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Music piracy among students on the university campus: Do males and females react differently?

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Abstract

This paper analyzes the role that gender plays on the likelihood and extent of peer-to-peer music file-sharing, a key issue in the debate on copyright protection. We use an extensive data set on university students, a core demographic in the use of file-sharing technologies. The empirical results suggest that male and female students respond differently to risk and economic incentives. Specifically, females tend to react more consistently with expected risk and economic deterrent factors, while males exhibit more sporadic behavior.

JEL classification: J16; O34; K42; D12

Keywords: Gender effects; Copyright protection; Music piracy

1. Introduction

Peer-to-peer file-sharing continues to be a popular mechanism to acquire media, such as music, movies, and software, at virtually no monetary cost. According to the Recording Industry Association of America, over 60 million people in the U.S. and Canada used file-sharing programs last year, contributing to a worldwide loss of over US$ 4.5 billion for the industry (RIAA, 2006). More recently, the growing success of fee-based music downloads, such as Apple iTunes®, has shifted some attention away from music file-sharing and towards other medias prone to file-sharing, such as movies. Nonetheless, the extent of illegal music file-sharing remains substantial, and the music industry continues to seek remedies (e.g., the use of enforcement and the promotion of low-cost substitutes) to reduce the inherent copyright violations that file-sharing fosters.

While the literature has analyzed the tradeoffs between file-sharing benefits (e.g., low price, convenience, and greater selection) and costs (e.g., risk and reduced quality), few would doubt that the benefits of file-sharing has led to its overwhelming popularity despite the implications of piracy. Yet, no study has focused on the role that gender plays on the likelihood and extent of copyright piracy. Gender differences abound not only in the criminology literature, but also in technology usage and labor market opportunities. Given that music file-sharing captures the elements of illicit behavior and technology usage, it is important to study how gender differences might bring light to new policy in the protection of copyrights. In this paper, we use a large sample of survey data on university students to investigate whether

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inherent differences exist between males and females with respect to the extent of using file-sharing technologies, and whether males and females respond differently to risk and economic incentives.

This paper focuses on university students, a segment of the population that is more likely to exhibit similar behavior and risk attitudes compared to the general population due to the narrower range of ages and educational background. The challenge, therefore, is to place greater emphasis on inherent differences between genders than on potential uncontrolled factors. Our findings suggest that male students are likely to use file-sharing technologies more frequently and to a greater extent than female students. We advance two general conclusions for this result: first, females, on average, possess greater risk perceptions and more willingness-to-pay to avoid "illegal" actions compared with males. Secondly, while female students react more consistently with expected risk and economic deterrent factors, male students exhibit more sporadic behavior. The remainder of the paper is as follows: Section 2 discusses the literature on copyright protection with emphasis on gender and risk behavior. Section 3 presents the empirical model. Section 4 describes the survey data used, while Section 5 discusses the empirical results. Finally, Section 6 discusses policy implications and concludes.

2. Background literature

The debate on file-sharing focuses on whether it has a deleterious effect on sales in the music industry. Stevans and Sessions (2005) found that file-sharing and other substitutes to music (e.g., DVDs) have decreased sales of music CDs, while Zentner (2005) found countries with larger Internet and broadband penetration (which facilitate file-sharing) have seen aggregate music sales fall. Rafael and Waldfogel (2006) used survey data to find that file-sharing reduces per capita spending on music and raises consumer welfare, while Oberholzer and Strumpf (2004) matched a sample of actual music downloads to U.S. sales data on 500 random albums, and found a negative correlation. While most studies showed a negative correlation between file-sharing and music sales, others studies (e.g., Gayer and Shy, 2005) have argued that file-sharing creates benefits, such as network externalities, that may offset part of the negative effects.

