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Did the RIAA's Prosecution of Music Piracy Impact Music Sales?

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Abstract Between 2004 and 2009 it is estimated that over 30 billion songs were downloaded illegally on different peer-to-peer sharing networks according to the Recording Industry Association of America (RIAA). In an attempt to stop this during the late 1990's and early 2000s the RIAA and other music labels engaged in a very public and vigorous campaign of prosecution of firms, such as Napster and Limewire, for copyright violations in order to reduce piracy. Due to the public backlash, in late 2008 the RIAA announced that they would begin to stop litigation on a grand scale. This paper examines the impact that this model of piracy prosecution had on music sales. We find evidence that the RIAA's model of litigation actually backfired and led to decreased legitimate album sales. Additionally, we find that variation in per capita seasonally adjusted album sales cannot be explained by the existence of both Limewire and Napster file sharing services.

Introduction

Since the advent of the internet, there have been substantial changes within the music industry. In 1999, the industry collected $28.6 billion in global revenue ($40.9 billion in

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2014 dollars), while in 2015 the music industry saw less than $15 billion in global revenue. Music industry revenue has fallen by nearly two thirds in the last 15 years. Furthermore, according to the Recording Industry Association of America (RIAA), over 942 million physical compact discs were sold in 2000. At the end of 2015, only 125 million had been sold, a decline of 87%. This decline in sales for physical albums has partly been replaced by the sales of digital songs and albums. In 2004, 5.2 million albums had been sold digitally. This had increased to over 103 million digital albums in 2015. However, this increase in digital sales has not been strong enough to reverse the overall decline in music sales.

According to record companies and different music trade associations, piracy is one of the main culprits for the large decline in music sales. Between 2004 and 2009 it is estimated that over 30 billion songs were downloaded illegally on different peer-to-peer (P2P) sharing networks (RIAA 2015). The RIAA claims of over 30 billion songs illegally downloaded from P2P sharing networks amounts to approximately 2.5 billion albums. However since music is an experienced good, when consumers hear music this may prompt them to purchase music in either a physical or digital formats.

Oberholzer-Gee and Strumpf (2007) offer a contrasting view and find that piracy has an insignificant effect on music sales. Peitz and Waelbroeck (2004) estimate that piracy is only responsible for 25% of the decline in music sales. Therefore, it is not clear if or to what extent, piracy is responsible for the sales decline in the music industry.

In an attempt to slow the tide of piracy, the RIAA and other music labels engaged in a very public and vigorous campaign of prosecution of firms, such as Napster, for copyright violations during the early- to mid-2000s. This prosecution model was soon extended to over 35,000 different individuals. This campaign continued until late-2008 when the RIAA announced they would stop litigation on a grand scale and only focus on the most egregious piracy violators. This paper examines the impact that this model of piracy prosecution had on music sales and tests whether P2P networks (e.g., Limewire and Napster) statistically impacted the amount of albums sold.

This paper contributes to the music piracy literature in two unique ways. First, it examines the effect of P2P music sharing sites on the quantity of albums sold using time series analysis. Most of the existing literature[1] does not use time series data because the most accurate data only exist in proprietary form. Here we collect data on the quantity of albums sold from Nielsen Soundscan (2015) from 1994 to 2015. Using these data, this paper jointly examines the effect of piracy and legal action taken by the RIAA against individuals that illegally downloaded music. Second, this paper also analyzes the impact of time period selection on the music piracy and litigation hypothesis. Many of the studies discussed above use data that ended in the early- to mid-2000s which may have impacted the conclusions that these studies reached.

