ESTIMATING THE WILLINGNESS TO PAY FOR DIGITAL MUSIC

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The general consensus among the copyright piracy literature is that economic incentives and enforcement are both effective strategies that complement one another in reducing the occurrence of piracy. Yet, the key factor underlying these strategies is the ability of the media industries to influence an individual's willingness to pay (WTP) for legal purchases when illegal versions exist. This article estimates the effects of factors influencing WTP for digital music downloads. Our results show that while income and risk perceptions play a dominant role in determining WTP, ethics are also important in influencing WTP. Our results are consistent with the growing consumer acceptance of fee-based music services that can exist alongside peer-to-peer file sharing as well as serve as a viable substitute. (*JEL* O34, K42, D12)

I. INTRODUCTION

For much of their existence, the media industries (in particular, the software, music, and film industries) have strived to find solutions to combat copyright piracy. Using most recent data available, losses from copyright piracy are estimated to exceed US$70 billion annually, with software piracy accounting for $48 billion (Business Software Alliance (BSA), 2007), music piracy for $4.5 billion (International Federation of the Phonographic Industry (IFPI), 2006), and movie piracy for $18.2 billion (Movie Picture Association of America (MPAA), 2006) per year. As demand for technology goods expands in developing and emerging countries, copyright piracy will continue to persist if effective strategies are not implemented to address the problem.

While there is general consensus in the literature that the use of economic incentives (carrots) are effective in reducing copyright piracy, the media industries still extensively use enforcement actions (sticks), or the threat of such actions (Bhattacharjee et al., 2006). Such actions include litigation against users of peer-to-peer technologies, premovie and concert warnings regarding illegal recordings, television commercials illustrating the harm of piracy, and increased government action against countries that allow mass-duplicated media files to be sold in black markets and on the Internet. Meanwhile, strategies to increase legal consumption have sprouted, including versioning, bundling, and sublicensing of software, Internet sales of digital music (e.g., iTunes), and simpler ways to rent movies via the Internet (e.g., Netflix).

This article presents a conceptual model of identifying how economic and enforcement strategies affect the extent to which individuals participate in the legal and illegal markets for copyright goods. An empirical study by Zentner (2006) found that music file sharing (illegal market participation) led to a 30% reduction in the likelihood of music purchases (legal market participation). A subsequent study by Oberholzer-Gee and Strumpf (2007) found no effect of file sharing on music sales, though Liebowitz (2007) presented an extensive critique against their conclusions. While reducing participation in the illegal market can decrease piracy, revenues will not increase unless consumption in the legal market, which we associate with an increase in the willingness to pay (WTP), subsequently increases. Because of differences in the legal and illegal markets for copyright goods, we must take into account both WTP

ABBREVIATION

WTP: Willingness to Pay

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and the corresponding value of acquiring copyright goods in the illegal market, which is influenced by nonpecuniary factors such as risk, quality issues, ethics, and time. These factors play an important role in determining which market individuals ultimately choose.

Following the conceptual model, we present an empirical analysis to estimate the determinants of WTP and their marginal effects using survey data focusing on music consumption among university students. Our findings are straightforward but important: we find that income and risk perceptions play a dominant role in influencing WTP. We also find that ethics strongly and positively influence WTP, which is consistent with the growing acceptance of fee-based music (e.g., iTunes). With significantly expanding song catalogs, online music stores have become a viable substitute to peer-to-peer file sharing. These findings build upon those in the existing literature by moving beyond the factors that solely influence piracy and focusing on the effect of sustaining the market for legally purchased music. The remainder of the article is as follows: Section II provides a literature background that leads to the conceptual model in Section III. Section IV describes the survey data. Section V presents the empirical framework, while Section VI presents the results and marginal effects on WTP. Finally, Section VII concludes.

II. BACKGROUND

There is a substantial literature focusing on the determinants of copyright piracy in the software and music industries (Varian, 2005). We focus on end-user piracy, where individuals acquire goods for their own use rather than for resale.[1] Cheng, Sims, and Teegen (1997) and Cohen and Cornwell (1989) were among the first to tie piracy to demographic factors, risk preferences, peer effects, income, and knowledge of copyright law. Proposed solutions to piracy have emphasized the importance of enforcement (e.g., threats of litigation and increased awareness of penalties for piracy) as well as economic incentives (Conner and Rumelt, 1991; Varian, 2005).