Solutions to combat copyright piracy resulting from file-sharing have emphasized enforcement, legal awareness, and economic incentives (see Varian, 2005, for a survey of solutions to copyright piracy). Enforcement strategies are frequently subject to debate; for example, Yoon (2002) argued that enforcement strategies are effective as they create a private cost to consumers that deters piracy, while Gayer and Shy (2005) questioned the effectiveness of enforcement by arguing that enforcement reduces network externalities that increase sales in the music industry. Economic incentives, such as the promotion of inexpensive, high quality, and legal alternatives to file-sharing, have increased in recent years with the success of fee-based music subscriptions. To determine optimal solutions to combat copyright piracy, the identification of factors that cause piracy is essential.

Copyright piracy can be explained by both innate and external factors. Innate factors include one's age, gender, ethnicity, income, and natural risk aversion, while external factors include peer effects and social perceptions of copyright law. But underlying many of these factors is the role that gender plays in behavioral actions. Studies have suggested that males and females possess inherent differences in risk preferences and subsequent behavior, while others dismissed the purported differences as resulting from the failure to account for relevant control variables. Nonetheless, the consensus is that there are differences in *revealed* behavior among genders (Dwyer et al., 2002), and that the underlying effect which influences these findings varies.

Early work on gender behavior uncovered general differences in the way males and females respond to risk and their corresponding actions. For example, Spigner et al. (1993) found gender differences in drug and alcohol abuse among college students, Flynn and Mertz (1994) uncovered differences in perceptions relating to environmental health risks, while Levy et al. (1999) studied how males and females differ in their investment strategies. More recently, Grable et al. (2004) studied why individuals might exhibit behavior that does not maximize expected utility, and focused on females who tended to show lower risk tolerance. Further studies on health risks related to obesity (Kan and Tsai, 2004) and future health risks (Nielsen et al., 2003) support similar conclusions.

A number of studies have also used experimental simulations to determine gender differences in a controlled environment where the influence of non-gender factors is minimized. Levin et al. (1988) was among the first to engage in extensive risk analysis using this technique, while a more recent experimental study by Cadsby and Maynes (2005) found that with respect to risky activities, females exhibited a smaller variance in behavior from one another, while males exhibited more sporadic behavior.

While much of the literature emphasizes the important role of gender differences on risky activities, some have criticized the approach by which these differences are measured. Shubert et al. (1999) and Bolton and Katok (1995)

argued that many gender studies fail to account for the true factors influencing the difference in behavior, thereby incorrectly attributing unaccounted identification variables to gender.

In this paper, we extend the literature by analyzing how male and female students react to policies that increase risk or economic incentives with respect to copyright piracy. Because differences in demographics can dilute the gender effect if not adequately controlled, our strategy is to constrain the demographics into a narrower band by focusing on university students. While most studies use a dummy variable to capture gender in a pooled analysis, in this paper we separate males and females into separate analyses for comparative purposes. Lastly, we include a set of control variables to capture remaining identifying factors in behavior. Thus, any inherent gender differences in behavior can be better portrayed using this methodology.

3. Empirical model

In recent years, the media has focused attention on music file-sharing within universities. Of particular concern is that many students use university resources, whose purpose is to promote academic goals, to engage in music file-sharing which arguably has little academic value. University students are an interesting group to focus on in studying copyright protection; they represent a market segment that exhibits technological savvy, high demand for music, low average level of income, and as found by Chiang and Assane (2002), a higher than average propensity for piracy. In addition, the university provides access to peers with similar mentalities, one that may perhaps be more risk-preferring. Finally, under most legal systems, individuals who violate copyrights are classified as *criminals*, yet society has increasingly bestowed a nonchalant view on this activity, similar to casual speeding, that tends to minimize the criminality of it.

The empirical model deals simultaneously with issues regarding two separate decisions by students: (i) whether or not they engage in music file-sharing, and if they do, (ii) what is the extent of it. To empirically analyze these two decisions, we first outline the estimation method; then, we specify the empirical model.