There are a few conclusions we can draw from this study. First, there is no structural break in the percentage change of per capita seasonally adjusted albums sold that

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[1] See Chiang and Assane (2009), Zentner (2006), Rob and Waldfogel (2006), and Stevans and Sessions (2005) for more details on the empirical studies of piracy and its effects.

corresponds to the period of operations for both Napster and Limewire P2P servers. This result is robust over many specifications of the model and all subsample estimations undertaken. Second, aggregate album sales declined with news media announcements of RIAA litigation against file sharers. The level of litigation (i.e., number of actual lawsuits) does not appear to matter for this effect. This result along with the previous conclusion implies that the music purchasing public perceived the RIAA's litigation strategy as heavy handed and subsequently purchased less music. This latter result is consistent with Bhattacharjee et al. (2006). Finally, news about music piracy did not have a statistical impact on variation in album sales.

Existing Literature

Piracy and Music Sales

There is a growing body of literature that suggests that piracy impacts music sales. This literature largely falls into two categories. The first category is comprised of willingness-to-pay (WTP) studies. Chiang and Assane (2009) find that university students WTP for legal music given the availability of a "free" illegal alternative is largely influenced by income and risk perceptions. Zentner (2006), using European consumer data from the Forrester Research mail survey, measures the impact of P2P activity on consumers' willingness to pay. He finds that, in 2002, sales would have been 7.8% higher in the absence of illegal file sharing.

The second category measures the impact of piracy on sales more directly, but the measure of sales is not always the same variable. Liebowitz (2004) and Peitz and Waelbroeck (2004) examine sales as total physical units sold as reported by the RIAA.[2] Stevans and Sessions (2005) examine sales of long-playing albums (LP's), cassettes, and compact disks (CD's) jointly using aggregate pricing data. Liebowitz (2004) concludes that piracy initially had significant impact on sales, but that the impact was mostly absorbed at that point and further fallout was less likely. Peitz and Waelbroeck (2004) conclude that piracy was responsible for the drop in sales during 2001 but not 2002. Stevans and Sessions (2005) do not hold quantity fixed in their analysis so they could be capturing the effect of declining prices on total revenue due to piracy. Blackburn (2004) finds that piracy might affect artists differentially in that well known artists might suffer declines in sales from P2P sites but that lesser known artists might see an increase in album sales from these same sites as consumers become more familiar with their work. Rob and Waldfogel (2006) follow up on Blackburn's results and show that P2P downloading reduced per capita expenditure on "hit" albums by $25 from 1999 to 2003. Nevertheless, they also find that consumer welfare increased by $70. Finally, Leung (2015) posits that although piracy might hurt record sales, it could also lead to increased sales of MP3 players, such as the iPod, and that the increased profits from additional iPod sales could, in theory, be used to compensate musicians for decreased record sales.

These previous studies communicate some important shortcomings in the literature that motivate this research. First, there is a need for a time series approach when examining if music piracy or litigation influenced music sales. Most of the previous studies listed above employ cross-sectional estimations. Second, almost all of these studies draw conclusions

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[2] Since the publication of these studies, this data is no longer supplied by the RIAA.

about music sales from roughly 2000 to 2003. From a trend perspective, this is when per capita album sales started to decline as evidenced in Fig. 1. However we can clearly see that the decline continued well beyond 2003 and even beyond 2008 when music piracy was still actively reported in the news.

Piracy and RIAA Litigation

The threat of piracy on the oligopolistically controlled music industry was clear by 2003. Zentner (2006) finds that P2P file sharing networks decrease the likelihood of purchasing music by as much as 30% using 2002 data. In order to combat the threat of piracy on their constituents' market share, the RIAA, on behalf of related music labels, began a series of personal law suits in September of 2003 against illegal downloaders. By 2006 the number had exceed 20,000 individual cases and was forecasted to exceed 47,000 by the end of 2010 (Sag 2005). Among the defendants in these cases were two 12-year-olds, a 60-year-old grandmother, and at least one dead person. Sag (2005) notes the potential for considerable public backlash against the RIAA for its campaign of law suits. Bhattacharjee et al. (2006) tracks the effect of publicized litigation on P2P user activity taking a behavioral approach. They find that most users decreased their sharing activity after news announcements of RIAA actions. Conversely, when an announcement indicated that the RIAA could not subpoena internet service provider (ISP) records, there was a noted increase in P2P activity.[3] They also note concern for the backlash against the RIAA. By December 2008 the RIAA announced that they would stop mass litigation of piracy cases and focus only the most egregious offenders.