1. While the issue of piracy for profit addresses similar concerns as end-user piracy, we focus on the latter. However, a few studies have addressed the issue of piracy for profit (e.g., Banerjee, 2003; Slive and Bernhardt, 1998).

The role of enforcement has been debated as some studies show enforcement measures to reduce piracy, while other studies do not. Yoon (2002) showed that enforcement creates a private cost to consumers that deters piracy, and Stolpe (2000) argued that enforcement can be effective if firms can afford such measures. At a national level, Marron and Steel (2000) and Gopal and Sanders (1998) showed that countries with stronger legal systems exhibited lower piracy rates. On the other hand, Ben-Shahar and Jacob (2004) argued that selectively reducing copyright enforcement might increase a firm's market share in legal sales. This finding supports Shy and Thisse (1999), Gayer and Shy (2003), and Peitz (2004), who argued that enforcement reduces the network externalities that drive legal market demand.

To study the role of risk factors, one must start with Becker (1968), who first internalized risk perceptions into economic functions such that it may be rational in certain cases to engage in dangerous or illegal activities that carry risk. Subsequent work has shown risk perceptions to be influenced by peer effects, when groups of individuals engaging in risky behavior provide an illusion of lower risk. Examples include speeding, recreational drug use, and music file sharing. Furthermore, cost-benefit analysis suggests that individuals weigh the benefits of copyright compliance (e.g., higher quality, user manuals, and customer support) against its costs (increased probability of apprehension along with potential viruses and spyware).

With respect to how individuals respond to economic factors, prior research has studied the role that income has on piracy. For example, Marron and Steel (2000) and Silva and Ramello (2000) showed a clear negative relationship between per capita income and national piracy rates. On a different note, Shy (2001) and King and Lampe (2003) estimated the extent by which WTP for copyright goods is enhanced by piracy as a result of network externalities. The general finding of these studies is that piracy can positively influence WTP. Yet, it is commonly assumed that higher WTP will ultimately lower piracy. This article contributes to the ongoing debate by studying the factors influencing WTP and its role in reducing the extent of copyright piracy.

We investigate how various enforcement and economic factors influence WTP using

university students as a focal group. The use of university students is by no means novel. In fact, studies by Cheng, Sims, and Teegen (1997), Gopal and Sanders (1998), Chiang and Assane (2007), and others used survey data on university students due to the accessibility of that data and to the relatively controlled environment compared to the more heterogeneous general population or alternative subsets such as teens. University students represent a market segment that exhibits technological savvy, high demand for copyright goods, and strong peer effects due to frequent interactions with one another, and has led to a survey on intellectual property law in relation to universities by Byman and Geller (2001).

III. CONCEPTUAL MODEL

We begin by introducing a legal market for copyright goods that includes store purchases, fee-based Internet downloads, and legal transfers (e.g., trials and gifts), and an illegal market that includes all other methods used to acquire copyright goods. To reduce or eliminate piracy, direct actions targeting the illegal market and indirect actions to increase participation in the legal market are both effective as long as the two markets are viewed as substitutes to one another. For each market, there exists a value and a price of participation. We assume individuals maximize consumer surplus, the difference between value and price in each market. Thus, if V_L and V_I represent the values and P_L and P_I represent prices in the legal and illegal markets, respectively, an individual would choose the illegal market if $(V_I - P_I) > (V_L - P_L)$. What remains is how V and P are measured in each market.

In the legal market, value is measured by an individual's WTP for copyright goods, which is influenced by factors such as income, product preference, product quality, and availability of substitutes (i.e., in the illegal market). In the illegal market, value is measured by similar factors as in the legal market, though WTP is used loosely as goods are not purchased in the same way as in the legal market.[2] Prices of copyright goods differ between the legal and illegal markets. In the legal market, price (P_L) is the market price for the good along with transactions costs (e.g., time and transportation). In the illegal market, where goods are copied without direct monetary payment, price (P_I) includes nonpecuniary factors. In particular, P_I includes the expected cost of avoiding enforcement, the cost of eliminating potential viruses and spyware, the expected cost of potential prosecution, and transactions costs (e.g., time) of acquiring the product.