3.1. Estimation methods

Consider the following system of censored equations:

$$Y_{1i} = Z_i'\gamma + \varepsilon_1, \qquad Y_{2i} = X_i'\beta + \varepsilon_2, \qquad d_i = 1\,(Y_{1i} > 0), \quad i = 1, 2, \ldots, N \tag{1}$$

where $1(\cdot)$ is a binary indicator function and $d = (Y_{1i} > 0)$ is a bivariate selection indicator function. Y_{1i} is not observed but the sign (i.e., d_i) is, whereas Y_{2i} is only observed when Y_{1i} (i.e., d_i) is positive. Moreover, while Y_{1i} captures the sample selection process, indicating whether a randomly selected student engages in music file-sharing, Y_{2i} is the variable of interest, measuring the extent of the activity. The error terms ε_1 and ε_2 are assumed to be jointly distributed with mean zero, variance (σ^2, 1) and covariance σ_{12}. Hence, our empirical approach is consistent with Amemiya's (1984) Type-2 Tobit and Heckman (1976, 1979). Subsample OLS estimation on positive Y_{2i} yields inconsistent β estimates since ε_2 in the subsample regression is generally not independent of X_i.

Two popular parametric methods are used to estimate Eq. (1). First, Heckman suggests a two-step estimation procedure. The first step consists of using the Probit maximum likelihood method to find $\hat{\gamma}$, an estimate of γ for all i based on $d_i = 1$ if $Y_{1i} > 0$ and $d_i = 0$ otherwise. The second step consists of finding $\hat{\beta}$, an estimate of β by OLS method for $d_i = 1$ if $Y_{1i} > 0$, by regressing Y_{2i} on X_i and λ, the inverse Mill's ratio. The second, alternative method consists of jointly estimating the parameters β and γ by the maximum likelihood method (see Amemiya, 1984).

3.2. Variables description

Appendix A contains full descriptions of the variables used. We introduce two dependent variables based on Eq. (1). The first (*Music*) is a binary variable that indicates whether or not a randomly selected student engages in file-sharing, while the second dependent variable (*Pmusic*) measures the percentage of total music collections consisting of music acquired via file-sharing. Next, we introduce the independent variables consisting of groups of variables pertaining to *Risk*, *Economic*, *Information*, *Innate*, and *Fairness* characteristics.

The *Risk* variables are directly measured by *RIAA-Threat*, the perceived risk of being sued by the RIAA for music piracy, and *Penalty*, the perceived amount of fine to be paid if found guilty of piracy. The role of risk is also measured indirectly by *Exam-Honesty*, a variable that measures whether a student typically considers cheating (in any form) when

taking an exam. The purpose of *Exam-Honesty* is to capture innate attitudes towards law conformity. Each of the *Risk* variables is expected to have deterrent effects on music file-sharing. The *Economic* variables are captured by *Value*, the willingness-to-pay for a music single (e.g., via download) and by *Work*, whether or not the student works, which is a loose proxy for income. It is also expected that the *Economic* variables will correlate negatively with file-sharing behavior.

The *Information* variables capture the environment that shapes students' attitudes toward copyright law. These include the university setting *(Campus)*, university policies toward copyright piracy (*Antipiracy*), and the interaction of these two variables (*Campus* × *Antipiracy)* to emphasize campus-specific policies. While the expected effect of *Campus* is unknown, the latter two variables are expected to dampen the desire for file-sharing. The *Innate* variables measure individual characteristics such as gender, age, ethnicity, class standing, and field of study. It is expected that males, younger students, and students in technical fields will exhibit higher rates of file-sharing. Finally, *Fairness* is introduced to measure whether a student believes prosecuting individuals for music file-sharing is a fair policy. This variable appears only in the selection equation for identification purposes and to mitigate the possibility of collinearity between the regressors X_i and λ (see Vella, 1998). It is expected that those who support enforcement would be less likely to engage in the activity.

