from CDs	Q1.3g) Private Internet
Q2.1 How many	Q2.8 How many	Q4.1a) How many	Q4.1b) How many	Q4.1d) How many	Q2.7 How many	Q4.1c) How many
Q2.2-2.6 Follow up	Q2.9-2.13 Follow up		Q4.2-4.5 Follow up			

The problem that emerges from our analysis of the dataset is that people did not always provide consistent answers to question 1.3 and the follow up questions like question 4.1b). Focusing on P2P downloaders, the questionnaire should have identified P2P downloaders at question 1.3d) through a yes/no question (participation rate) and then identified how much they downloaded at question 4.1b) (the activity rate). The problem is there were people who responded they did acquire music from P2P networks in question 1.3d) but who, in response to question 4.1b)(i), answered they downloaded zero tracks from P2P networks in 2005 or said they did not know how many tracks they downloaded. Table 2, below, shows the number of people responding “no” or “yes” in response to question 1.3d) on participation in downloading (by rows) and how these groups answered the follow up question 4.1b)(i) on the amount downloaded in 2005 (by columns). Table 3, below, shows the same results as a percentage of the total sample.

Table 2				
Q1.3d ) Download free music from P2P networks?	QUESTION 4.1b)(i) How many free tracks do you download from P2P networks in an average month in 2005?			
	0	0 < Answer	Don't Know	TOTAL
No=2	1,490	-	-	1,490
Yes=1	95	445	61	602
Total	1,585	445	61	2,092

Table 3				
Q1.3d) Download free music from P2P networks?	QUESTION 4.1b)(i) How many free tracks do you download from P2P networks in an average month in 2005?			
	0	0<Answer<999	999	TOTAL
No=2	71%	0%	0%	71%
Yes=1	5%	21%	3%	29%
Total	76%	21%	3%	100%

As shown in the bottom left cells of the tables 2 and 3, 95 people (table 2), representing 5% of the population (table 3) responded “yes” to question 1.3d) which asked whether they downloaded tracks from P2P networks, but then in response to question 4.1b), answered they had downloaded zero tracks.<sup>18</sup> If we add the 3% who answered they did not know how many tracks they downloaded in response to question 4.1b, then 8% of the weighted sample did not provide directly useable answers.

In what follows, we shall focus our analysis on those who either responded to question 4.1b) with the amount they downloaded or provided a “don’t know”

response. We excluded the 5% group who answered “yes” to question 1.3b) but answered “zero” to question 4.1b) for two main reasons. First, we prefer the more precise numeric question 4.1b as it is more reliable, making question 1.3d) redundant. Second, on cross-checking, most of the group who answered “zero” to 4.1b)(i) for 2005 also answered “zero” in relation to 4.1b) (ii) for the prior year 2004, thus suggesting they were not responding inadvertently to 4.1b)(i).

<sup>18</sup> Although 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 AF based their whole analysis on.



# The impact of P2P availability on purchases

We are interested in the P2P downloaders whose response to question 4.1b) identifies how many tracks they downloaded. For this group, we want to examine their response to question 4.4 which as noted 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

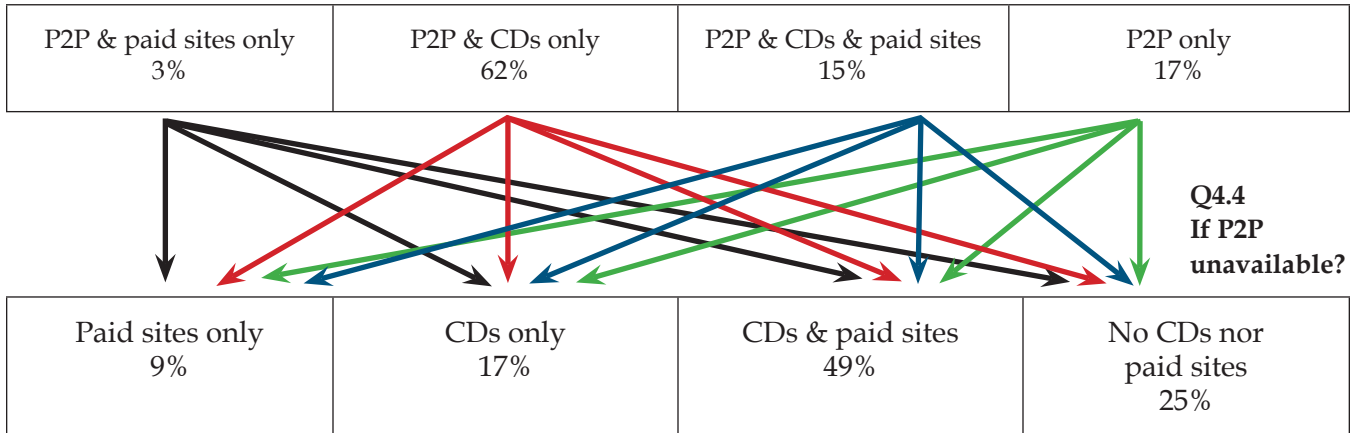
Table 4, below, summarizes the key responses from the questionnaire that are then relevant. The left hand side identifies in three columns the relevant questions and possible answers on current music acquisition behaviour posed in the main questionnaire on the assumption that P2P downloads are available. The right hand side, in two columns, identifies the relevant questions and possible answers on music acquisition behaviour posed on the assumption that P2P downloads are NOT available.