Model and Data

In order to determine what effect RIAA and music industry initiated litigation has had on music sales, it is necessary to have data on actual music sales. Nielsen's SoundScan[4] service is a private database that tracks weekly sales of albums, songs, and videos both in the aggregate and by album and artist designation. This tracking is done for both physical and digital copies. For the purposes of this study, we ignored singles and videos and focused only on the purchase of albums — both digital and physical. These weekly sales were aggregated from January of 1994 to December of 2014 at the monthly level to correlate more closely to the time frame of other data, such as income. An examination of the raw sales data shows a very strong seasonal component to sales in the month of December. In fact, December sales in any given year averaged 210% of average monthly sales in the preceding 11 months of the year. For example, in 1994, average monthly sales of albums are 44.890 million per month but are 100.09 million in December of 1994. Similarly, average monthly album sales were 20.208 million per month in 2014 and 34.728 million in December of that year. Monthly music sales

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[3] The RIAA requested that Verizon Internet Services turn over the names of two suspected MP3 file traders based upon their internet usage. Verizon refused to comply and was sued by the RIAA. A lower federal court ordered that Verizon had to turn over the name. On appeal to the Washington, D.C. Circuit Court of Appeals, the lower court's ruling was overturned (RIAA v. Verizon 2003).

[4] While Nielsen SoundScan publishes this data, they are in no way responsible for the findings of this research. Nielsen neither confirms nor denies the conclusions reached by the authors here.

were then adjusted for this seasonality using a standard additive seasonal adjustment and were converted into per capita music sales with monthly population data coming from the Census Bureau (2015). A percentage change was taken on this series to ensure stationarity. This is plotted in Fig. 2. This series is stationary based on preliminary augmented Dickey-Fuller (ADF) testing.

The regression estimated for this study can be found in Eq. (1). This regression embodies elements from the previous literature while not only separately accounting for both music piracy and litigation, but also properly fitting the data using standard univariate atheoretical time series techniques.

$$y_t = \beta_0 + \sum_{i=1}^{J}\gamma_i y_{t-i} + \beta_1 t + \beta_2 t^2 + \beta_3 I_t + \beta_4 RIAA_{s,t} + \beta_5 RIAA_{c,t} + \beta_6 \ln\left(1 + RIAA_{l,t}\right)$$
$$+ \beta_7 MP_t + \beta_8 MP_{c,t} + \beta_9 S_t + \beta_{10} N_t + \beta_{11} L_t + \varepsilon_t \tag{1}$$

y_t is the percentage change of seasonally adjusted per capita album sales in the U.S. We allow for J number of lags of this dependent variable in order to avoid any serial correlation problems. The specific number of lags chosen is discussed below. Both a standard time trend (t) and the square of that trend (t^2) are included for the sake of completeness.