Figure 1 illustrates the two markets, legal and illegal, as defined in the discussion above. While the good is the same in each market, there are differences (e.g., in quality) between the goods that make them substitutes, but not perfect substitutes. In each market, the willingness to participate in that market is represented by V_i, $i = \{L, I\}$. At a price of P_L, quantity Q_L is purchased in the legal market. In Figure 1B, consumers participate in the illegal market where V_I accounts for the willingness to sacrifice quality and/or customer support by acquiring an illegal copy. In sum, consumers have two different reservation prices, V_L for legal copies and V_I for illegal copies, and face two different prices, the (legal) market price P_L and the (piracy) acquisition "price" P_I.

Assuming consumers choose among a legally purchased good, an acquired (illegal) copy, or no purchase at all, piracy occurs when an individual is unwilling to pay for a good but is willing to acquire a pirated version of it. Thus, the greater is V_I (Figure 1B), the more likely one would resort to piracy. The media industry can discourage piracy by increasing the price (e.g., P_I to P_I') in the illegal market by increasing the perception of risk, the penalty when caught, or reducing the convenience factor (or a combination of these measures).

Given that an illegal copy is a substitute to a legally purchased good, P_I affects V_L through the cross elasticity of demand, just as P_L affects V_I. For example, if P_I increases to P_I' (Figure 1B), Q_I falls to Q_I'; subsequently, V_L increases to V_L' (in Figure 1A), and Q_L increases to Q_L'. The ideal outcome occurs when $P_L = P_I''$, where there is no incentive to acquire goods outside of the legal market.[3] Yet, the

2. Boldrin and Levine (2002) suggest that intellectual property laws legalize the monopoly status of the copyright owner and turn legal copies into a different good, which is a substitute of, but not identical to, illegal copies acquired via piracy.

3. At the other extreme, if $P_I = 0$, implying that there are 0 risks or costs to participating in the illegal market, we would expect higher levels of piracy. However, this does not imply that the legal market would never be used because such use depends on whether consumers view illegal copies to be perfect substitutes of legal copies.

FIGURE 1
(a) Legal market; (b) Illegal market

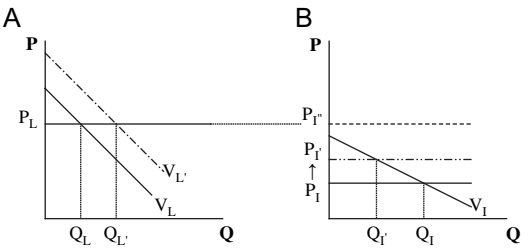
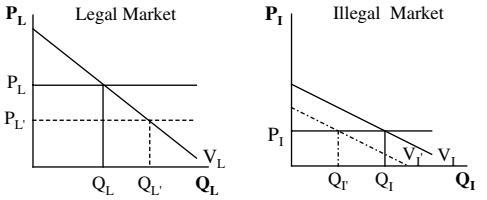


FIGURE 2
The Effect of Lowering (Legal) Market Prices



overarching hypothesis is that while enforcement can increase P_I and hence increase V_L in the legal market, economic solutions that reduce market price P_L will have a complementary role in reducing piracy by increasing the consumer surplus of legal purchases, while decreasing V_I in the illegal market. In Figure 2, when the market price P_L falls to $P_L^{'}$, V_I decreases to $V_I^{'}$ in the illegal market. Hence, the quantity of legal purchases increases ($Q_L \rightarrow Q_L^{'}$) while piracy decreases ($Q_I \rightarrow Q_I^{'}$), resulting in the same qualitative outcome as pursuing enforcement strategies. The difference, then, lies in the extent to which consumers move from one market to another when the attractiveness of the original market changes. This again depends on the cross-elasticity of demand between legal and illegal goods.

Lastly, if V_L is less than P_L in the legal markets (negative consumer surplus), any consumption must be via piracy as long as $V_I > P_I$ in the illegal market, that is, that the consumer actually desires the product enough to compensate for the risks.