4. Data

The data are obtained by random sample of university students from three large universities during the 2003-04 academic year: Florida Atlantic University, University of Nevada Las Vegas, and New Mexico State University. The survey was comprehensive, including questions on general views toward copyright law along with specific questions related to music file-sharing. To avoid a selectivity bias, the surveys were collected in settings where a diverse composition of students was present. The universities were chosen based on their diversity of students along with their ties to the authors. A large sample collected at the individual level ensures that all demographics are represented. The difficulty of collecting behavioral data stems from asking individuals about their experiences with copyright piracy. Careful survey design (i.e., avoiding the use of the word *piracy*) allowed questions to better elicit truthful responses.

Asking individuals about sensitive topics such as potentially illegal acts can result in truthful responses being withheld. To reduce this occurrence, in addition to careful survey design, all responses and identities of participating students are kept strictly anonymous. All surveys were collected by third-party survey-takers both in class and on campus, by selected faculty and students, respectively. Because of the risk of data entry error, all data were entered twice and compared for inconsistencies. After a small number of surveys were dropped due to respondent error, a total of 763 responses were collected, of which 456 were complete to provide useful data for our empirical model.

Among the questions asked on the survey include those asking about views of recent enforcement activities, extent of music usage and file-sharing, and the willingness-to-pay for music. The key question is whether the surveyed students use file-sharing services in order to download music at no cost from the Internet, and if so, to what extent in terms of percentage of total music collections.

Table 1 presents means and standard deviations for the aggregate sample along with female and male samples individually. Females and males represent 50.7% and 49.3% of the sample, respectively, or roughly half of the total sample each. Within each gender, the distribution of characteristics such as age and class standing are similar; however, males are more represented in computer-related and other scientific fields of study. Overall, the sample statistics closely resemble those of both the surveyed institutions along with U.S. and Canadian universities in general.

Turning to the dependent variable, the extent of file-sharing (our proxy for music piracy), male students in general show relatively higher file-sharing rates compared with females. Approximately 62% of males and 54% of females admit to using file-sharing technologies, while 44% and 36% of the music collections belonging to males and females, respectively, consist of music acquired via file-sharing. These differences in file-sharing behavior are statistically significant at the 5% level.

An initial response to this finding is that there exist differences in Internet usage between males and females. A study by Wasserman and Richmond-Abbott (2005) found no correlation between gender and the frequency of accessing the Internet; however, they did find differences in the way males and females use the Internet. For example, males tend to stay online longer and are more likely to chat live with others on the Internet. However, it is uncertain whether these variations are as pronounced in the university setting, where Internet activities are an essential aspect of everyday life.

Table 1
Summary results: mean (standard deviation)

Variables	All	Male (M)	Female (F)	Difference (M − F)
Dependent variables				
Music	.581 (.493)	.620 (.486)	.540 (.499)	.080** (.038)
Pmusic	.402 (.393)	.436 (.393)	.362 (.387)	.074** (.031)
Independent variables				
Risk variables				
RIAA-Threat	.130 (.173)	.107 (.151)	.155 (.191)	−.049*** (.013)
Log(*Penalty*)	6.056 (2.014)	5.80 (1.99)	6.28 (2.01)	−.483*** (.167)
Exam-Honesty	3.306 (.752)	3.26 (.787)	3.36 (.700)	.274 (.080)
Economic variables				
Value	.656 (.963)	.523 (.758)	.799 (1.12)	−.277*** (.076)
Work	.712 (.453)	.693 (.462)	.733 (.443)	−.041 (.035)
Information variables				
Campus	.548 (.498)	.523 (.500)	.577 (.495)	−.053 (.039)
Antipiracy	.131 (.339)	.145 (.353)	.114 (.318)	.031 (.028)
Campus × *Antipiracy*	.089 (.285)	.092 (.289)	.084 (.278)	.008 (.023)
Innate variables				
Male	.507 (.500)			
Age	22.240 (4.632)	22.150 (4.440)	22.341 (4.842)	−.196 (.363)
Computer	.074 (.261)	.095 (.289)	.052 (.223)	.043** (.020)
Business	.382 (.486)	.396 (.490)	.371 (.484)	.024 (.038)
Science	.189 (.392)	.202 (.402)	.174 (.380)	.028 (.030)
Class	2.826 (1.078)	2.802 (1.101)	2.856 (1.056)	−.044 (.084)
White	.506 (.500)	.523 (.027)	.494 (.028)	.029 (.039)
Asian	.139 (.346)	.147 (.355)	.130 (.337)	.017 (.027)
Fairness	.499 (.499)	.442 (.497)	.558 (.497)	−.114 (.039)

Note: The asterisks ** and *** appearing in the Difference column indicate statistical significance at .05 and .01, respectively.