Monthly data on income (I_t) were collected from the Bureau of Economic Analysis and converted to the month-to-month percentage change in income. Dummy variables were used for several conditions. The first of these are dummy variables for the P2P service Napster (N_t). If Napster was in service, the dummy variable was equal to 1, 0 otherwise. The same is true for the P2P service Limewire (L_t). Napster was in operation from June of 1999 to July of 2001, whereas Limewire was in operation from May of 2000 until September of 2010. The choice of using Napster as a variable to measure album sales should be obvious—it was the "famous projenitor" of P2P services and should be able to measure the impact that P2P services have on album sales. However, it also had a fairly short life span of operations lasting only slightly more than two years. Including a dummy variable only for Napster could mask any other random but independent effects from
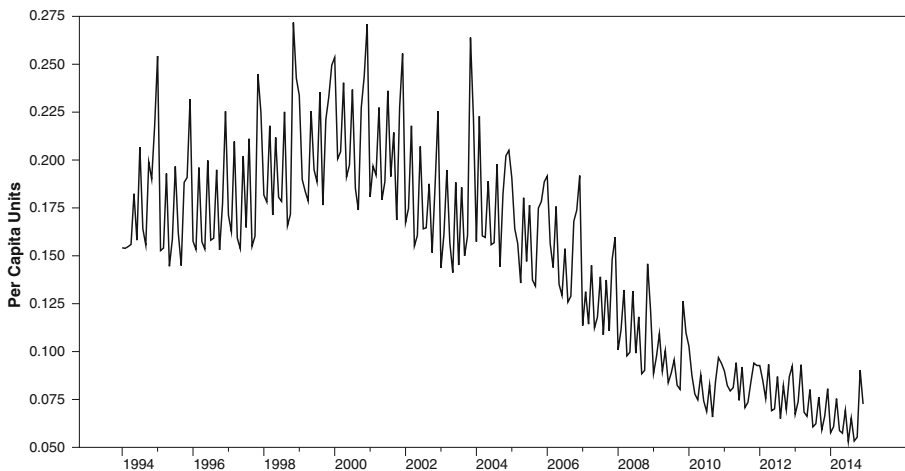

Fig. 1 Per Capita Album Sales. Source: Authors' calculations using data from Nielson SoundScan (2015) and the Census Bureau (2015)
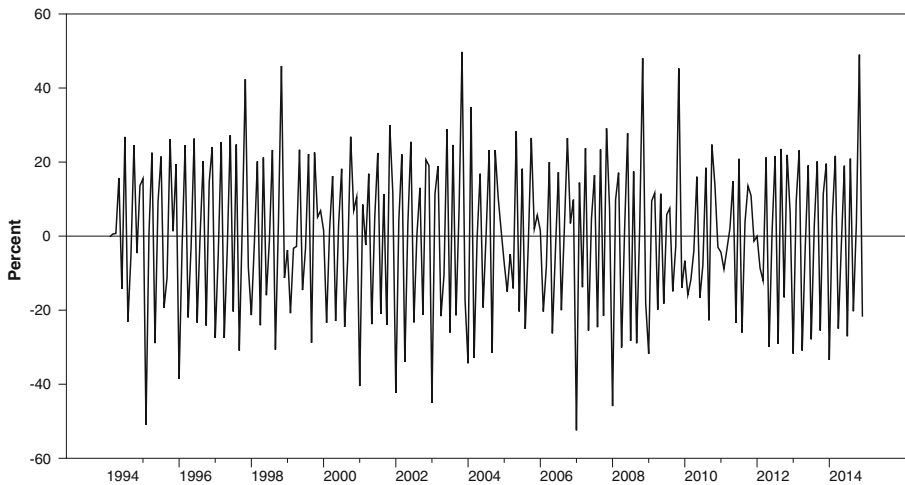
Fig. 2 Percent Change in Seasonally Adjusted Per Capita Album Sales. Source: Authors' calculations using data from Nielson SoundScan (2015) and the Census Bureau (2015)

Napster that occurred at the same time as Napster.[5] Therefore, Limewire was chosen to examine whether long-running P2P services also have an effect.[6]

Personal suits (S_t) is a dummy variable for litigation by the record industry and is equal to 1 in the months when the public litigation policy was active, 0 otherwise. This time period of personal suits ran from September of 2003 until December of 2008, which corresponds to the RIAA making public announcements that they were going to begin and end active and vigorous litigation against music piracy.[7] In order for the music industry's strategy to be successful, consumers have to have knowledge about the possibility of being sued by either the RIAA or a record company. We conducted monthly searches of the Lexis Nexis database (2015) for news stories about music piracy (MP_t) and RIAA suits ($RIAA_{s,\,t}$). The number of news stories appearing in news outlets indexed by Lexis Nexus for these two phrases was catalogued. There were significantly more news events for music piracy than there were for RIAA suits. We also kept a monthly cumulative total of these news stories in order to capture any nonlinear behavioural effects. If consumers read a news story about music piracy, it might not have that large of an initial effect on them. However, repeated exposure to news about piracy or litigation might prompt changes in consumer behavior. This effect is reflected in the music piracy cumulative variable ($MP_{c,\,t}$), as well as the RIAA cumulative variable ($RIAA_{c,\,t}$).