IV. DATA

The data used in the empirical section consist of a large sample of randomly selected students from a diverse set of universities obtained from Chiang and Assane (2007). While the survey data included extensive information on consumption patterns for both software and music, we focus solely on the latter in this article. The survey assesses a student's knowledge and perceptions of copyright law including views on recent enforcement actions, along with questions pertaining to peer effects, ethics, and demographic characteristics. The sample includes students of all ages, class standing, and academic majors to ensure adequate representation of student demographics. While the advantages of using individual behavioral data are substantial, questions must be designed in a manner that effectively elicits truthful responses (e.g., avoiding the use of terms with negative connotations such as "piracy").[4] Moreover, a potential limitation of our survey data is that it relies exclusively on university students and is not broad enough to include other related market segments, such as high school students, those who do not pursue a university education, and recent university graduates. Nonetheless, we proceed by assuming that each omitted group exhibits similar consumption patterns for digital music as university students.

Summary data from the survey indicated that 58% of university students admitted to owning unlicensed music, with the average music collection consisting 40% of unlicensed copies. In addition, the survey asked questions pertaining to willingness to buy various forms of digital music (e.g., mean WTP for a single digital music download = \$0.66) along with risk perceptions, specifically, the perceived chance of being caught for illegal music downloads (mean = 13%) and the perceived severity of punishment if caught (mean = \$2,912).[5] Respondents also were asked whether they believed piracy was unfair to different parties within the industry, including artists, distributors, and stores, along with whether Internet sites that promote the illegal distribution of music should be shut down. Summary statistics for all variables used in the present study are shown in Table 1.

4. Detailed information on the survey methodology can be found in Chiang and Assane (2007).

5. While prison sentences are also a possible form of penalty for music piracy (by current copyright law), such punishments are rarely used in practice; therefore, we only estimate the perceived extent of fines.

TABLE 1
Variable Names, Definitions, and Descriptive Statistics

Variables	Descriptions	Means (SD)
Dependent variables		
WTP	Willingness to pay for a digital music single	0.662 (0.978)
Key variables		
Income	1 if work part-time and = 2 if work full-time	1.02 (0.764)
Caught	Perceived chance (%) of an individual engaging in music piracy to be prosecuted for a copyright violation	13.27 (17.87)
Fine	Perceived fine to be paid if found guilty of a music copyright violation (in dollars)	2,912.28 (13,399.9)
Demographic variables		
Male	1 if male	0.506 (0.500)
Age	Age (in years)	22.23 (4.62)
White	1 if white or Caucasian	0.506 (0.500)
Asian	1 if Asian or Asian-American	0.138 (0.346)
Peer variables		
Tech	1 if business, computer, science, math, or engineering academic major	0.645 (0.479)
Ethics variables		
Fairness	1 if piracy is believed to be unfair to copyright owners	0.499 (0.500)
Shut	1 if music file-sharing services should be shut down	0.247 (0.432)

A complete behavioral model of how students form and react to risk perceptions and how they respond to economic incentives is complex but can be explained by a few categories of factors measured by the data. First, there are factors directly influencing WTP, including income and perceptions of risk that derive from the estimated probability of being caught and the perceived penalties if caught. Second, there are factors indirectly influencing WTP, including peer effects reinforced through class standing, academic major, workplace, or living arrangement, and ethics variables influenced by one's upbringing or societal norms. Lastly, there are control variables represented by demographic factors such as age, ethnicity, and gender.

V. EMPIRICAL FRAMEWORK

The model of the WTP for digital music downloads is specified as:

$$\text{WTP} = \boldsymbol{X}'\beta + \varepsilon \tag{1}$$

where $\boldsymbol{X}$ is the vector of explanatory variables, β is the vector of unknown coefficients, and ε is a random error term. The vector $\boldsymbol{X}$ comprises a group of variables that are identified as key to WTP and a group of variables treated as controls. The effects of these two groups of variables on WTP are briefly analyzed.