Table 4: Underlying Survey Question Structure				
P2P AVAILABLE SURVEY RESPONDENTS' CURRENT BEHAVIOURS			P2P UNAVAILABLE SURVEY RESPONDENTS' Q4.4 RESPONSE	
P2P	CDs	Pay sites (PS)	CDs	Pay sites
Q4.1b	Q2.1	Q2.8	Q4.4b	Q4.4a
= 0	= 0	= 0	= 0	= 0
>0	>0	>0	>0	>0
999 Don't know	999 Don't know	999 Don't know	999 Don't know	999 Don't know

We can then adapt the decision tree from above for this group of P2P downloaders to identify their possible responses to question 4.4 a) on pay site purchases and 4.4 b) on CD purchases if P2P downloads were not available as follows. At the top of the decision tree, we identify that 21% of the weighted sample said they acquired music illegally through free P2P networks. In the next level or in the middle stage of the decision tree, we identify the various mixes of P2P downloads and legitimate purchasing behaviour possible including from left to right in four columns as follows: i) the 3% who use P2P and paid sites only; ii) the 62% who use P2P and CDs only; iii) the 15% who use P2P and CDs and paid sites; and iv) the 17% who use P2P only.

**Figure 10**

Acquire it illegally?  
Q1.3 d) and Q4.1 b)  
Answer positive 21%



The bottom row of the above decision tree shows the responses to question 4.4 as to the effect of P2P availability overall. In total, 75% of P2P downloaders responded that if P2P were not available they would have purchased either through paid sites only (9%), CDs only (17%) or through CDs and pay sites (49%). Only 25% of people say they would not have bought the music if it were not available on P2P for free. This clearly suggests P2P network availability is reducing music demand of 75% of music downloaders which is quite contrary to AF's much publicized claim.

In what follows we analyze in greater depth the responses to question 4.4 shown in the bottom row of the above decision tree as to the effect of P2P availability on music purchasing behaviour. We first do this for the four different groups identified in the second to last row of the decision tree above separately. Then we combine and summarize the analysis. Our discussion proceeds in the following order:

- First, we review the behaviour of those who we call hard core P2P downloaders identified in the fourth column in the second to 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).

- 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 second to last row of the decision tree above.
- 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 second to last row of the decision tree.
- 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 second to last row of the decision tree.



## 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 second to last row of the decision tree (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, AF 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.”<sup>19</sup>

Claiming instead “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.”<sup>20</sup>

In an earlier paper as noted they previously made the stronger claim “that P2P file-sharing tends to increase rather than decrease music purchasing.”

Taking AF’s earlier conclusion, which was formulated in a paper published in 2007, 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, which is inconsistent with AF’s initial prediction that it had a positive relationship based on cross sectional analysis. If P2P purchases increased music purchases as claimed in AF’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 P2P.

AF’s analysis thus suggests two predictions in relation to this group:

- Assuming earlier AF claims, one would certainly not expect this group to purchase any music if P2P networks were removed altogether – as this group

doesn’t purchase even when P2P networks are available, and according to AF, P2P downloading increases music purchases.

- Assuming the later AF 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 this group doesn’t purchase even when P2P networks are available, and according to AF, 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 21.2% of total weighted downloads. The significant result is that 63% 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 question 4.4 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.

Assuming a pay site download costs 99 cents in 2005 and a CD track \$1.08<sup>21</sup>, this would have implied additional expenditure on music on average of \$168 per hard core downloader – if P2P networks were not available.

## 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 second to last row of the decision tree 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 87% percent of these “fully mixed” P2P downloaders say they would buy the tracks they downloaded if the songs were not available on P2P networks.

19 Andersen and Frenz, “Don’t blame the P2P file-sharers: the impact of free music downloads on the purchase of music CDs in Canada,” (March 2010): 734.