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[5] Some of these effects could be changes in average download speeds for MP3s from the internet which, in theory, could have an impact on the amount of piracy. However, even for piracy occuring on a very slow 56K modem, someone could download a 3 MB MP3 file in fewer than seven minutes, a relatively short time to wait for 'free' music.

[6] Of course, Limewire is not the only option for inclusion in the analysis. One could also pick from any of a number of other P2P services such as Gnutella, Kazaa, Scour, Grokster, etc. However, since all of these P2P sites perform a similar service and have operated for roughly the same time frame, including a dummy variable for each of them would be redundant.

[7] This does not mean that the RIAA and record companies did not persue litigation against piracy and theft before or after these dates. In fact, they did. These dates merely correspond to their public announcements that they were going to begin to pursue civil actions on a broad scale. The announcement in December of 2008 that they were going to cease broad scale civil litigation was widely seen as the RIAA "throwing in the towel" on the litigation strategy.

Finally, the RIAA started announcing its litigation activity in September 2003. Well into 2006, they continued to publish updates about their litigation activities and successes in court in the News Release section of their website. The number of monthly self-reported lawsuits was collected in order to capture the marginal effect of the level of litigation activity ($RIAA_{L, t}$) and is shown in Fig. 2. To scale this variable appropriately, a 1 was added to every observation and the natural log was taken for the entire series. The largest observation in levels for this variable occurred in August 2004 with 897 individual lawsuits filed that month. The minimum nonzero observation was November 2003 with 41 suits (Fig. 3).

Results

Table 1 outlines the descriptive statistics of the data and illustrates some interesting points. Seasonally adjusted album sales have trended downward with the low point of 16.909 million albums occurring in July of 2014. Per capita sales has a maximum of 0.272 albums per person per month to a minimum of 0.053 albums per person per month. Since these are in monthly per capita amounts, converting them to annual album sales per person can be helpful. This ranges from people purchasing 3.3 albums per year on average to purchasing 0.64 albums per year over the sample period. In other words, consumers previously purchased an album on average every 3.5 months. They are now buying an album on average every 19 months. The reader will note that the mean value of the Napster indicator variable is 0.103, indicating that Napster was only present for 10% of the time period whereas Limewire was a running P2P service for half of the time period under consideration. Music industry litigation occurred during 25% of the sample period.

Equation (1) is estimated by ordinary least squares for the full model as well as multiple other specifications that impose some joint restrictions. This serves as a robustness check to ensure that the music piracy variables are not correlated with the RIAA suits activity variables. The results of this exercise are in Table 2. Six different
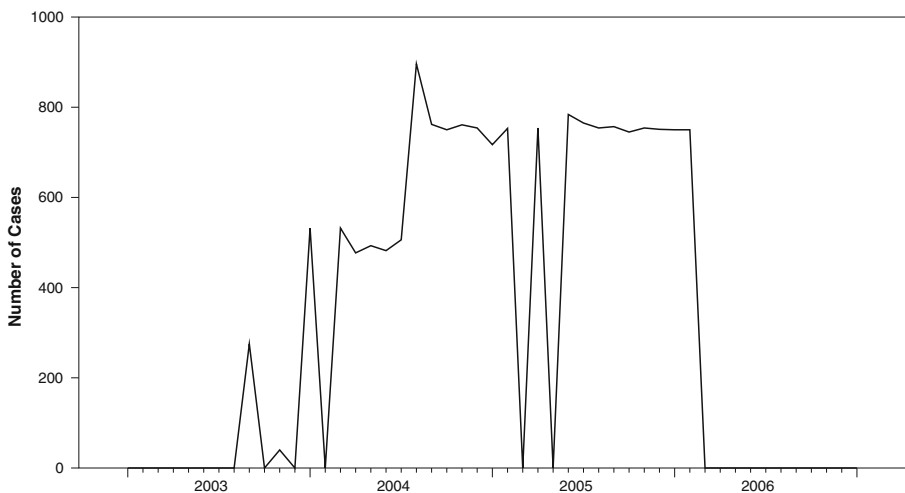