Thus, progressing beyond possible variations in Internet usage, a significant part of the variations in file-sharing patterns can be explained by differences found between females and males with respect to risk and economic factors. Fig. 1 provides a frequency distribution of the key risk variable, *RIAA-Threat*, the perceived probability of apprehension. The histogram shows that despite an equal representation of females and males in the sample, females perceive relatively higher levels of risk compared to males.

Likewise, Fig. 2 provides a frequency distribution of the economic variable, *Value*, another important determinant which measures the economic value (i.e., willingness-to-pay) for a legally downloaded single song. As in Fig. 1, differences between females and males appear, with females showing higher willingness-to-pay compared to males. This is illustrated in Fig. 2 by a greater concentration of male observations on the lower tail of the distribution (less than US$ .50 per song), while females show more concentration on the upper tail of the distribution (greater than US$ 1 per song).

Though descriptive differences clearly exist between females and males, the critical factor is *how* females and males react to these determinants. Given that males have lower risk perceptions, does this necessarily correlate with greater

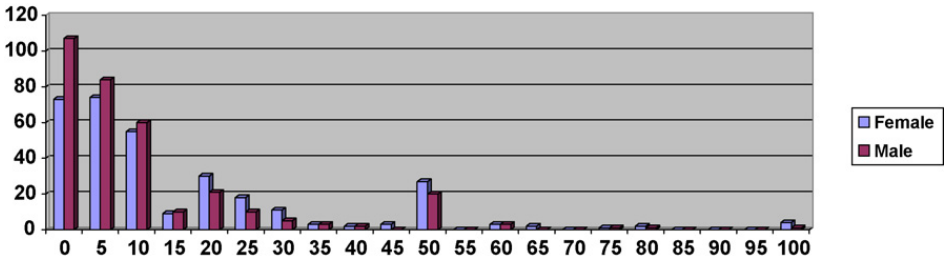

Fig. 1. Perceived probability of being caught and fined for music piracy.

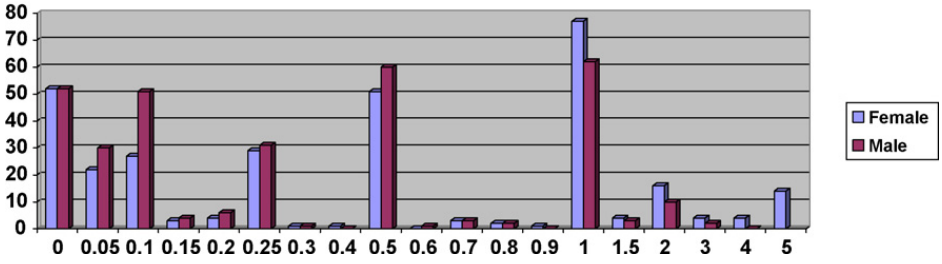

Fig. 2. Willingness-to-pay for a music single.

music piracy among males? Or stated more generally, are females relatively more sensitive to risk and economic factors than males? We address these questions along with other gender differences using the regression results presented in the following section to further shed light on the inherent differences in behavior between genders.

5. Results

Table 2 contains the empirical results based on three estimation procedures. The Probit maximum likelihood method captures the determinants of file-sharing participation, while the two-step Heckman and the Tobit maximum likelihood methods estimate file-shared music as a percentage of all music owned. In addition, the estimations for each procedure are presented for the entire sample and for the individual samples of males and females. The latter is provided to illustrate the differences between genders with respect to individual determinants.