A. The Regressors

The key variables consist of economic and noneconomic factors that influence the WTP for digital music. The economic factor is measured by *INCOME*, which is commonly used in the piracy literature to provide insight into the ability or WTP for copyright goods, with the presumption that a higher level of income is associated with less piracy. In relation to university students, however, income and financial support are typically derived from multiple sources including scholarships, financial aid, and/or parental support. To capture the effect we are interested in, we needed to focus on students' disposable or discretionary income. Since many students work part-time or full-time to provide their disposable incomes (in addition to school expenses for some), in our model the variable *INCOME* is proxied by a variable indicating the extent to which a student works (full-time, part-time, or not at all) as a loose approximation of disposable income that influences the WTP for copyright goods.[6]

WTP also can be influenced by noneconomic variables pertaining to risk behavior. For example, individuals who are more risk

6. The survey did not ask for an estimate of monthly disposable income, which would be a more direct way of measuring the variable *INCOME*. Due to this limitation, we used the extent to which a student works as a proxy for disposable income.

averse by nature or those who are more likely to be influenced by risk warnings are more likely to respond to risk by reducing their likelihood or extent of participating in the illegal market. We assess risk using two variables, *CAUGHT* and *PENALTY*. The variable *CAUGHT* is measured on a scale from 0 to 100 corresponding to the perceived likelihood of an individual who acquires music illegally of being caught and prosecuted. The variable *PENALTY* measures the perceived amount of fines (in dollars) that is expected to be levied if an individual is prosecuted for music piracy. Higher values of *CAUGHT* and *PENALTY* are indicative of risk-averse behavior that leads individuals away from piracy and increases WTP. Thus, the coefficients of both *CAUGHT* and *PENALTY* are expected to be positive. The magnitudes of these coefficients reflect the relative sensitivity of WTP to changes in certainty of apprehension and the severity of punishment. If, for example, the coefficient on *CAUGHT* is greater in absolute terms than that for *PENALTY*, then certainty of apprehension has a greater influence on WTP than the perceived severity of punishment.

Next, we turn to the control variables captured by demographic factors, peer effects, and estimates of ethics. Demographic variables include age (*AGE*), gender (*MALE*), and ethnicity (*WHITE* and *ASIAN*). These innate factors are not influenced by one's environment, though they carry important implications for piracy. A number of studies have emphasized demographic factors in relation to copyright piracy. Nyaw and Ng (1994) found that older individuals are less tolerant of unethical behavior than younger individuals, while Wood and Glass (1995) and Sims, Cheng, and Teegen (1996) found that males are more likely than females to engage in piracy. We do not presuppose the effect of race or ethnicity. Peer effects variables are those that are largely influenced by one's environment, and include major area of study. Because piracy affects all academic majors, we create a binary variable (*TECH*) that takes a value of 1 if a student is a business, computer-related, science, math, or engineering major, and 0 for all other majors. The intuition behind this variable is that students who are more technically minded may find new technologies to acquire music easier to pursue, which might lead to a lower WTP for purchased music. Lastly, we include two ethics variables, *FAIRNESS* and *SHUT,* to measure whether a student believes piracy is unfair to copyright owners (*FAIRNESS* = 1) and whether websites facilitating copyright piracy should be shut down (*SHUT* = 1). We expect *FAIRNESS* and *SHUT* to be positively associated with WTP.

B. Econometric Specification

The dependent variable WTP contains a large number of observations with a value of 0 that would bias the use of an ordinary least squares estimator. A two-equation model is appropriately used where the first equation reflects the existence of a reported WTP and the second equation accounts for the extent of WTP. Accordingly, we have:

$$d^{*} = X^{'}\alpha + u \tag{2}$$

$$\text{WTP} = \boldsymbol{X}^{'}\beta + \varepsilon \tag{3}$$

where WTP = 0 if $d^{*} = 0$ and WTP = WTP* if $d^{*} = 1$ and $E[\text{WTP} \mid \text{WTP} > 0] = [X'\beta + \sigma\lambda(X'\beta/\sigma)]$.