Fig. 3 Number of RIAA Cases Filed. Source: Authors' calculations using Lexis Nexis (2015)

Table 1 Descriptive Statistics

	Mean	Median	Max	Min	Std. Dev.	Obs
Pct Chg in Income	0.383	0.395	5.271	−5.844	0.76	251
Limewire	0.496	0	1	0	0.50	252
Music Piracy Cumulative	1756	1772	4052	1	1455.42	252
Music Piracy	16.08	14	82	0	13.78	252
Napster	0.103	0	1	0	0.30	252
Pct Change in *Per Cap Sales*	−0.300	1.323	49.763	−52.451	20.83	251
Per Cap Sales	0.149	0.156	0.272	0.053	0.05	252
Personal Suit	0.25	0	1	0	0.44	252
Population	292,783	293,227	320,284	262,021	16,969	252
RIAA Suit	0.175	0	7	0	0.64	252
RIAA Cumulative	24.508	34	44	0	18.64	252
ln(1 + RIAA Litigation)	0.633	0	6.799	0	0.121	252
Albums (SA)	42,777	43,334	76,988	16,909	14,419	252

Source: Authors' calculations using data from the Bureau of Economic Analysis (2015) and Nielson Sound Scan (2015)

versions of the model are estimated over the full sample period. For all six models, the adjusted R^2 statistic is relatively stable and the Durbin-Watson statistic indicates that the models do not suffer from any positive or negative serial correlation.

There are a few more specific conclusions we can draw from this exercise. First, the RIAA suits variable, which captures public awareness of RIAA litigation, is significant in explaining the percentage change in seasonally adjusted per capita music sales. The significantly negative coefficient implies that individuals purchased less music as a result of increased awareness of RIAA legal action. This exercise would suggest that there was a sales backlash to the RIAA's decision to start suing its customers, a concern echoed in the literature by Sag (2005) and Bhattacharjee et al. (2006). Furthermore, while this public awareness variable is significant, the level of the litigation activity is not, further reinforcing that it was not the number of lawsuits that altered consumer behavior but the presence of an active litigation policy.

Second, the Napster and Limewire dummy variables are not significant in explaining variation in seasonally adjusted per capita music sales for the full sample period. This finding is in contrast to some of the existing literature which, as previously discussed, is largely focused on different metrics of measuring music piracy either through WTP surveys of college students or utilization of average pricing data to represent sales. Our result implies that the increase in piracy activity in the early 2000's was largely among consumers that were either not able or not willing to purchase music. In other words, they were individuals who did not intend to purchase music in the first place and therefore their presence did not decrease music sales. Waldfogel (2010) also found that most pirated music is music that consumers would not have purchased anyway.

Third, the autoregressive lags of the dependent variable are always significant. This indicates a relatively high degree of persistence in the underlying dynamics of the data. Earlier diagnostic tests show that the inclusion of a third autoregressive lag (and higher

Table 2 Effect of Piracy on Music Sales - Ordinary Least Squares Regression Results