Overall, the estimates yielded by the three procedures are mostly consistent with expectations. Male students are more likely to use file-sharing technologies, though the coefficients on *Male* are only significant at the 10% level. The results also indicate that students, male and female, are consistently sensitive to risk factors and economic incentives; further, demographic factors such as age, class standing, and field of study, have the intuitive signs. But differences exist when comparing across genders. For example, male students in computer and other scientific fields tend to engage in file-sharing more than their female counterparts in similar fields.

The Probit estimates in Columns 1–3 of Table 2 generally exhibit anticipated patterns. The risk variables (*RIAA-Threat* and *Penalty*), and particularly the implicit risk variable *Exam-Honesty*, exert a strong deterrent against music file-sharing. Likewise, file-sharing decreases with a strong willingness-to-pay for music (*Value*), particularly among female students relative to male students as indicated by the absolute value of the coefficients. Lastly, file-sharing decreases when students mature as indicated by the variables *Age* and *Class*. However, as mentioned earlier, males and females exhibit highly varying behavior when controlling for field of study, with *Computer* and *Science* coefficients appearing much stronger among males.

While the Probit results estimate the likelihood of students using file-sharing technologies, we are also interested in the factors that influence the proportion of music acquired using file-sharing methods. In Columns 4–6 and 7–9, two-step Heckman and Tobit maximum likelihood estimates are reported, respectively. The sign patterns and statistical significance of the coefficient estimates, though mostly similar to the Probit results, strengthen the Probit results, for example, among economic and field of study variables. As in the Probit results, *RIAA-Threat*, *Penalty*, and *Value* contribute negatively to the extent of file-sharing. Moreover, males in computer and scientific fields engaged in file-sharing more than females in the same fields. Even when facing a lesser income constraint (assuming the case applies when they work), male students continue to exhibit sporadic behavior in file-sharing. In contrast, working female students used file-sharing much less. The findings that female students tend to conform more closely to expected risk behavior supports the argument by Cadsby and Maynes (2005).

To further illustrate the size and significance of behavioral differences between male and female students, we report in Table 3 elasticities of the three key variables, *RIAA-Threat*, *Penalty*, and *Value*. Each variable is found to be highly inelastic, suggesting that small changes in risk perception and willingness-to-pay will likely not affect behavior. This finding is consistent with the nature of our data that focus on single songs sold at relatively low, uniform prices and with limited substitutes (for each particular song), naturally resulting in less price sensitivity. However, it is likely that large changes in the key variables in conjunction with changes in other control variables (e.g., changes in awareness of campus anti-piracy campaigns), could produce sizeable responses. Moreover, as expected, females exhibit higher elasticities relative to males for the three key variables, suggesting that females respond to incentives and enforcement

Table 2
Determinants of music file-sharing participation and percentage of total music acquired via file-sharing