The value of d^{*} is observed and can be either 0 or 1. The selection Equation (2) is a probit model and the main Equation (3) is a regression model on WTP being positive.[7] The term $\lambda(X'\beta/\sigma)] = \lambda(z) = [\phi(z)/\Phi(z)]$ is the inverse Mills ratio, where $\phi(z)$ and $\Phi(z)$ are the standard normal density function and the normal cumulative density function, respectively. It is further assumed that the error terms u and ε follow a bivariate normal distribution.

$$\begin{bmatrix} u \\ \in \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_u^2 & \rho\sigma \\ \rho\sigma & 1 \end{bmatrix} \right)$$

Equations 2 and 3 are estimated following the two-step Heckman (1976, 1979) estimator and the computation of the marginal effects takes into consideration that a change in the explanatory variable affects both the binary decision to purchase music and the extent of WTP (see, e.g., Johnson and Kotz, 1994; Min and Kim, 2003). The marginal effect of the binary decision is:

7. This specification follows directly from Heckman (1976, 1979) and Maddala (1983).

$$\frac{\partial P[d=1]}{\partial X} = \frac{\partial \Phi(X'\alpha)}{\partial X} = \alpha'\phi(X'\alpha)$$

and the marginal effect for WTP > 0 is

$$\frac{\partial P[\text{WTP}/d=1]}{\partial X} = \beta - \rho\sigma\alpha\frac{\phi(X'\alpha)}{\Phi(X'\alpha)}\left[X'\alpha + \frac{\phi(X'\alpha)}{\Phi(X'\alpha)}\right].$$

The Heckman maximum likelihood estimates for the main and selection equations along with the marginal effects are discussed in the next section. It is likely that ***X***, the vector of regressors in Equations 1 and 2, may contain the same information because the factors that explain the decision to pay for music are the same factors that would contribute to the magnitude of WTP. The lack of valid exclusion restrictions in estimating Equation 1 is a source of identification problem that can lead to high collinearity between λ, the inverse Mills ratio, and the regressors (see Vella, 1998). To mitigate this problem, we use the ethics variables *FAIRNESS* and *SHUT* as entering the selection equation but not the main equation. Students who view piracy as an unfair practice against the music industry or those who support the closure of websites that facilitate music piracy are less likely to engage in such activity and hence will be more willing to pay for their substitutes in the legal market.

VI. RESULTS

Empirical results of the determinants of WTP are presented in Table 2 along with the estimation of the marginal effects of the regressors on WTP for music. We then show in Table 3 that our findings are robust to alternative methods of estimation.

A. Determinants of WTP

In columns 1 and 2 of Table 2, we report the Heckman maximum likelihood estimates of the main and selection equations, respectively. The Wald test and the log-likelihood ratio test are very large and significant, indicating that the right-hand side variables as a whole are important in explaining *WTP*. Overall, the results of the two equations are

TABLE 2
Coefficient Estimates and Marginal Effects in the Heckman Models

	Main Equation	Selection Equation	Marginal Effect (Decision)	Marginal Effect (Amount)
Key variables				
Income	0.109*** (0.027)	0.112*** (0.042)	0.211*** (0.049)	0.191*** (0.060)
Caught	0.007*** (0.002)	0.007*** (0.002)	0.010*** (0.004)	0.021*** (0.009)
Log(Fine)	0.005*** (0.002)	0.009*** (0.003)	0.003*** (0.001)	0.017*** (0.009)
Demographic variables				
Male	−0.206*** (0.086)	−0.217*** (0.089)	−0.116*** (0.008)	−0.261*** (0.103)
Age	0.020** (0.007)	0.026** (0.010)	0.014** (0.009)	0.019** (0.003)
White	−0.189** (0.080)	−0.195** (0.087)	−0.009** (0.004)	−0.204* (0.101)
Asian	−0.022 (0.137)	−0.032 (0.165)	−0.008 (0.027)	−0.101 (0.129)
Peer variables				
Tech	−0.114 (0.091)	−0.118 (0.096)	−0.261 (0.609)	−0.109 (0.304)
Ethics variables				
Fairness		0.009** (0.004)	0.006* (0.004)	0.046*** (0.016)
Shut		0.005* (0.003)	0.005* (0.003)	0.010** (0.009)
Inverse mills ratio (λ)	−0.465 (0.634)			
Intercept	−0.134** (0.067)	−0.209** (0.105)		
Wald test	28.73*** (0.0004)			
LR test	51.93*** (0.0002)			
N	531	531		

Notes: Numbers in parentheses are asymptotic standard deviations.
*, **, ***Statistical significance at .10, .05, and .01, respectively.