20 Ibid., 735.

21 This estimated average price of a single track on CDs in 2005 assumes there were 13 tracks to a CD and CDs cost around \$14 in 2005.

On a weighted basis, this group of “fully mixed” downloaders downloaded 1,388 songs. They then indicated in response to question 4.4 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 costs 99 cents in 2005 and a CD track \$1.08<sup>22</sup>, this would have implied additional expenditure on music on average of \$182 “fully mixed” downloader—if P2P networks were not available.

### **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 second to last row of the decision tree, 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 79% 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 costs 99 cents in 2005 and a CD track \$1.08<sup>23</sup>, this would have implied additional expenditure on music on average of \$187 “CD mixed” downloader—if P2P networks were not available.



### **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 second to last row of the decision tree, 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 85% 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 question 4.4 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 costs 99 cents in 2005 and a CD track \$1.08<sup>24</sup>, this would have implied additional expenditure on music on average of \$291 “pay site mixed” downloader—if P2P were not available.

22 This estimated average price of a single track on CDs in 2005 assumes there were 13 tracks to a CD and CDs cost around \$14 in 2005.

23 This estimated average price of a single track on CDs in 2005 assumes there were 13 tracks to a CD and CDs cost around \$14 in 2005.

24 Birgitte Anderson and Marion Frenz, “The Impact of and P2P File-Sharing on the Purchase of Music: A Study for Industry Canada,” [http://www.ic.gc.ca/app/cmmn/srch/vSearch.jsessionid=00014ELsvBcbtwElit7caecMr:-GCJQEU?V\\_TOKEN=1297072362550](http://www.ic.gc.ca/app/cmmn/srch/vSearch.jsessionid=00014ELsvBcbtwElit7caecMr:-GCJQEU?V_TOKEN=1297072362550), table 3.1, p. 37 (accessed February 2007).

## Summary of the effect of P2P availability on music purchases

Table 6, below, summarizes the results identified to date and outlined above from respondents' answers to question 4.4 which asked the amount of downloads respondents said they would replace by purchasing CDs or from pay sites, if P2P networks were not available. Thus:

- In the first data column is the number of people in each downloader category, by row. Thus as shown in the last data row of the first column, 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, we have the amount of downloads respondents said they would replace by purchasing CDs or from pay sites per month, if P2P networks were not available.

- In the last four columns we indicate the implications 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 6 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 6: Summary of the Effect of P2P availability on Music Purchases**

Original behaviour	Count	Amount replaced per month		Additional expenditure per year			
	Number of downloaders	By pay sites (PS)	By CDs	By PS if PS = \$0.99	By CDs if CDs = \$1.08	Total	Average per person per year
P2P only	76	400	617	\$4,752	\$7,968	\$12,720	\$168
P2P,CD & PS	66	479	493	\$5,690	\$6,367	\$12,057	\$182
P2P,CD only	276	1960	2181	\$23,290	\$28,184	\$51,474	\$187
P2P,PS only	12	170	119	\$2,020	\$1,536	\$3,556	\$291
Don't know	16						
<b>TOTAL</b>	<b>445</b>	<b>3009</b>	<b>3409</b>	<b>\$35,751</b>	<b>\$44,055</b>	<b>\$79,806</b>	<b>\$179</b>



Table 7, below, further indicates the total expenditure effects the above results imply, if no songs were available on P2P networks. The first row identifies AF’s estimate of the size of the downloading population in 2005 at 7,053,251.<sup>25</sup> The second row identifies the amount of displaced spending on average per downloader of \$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. The analysis in the table below suggests the failure to prohibit P2P music downloading could cost the music industry in Canada as much as \$1.1 billion, using weighted data. This seems to be on the high side. It therefore invites further work on the underlying data. 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 the songs through legitimate means.

<b>Table 7: The Effect on Total Expenditure</b>	
Downloaders in total population	7,053,251
Average displaced spending	\$179
Total spent	1,263,735,581

The problem for Andersen and Frenz’s analysis is their conclusions are contradicted by the survey respondents’ answers to questions 4.4, which suggest 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.”<sup>26</sup> Contrary to Andersen and Frenz’s claims, the results from question 4.4 suggest if music were not available on P2P networks, respondents would buy a significant positive percentage of the downloaded music no longer available.

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 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.

<sup>25</sup> Andersen and Frenz, “Don’t blame the P2P file-sharers: the impact of free music downloads on the purchase of music CDs in Canada,” (March 2010): 734.

<sup>26</sup> Ibid., 734.

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