	Probit			Two-step Heckman			Maximum likelihood method		
	(1) All	(2) Male	(3) Female	(4) All	(5) Male	(6) Female	(7) All	(8) Male	(9) Female
Risk variables									
RIAA-Threat	−.125* (.074)	−.139 (.573)	−.231 (.573)	−.117* (.070)	−.131 (.274)	−.154 (.187)	−.118* (.071)	−.130 (.241)	−.156 (.117)
Log(*Penalty*)	−.017 (.032)	−.005 (.046)	−.060 (.048)	−.009 (.008)	−.017 (.022)	−.015 (.018)	−.008 (.009)	−.015 (.013)	−.015 (.013)
Exam-Honesty	−.318*** (.097)	−.299** (.127)	−.310** (.146)	−.085*** (.025)	−.095* (.057)	−.137*** (.053)	−.082*** (.028)	−.082** (.034)	−.141*** (.041)
Economic variables									
Value	−.151** (.065)	−.106 (.124)	−.154** (.081)	−.050*** (.019)	−.036 (.054)	−.049* (.026)	−.050*** (.018)	−.043 (.039)	−.050** (.019)
Work	−.073 (.147)	−.015 (.200)	−.210 (.225)	−.046 (.041)	.016 (.093)	−.166** (.085)	−.048 (.044)	.019 (.058)	−.155** (.063)
Information variables									
Campus	−.041 (.145)	.037 (.212)	−.155 (.207)	.012 (.063)	.194 (.111)	−.098 (.122)	.008 (.063)	.154 (.219)	−.066 (.061)
Antipiracy	.473 (.358)	.581 (.476)	.070 (.596)	.197 (.165)	.214 (.200)	.172 (.258)	.194 (.096)	.210 (.117)	.147 (.194)
Campus × *Antipiracy*	.473 (.358)	−.496 (.581)	−.505 (.683)	−.184 (.121)	−.206 (.225)	−.152 (.285)	−.181 (.117)	−.206* (.137)	−.122 (.211)
Innate variables									
Male	.216* (.131)			.039** (.018)			.041** (.018)		
Age	−.038** (−.017)	−.017 (.026)	−.060***(.024)	−.013*** (.005)	.008 (.013)	−.009* (.006)	−.013***(.003)	−.010** (.005)	−.098*** (.004)
Computer	.051 (.258)	.473 (.369)	−.526 (.454)	.135* (.077)	.329** (.161)	−.073 (.167)	.133* (.073)	.309*** (.093)	−.047 (.099)
Business	−.195 (1.30)	−.145 (.213)	−.196 (.214)	.060 (.044)	.075 (.101)	−.018 (.061)	.066 (.047)	.094* (.060)	−.019 (.060)
Science	.113 (.193)	.550* (.305)	−.301 (.269)	.039 (.058)	.152* (.089)	−.056 (.111)	.040* (.029)	.145* (.078)	−.043 (.082)
Class	−.025 (.071)	−.097 (.103)	−.055 (.101)	−.019 (.020)	−.039 (.047)	−.015 (.040)	−.019 (.020)	−.033 (.028)	−.017 (.028)
White	.241* (.142)	.180 (.208)	.311 (.198)	.054 (.042)	.114 (.097)	.028 (.056)	.055 (.041)	.101* (.060)	.033 (.056)
Asian	−.109 (.204)	.032 (.294)	−.285 (.310)	.137** (.062)	.149 (.141)	.141 (.126)	.142** (.062)	.140* (.081)	.153 (.095)
Fairness	−.196 (.131)	−.259 (.194)	−.171 (.190)						
Constant	2.440*** (4.832)	2.167*** (.755)	3.034*** (.694)	1.103*** (.148)	.872** (.342)	1.424*** (.275)	1.089*** (.135)	.902*** (.178)	1.414*** (.169)
Log-likelihood	−271.43	−131.11	−137.92				−242.73	100.24	100.69
λ				.265	.610**	−.501*			
σ							.376	.370	.261
N	456	229	232	456	229	232	456	229	232

Note: Numbers in parentheses are asymptotic standard errors. The asterisks *, **, and *** indicate statistical significance at .1, .05 and .01, respectively.

Table 3
Estimated elasticities of key variables

	Probit			Two-step Heckman			Maximum Likelihood Method		
	(1) All	(2) Male	(3) Female	(4) All	(5) Male	(6) Female	(7) All	(8) Male	(9) Female
RIAA-Threat	−.066* (.074)	−.046 (.573)	−.070 (.573)	−.051* (.070)	−.058 (.274)	−.067 (.187)	−.056* (.071)	−.059 (.241)	−.069 (.117)
Penalty	−.012 (.032)	−.025 (.046)	−.046 (.048)	−.030 (.008)	−.020 (.022)	−.043 (.018)	−.032 (.009)	−.020 (.013)	−.042 (.013)
Value	−.015** (.065)	−.011 (.124)	−.021** (.081)	−.012*** (.019)	−.014 (.054)	−.027* (.026)	−.012***(.018)	−.014 (.039)	−.025** (.019)

Note: Numbers in parentheses are asymptotic standard errors. The asterisks *, **, and *** indicate statistical significance at .1, .05 and .01, respectively.

more than males. For example, a 100% increase in *RIAA-Threat* (e.g., from 5% to 10%) reduces the extent file-sharing by 6% among males and 7% among females. A 300% increase in *Value* (e.g., from US$ .25 to the industry average of US$ 1.00 per song) reduces the extent of file-sharing by 4% among males and 8% among females. Thus, students respond to both value and risk factors, which support the music industry's efforts to promote high-quality fee-based music services in addition to enforcement.