TABLE 3
Quantile Regression Estimates Using Key Variables (Dependent Variable Is WTP)

	Key Variables		
Quantiles	**Income**	**Caught**	**Log (Fine)**
25th	0.0439*** (0.013)	0.0014*** (0.001)	0.0046*** (0.002)
50th	0.0771*** (0.024)	0.0024*** (0.001)	0.0017** (0.001)
75th	0.0798*** (0.023)	0.0032*** (0.0001)	0.0013** (0.001)

Note: Numbers in parentheses are asymptotic standard deviations.
** and ***Statistical significance at .05 and .01, respectively.

similar in terms of signs, magnitude of coefficients, and statistical significance. However, the negative but insignificant λ (inverse Mills ratio) may indicate lack of correlation between the unobservable factors of the selection and main equations. Hence, this may indicate that the unobserved factors that influence the participation in WTP are not significantly correlated with those that affect the extent of WTP.

Consistent with existing empirical literature, we find our key variables *INCOME* (economic factor) and *CAUGHT* and *PENALTY* (risk factors) contribute significantly and positively to influencing students' WTP for digital music downloads. Moreover, with respect to demographic variables, our findings are mostly in line with previous results. Male students are significantly less likely to be willing to pay for music relative to female students. Likewise, older students are significantly more willing to pay for music, a finding that may reflect a growing maturity level as students complete their studies.

Next, we turn to the ethnicity variables, where *WHITE* and *ASIAN* exhibit negative correlations with WTP, with the former exhibiting a significant coefficient. These results imply that white/Caucasian and Asian/Asian-American students are more likely to acquire music using piracy methods, with the former exhibiting a stronger tendency. This finding is contrary to that of a study of software piracy by Swinyard, Rinne, and Kau (1990), who found Asian students to pirate software significantly more than the average student. However, while software consumption tends to be higher among those with careers that require greater software usage (and the ethnicities that represent these careers in higher proportions), music consumption arguably crosses all ethnic boundaries and career paths. This may explain why the variable *TECH*, which captures academic majors that are more technological in nature, is insignificantly correlated with WTP (though the sign of the coefficient is negative as expected).

Next, we report the results from our ethics variables, *FAIRNESS* and *SHUT*, which appear only in the selection equation (Equation 2). The coefficients for both variables are positive and significant at the 5% and 10% levels, respectively. These results are consistent with expectations; that is, aside from the key income and risk variables, ethical considerations also are a contributing factor in a student's decision to purchase music rather than using file-sharing methods or forgoing consumption.

B. Marginal Effects of Key Regressors on WTP

Columns 3 and 4 of Table 2 report the marginal effects of the key variables and the control variables for the selection equation and the extent of WTP equation, respectively. Our findings are consistent with patterns observed in columns 1 and 2 of Table 2 and show a few noteworthy features. First, the key economic variable *INCOME* and risk variables *CAUGHT* and *PENALTY* exert a significantly positive effect on WTP though the coefficients tend be small suggesting low responsiveness to WTP. Second, the coefficient on *INCOME* is relatively stronger than those of the enforcement variables *CAUGHT* and *PENALTY*. Students are more influenced in their WTP with respect to their levels of disposable income than the likelihood of being caught and perceived penalty. Specifically, a 1% increase in income induces a 0.21% and 0.19% increase in the participation and extent of WTP, respectively. Third, the marginal effects of demographic variables on WTP are also in line with the rest of the findings. The coefficient on *MALE* has the strongest negative impact on WTP, followed by the

coefficient on *WHITE*. The coefficients on *ASIAN* and *TECH* are also negative but insignificant. Finally, the ethics variables *FAIRNESS* and *SHUT* show a positive and significant marginal effect on WTP.

The findings in our model are in line with current trends in music consumption. Over the past few years, online digital music services have matched peer-to-peer file-sharing services in terms of the size of their music catalogs, while surpassing them in terms of quality and convenience. This is consistent with the growing popularity of fee-based digital music, of which sales are predicted to grow 23% a year through 2012 (Netherby, 2008). Our findings contend that income factors, enforcement strategies, and ethics considerations all have a stake in improving participation in the legal market. This shift in music consumption toward fee-based digital music may exist alongside peer-to-peer downloads (i.e., having a larger music collection consisting of purchased and non-purchased music) or as a substitute to peer-to-peer downloads.