Independent Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Limewire	−1.752	−1.677	−3.927	−2.950		
	(5.253)	(5.118)	(4.478)	(4.052)		
Napster	2.058	2.108	1.473	1.712		
	(3.903)	(3.847)	(3.831)	(3.748)		
Personal Suits	4.915	4.867				
	(5.122)	(4.982)				
Music Piracy - News	0.048	0.048	0.047		0.031	
	(0.127)	(0.127)	(0.128)		(0.129)	
Music Piracy Cumulative - News	−0.373	−0.564	2.084		0.617	
	(9.219)	(8.734)	(8.135)		(7.527)	
RIAA Suits - News	−3.539**	−3.541**	−3.396**	−2.992**	−3.136**	−2.894**
	(1.583)	(1.577)	(1.587)	(1.257)	(1.546)	(1.197)
RIAA Cumulative - News	−0.231	−0.234	0.062	0.041	−0.086	−0.084
	(0.396)	(0.390)	(0.250)	(0.246)	(0.190)	(0.190)
RIAA Litigation	−0.037					
	(0.716)					
Percentage Change Income	1.853*	1.851*	1.846*	1.900*	1.953*	1.974*
	(1.052)	(1.050)	(1.036)	(1.068)	(1.068)	(1.084)
Constant	0.651	1.046	−3.893	0.086	−0.554	0.412
	(19.244)	(18.285)	(17.242)	(4.207)	(15.500)	(3.965)
1st order lag	−0.665***	−0.666***	−0.663***	−0.662***	−0.662***	−0.662***
	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)
2nd order lag	−0.536***	−0.536***	−0.536***	−0.535***	−0.535***	−0.534***
	(0.055)	(0.054)	(0.055)	(0.055)	(0.055)	(0.055)
Deterministic Trend	0.027	0.037	−0.116	0.015	−0.051	−0.002
	(0.530)	(0.504)	(0.471)	(0.116)	(0.457)	(0.093)
Deterministic Trend Squared	0.000	0.000	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)
R^2	0.401	0.404	0.404	0.408	0.407	0.412
Durbin-Watson	2.012	2.013	2.014	2.014	2.015	2.015

Source: Authors' calculations using data from the Bureau of Economic Analysis (2015) and Nielson Sound Scan (2015)

Notes: *, **, and *** represent significance at the 10, 5, and 1% respectively. Numbers in parenthesis are standard errors

order lags as well) is unimportant. Finally, income has a significant and positive effect on album sales such that for every 1% increase in income, there is a 1.9% change change in the quantity of album sales. [8] This result is consistent with Peitz and Waelbroeck (2004) who find similar results, as well as with Liebowitz (2004) in sign but not in magnitude.

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[8] The authors urge caution when interpreting this result because it is sensitive to the subsample window used which is evidenced in Table 3.

There is some concern that the sample period may influence some of the findings in Table 2. Seasonally adjusted per capita sales (in levels) are not stationary. Many of the previous studies listed above have sample periods that end in the early 2000s. It might have been reasonable to conclude with the available data at the time that piracy had an effect on album sales. In order to explore this more thoroughly we re-estimate the model from 1994 to 2004 and slowly add more data to the subsample window in yearly increments. The results are located in Table 3. RIAA suits and the autoregressive lags continue to be important for all sample periods. The Limewire and Napster binary variables are never significant. The percentage change in income is only significant for the longest subsample window. These results, as well as those presented in Table 2, would suggest that music piracy was not a significant factor in the decline in music purchases over the last 20 years. Additionally, the music piracy variables are never important in explaining the variation in per capita music sales for any of the time intervals tested. This raises important concerns regarding previous estimates of the "cost" of piracy in the music industry using alternative estimation strategies.

Conclusions

The purpose of this paper is to examine the effect of RIAA litigation of music piracy on album sales. Rather than relying on survey or total revenue data as has been done in previous studies, this paper aggregates actual weekly music album sales with monthly sales using other monthly variables. Using standard univariate time series techniques, we have determined that the music industry's policy of litigation in all likelihood backfired in terms of album sales. A further interesting result is demonstrated by disentangling the impact of piracy from litigation. We are able to show that piracy did not have a measurable impact on album sales and this result is robust along with many subsample estimations—although we admit that this result may be subject to revision if there were reliable data available on the "amount" of piracy that occurred in any given month.[9] An additional limitation of our study is the exclusion of music singles. Since piracy of music tends to move strongly towards individual singles, our findings on piracy might not hold for this format. Research on this shortcoming is currently underway. The authors also encourage further research to confirm our results and to see if these results hold over a variety of different processes for purchasing and listening to music in different formats and structures, such as streaming. For example, recall that Blackburn (2004) found that piracy might impact artists differentially. Additional analysis of sales at the individual artist's album level might clarify or confirm our results.[10]