Interestingly, significant differences in behavior between male and female students are also highlighted by λ, the inverse Mill's ratio estimate. In general, λ captures the relationship between unmeasured factors affecting the likelihood of file-sharing and unmeasured factors explaining the proportion of music collections acquired via file-sharing. Hence the positive coefficient estimate of λ in the male equations suggests that male students who are more likely to engage in file-sharing are also more likely to possess a larger proportion of total music acquired via file-sharing. This contrasts with the negative coefficients on λ in the female equations, which suggest that female students who participate in file-sharing are not as likely to have as large of a proportion of total music acquired via file-sharing.

6. Conclusion

This paper analyzes the role that gender plays on the likelihood and extent of peer-to-peer music file-sharing among university students, a key issue in the debate on copyright protection. Our results show that male students, on average, are more likely to use file-sharing to acquire music and to have a higher percentage of their total music collection consisting of music acquired via file-sharing. This result is influenced by the finding that female students possess relatively higher risk perceptions and willingness-to-pay for legal alternatives compared with males; and secondly, while female students tend to respond to enforcement actions and economic incentives with greater consistency, male students exhibit more heterogeneity in their actions.

Hence, policy implications stemming from these results for reducing music piracy on the university campus (and in general) suggests that the music industry should (i) continue its usage of enforcement actions (either by actual actions and/or publicized threats) as students of both genders are found to respond to such risk perceptions, (ii) increase its support in the expansion of fee-based music subscriptions and download services by helping firms and artists resolve issues that inhibit their growth, and (iii) take a more active role in technological protection (i.e., Digital Rights Management) that increases the cost of music file-sharing. Only when the perceived explicit and implicit costs of file-sharing outweigh the benefits will this avenue of music piracy be contained.

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Appendix A. Variable names and description

Variables	Description
Dependent variables	
Music	=1 if the student currently engages in file-sharing
Pmusic	Percentage (0–100) of total music collection consisting of music downloads acquired via file-sharing
Independent variables	
Risk variables	
RIAA-Threat	Perceived probability (0–100) of an individual engaging in file-sharing to be sued by the RIAA for copyright violation
Log(*Penalty*)	The logged amount of the perceived fine (in US$) to be paid if found guilty of a copyright violation as a result of file-sharing
Exam-Honesty	Measures whether a student typically considers cheating (in any form) when taking exams. Variable ranges from 0 to 4, where 4 = Never, 3 = Occasionally, 2 = Usually, 1 = Often, and 0 = Always

Appendix A (*Continued*)

Variables	Description
Economic variables	
Value	Amount (in US$) that the student is willing to pay for a legally downloaded song, on average
Work	=1 if the student works at least part-time
Information variables	
Campus	=1 if FAU student and = 0 if UNLV or New Mexico State student
Antipiracy	=1 if a student is familiar with his or her university's anti-piracy awareness campaign
Campus × *Antipiracy*	Interaction term between the variables *Campus* and *Antipiracy*
Innate variables	
Age	Age of student (in years)
Male	=1 if Male
Computer	=1 if Computer Science (or related) major
Business	=1 if Business/Economics (or related) major
Science	=1 if Science/Engineering/Math (or related) major
Class	Ranges from 1 (First-year) to 5 (Graduate student)
White	=1 if White/Caucasian
Asian	=1 if Asian/Asian-American
Fairness	=1 if the student believes the prosecution of individuals for music file-sharing is a fair policy

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