C. Robustness and Alternative Specification

Summary descriptive results in Table 1 along with kernel density estimates shown in Figures 3 and 4 indicate that the variables *CAUGHT* and *FINE* are skewed, which could bias the regression results in Table 2. Accordingly, quantile regression can be a useful estimation tool in that the derived estimates can be a check for the robustness of our results in Table 2 and can provide marginal effects of the covariates at different points of the dependent variable *WTP*.

In Table 3, we summarize selected quantile regression results based on the main equation variables in Table 2 for the key variables *INCOME*, *CAUGHT*, and Log(*FINE*) with respect to the 25th, 50th, and 75th quantiles. The findings are consistent with their counterparts in Table 2. The coefficients are positive as expected and are statistically significant at least at the 5% level.

VII. CONCLUSION

While much of the debate on copyright piracy has focused on what determines the likelihood or extent of piracy, no existing research has focused on the factors influencing the underlying WTP for legal purchases when illegal versions exist. Reducing piracy entails reducing the net value of participating in the illegal market or increasing the net value of participating in the legal market, or both. Economic incentives and enforcement actions both contribute to such outcomes though it is unclear to what extent such strategies influence the willingness of individuals to pay for goods in the legal market.

This article addresses the important issue of what influences a consumer's WTP for digital music when illegal alternatives exist. Our model estimates the effects of key income and risk variables and their marginal effects on WTP for legal digital music downloads in the United States among university students. Our findings show that WTP is largely influenced by income and risk perceptions, as expected. Specifically, when students have larger levels of disposable

FIGURE 3
Perceived Chance of Being Caught for Copyright Violation

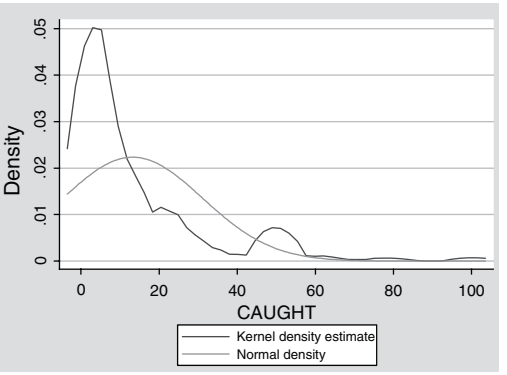
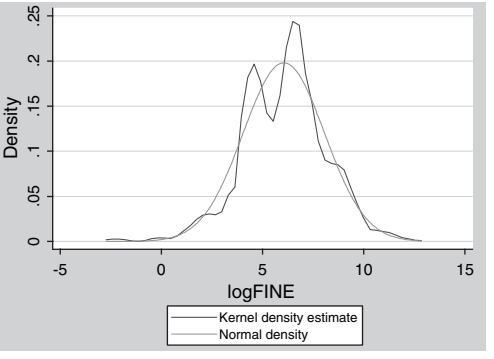


FIGURE 4
Perceived log(FINE) If Found Guilty



income or greater perceptions of the risks of engaging in music piracy, the WTP to pay for legal digital music rises. Thus, government policies and corporate strategies aimed at increasing the value of legal music downloads (by lowering prices or increasing their perceived value) and increasing perceived risk of piracy (by making illegal downloads less attractive) can have a complementary and significant impact on reducing music piracy.

In addition to income and risk factors, the findings on demographic factors confirm what is already implied in the literature. Our main new finding is that ethics variables also play an important role in increasing the WTP for digital music. In particular, campaigns to increase awareness of the potential harmful effects of all forms of copyright piracy are shown to be effective in influencing the decisions of students when choosing the means to acquire music. This, along with the increasing convenience and song selection of online music stores, reflects the sharp growth in digital music sales in recent years as individuals substitute legal digital music downloads for illegal versions obtained primarily through file sharing. Though illegal markets for music still widely abound, the future of copyright appears to be a little more promising with the success of fee-based digital music and the willingness of students and the population in general to pay for it.

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