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[9] There are services that attempt to measure the amount of file sharing such as Big Champagne, comScore Media Metrix, and the Pew Internet and American Life Project, but each of these services has limitations in their methodology. See Liebowitz (2006) for a discussion of the problems and limitations in measuring file sharing activity.

[10] The amount of data necessary to engage in this level of analysis would be quite large. For example, to understand how piracy impacts artist A's sales of their fourth album, you would also need to know how sales of artist A's first, second, and third albums impact the fourth album, as well as the impacts from sales of artists' B, C, D, etc. albums. To put this problem in context, consider that in any given year approximately 75,000 different albums are released.

Table 3 Effect of Piracy on Music Sales: Rolling Ordinary Least Squares Results

Independent Variable	1994–2004	1994–2005	1994–2006	1994–2007	1994–2008	1994–2009	1994–2010	1994–2011	1994–2012	1994–2013
Limewire	3.592	4.934	5.841	16.930	17.005	8.798	−5.825	−2.142	−1.597	−2.647
	(10.238)	(10.628)	(10.604)	(12.108)	(12.311)	(8.859)	(7.075)	(6.683)	(6.395)	(5.472)
Napster	6.309	5.470	5.338	3.361	3.092	2.281	1.477	1.651	1.861	2.225
	(4.450)	(4.351)	(4.284)	(4.383)	(4.372)	(4.300)	(4.083)	(3.930)	(3.872)	(3.843)
Personal Suits	5.276	5.707	5.935	22.435	23.848	11.024	4.603	6.497	5.639	3.923
	(14.426)	(14.822)	(14.567)	(15.826)	(16.424)	(8.737)	(8.051)	(7.739)	(6.830)	(5.359)
Music Piracy	0.116	0.148	0.130	0.033	0.020	0.052	0.070	0.056	0.038	0.049
	(0.170)	(0.167)	(0.151)	(0.146)	(0.139)	(0.144)	(0.134)	(0.134)	(0.134)	(0.129)
Music Piracy Cumulative	−21.196	−18.956	−18.115	−9.539	−8.446	−3.487	5.753	3.460	1.040	−1.016
	(13.888)	(14.003)	(14.013)	(14.291)	(14.115)	(13.916)	(12.052)	(10.399)	(9.503)	(8.840)
RIAA Suits	−3.588**	−3.478*	−3.328**	−3.994**	−4.115**	−3.711**	−3.818**	−3.741**	−3.500**	−3.528**
	(1.771)	(1.785)	(1.616)	(1.696)	(1.648)	(1.652)	(1.588)	(1.580)	(1.574)	(1.583)
RIAA Cumulative	0.150	−0.020	−0.162	−1.442	−1.411	−0.935	−0.265	−0.419	−0.321	−0.146
	(1.184)	(1.103)	(1.053)	(1.221)	(1.201)	(0.898)	(0.749)	(0.704)	(0.597)	(0.429)
Percentage Change Income	2.704	2.118	2.459	2.521	0.317	0.961	0.965	1.024	1.439	1.805*
	(2.386)	(1.805)	(1.770)	(1.832)	(1.394)	(1.496)	(1.375)	(1.389)	(1.384)	(1.047)
Constant	44.780	40.010	38.447	20.520	18.487	9.061	−11.600	−6.644	−2.087	1.788
	(28.564)	(28.724)	(28.493)	(28.905)	(28.765)	(28.342)	(24.617)	(21.193)	(19.550)	(18.465)
1st order lag	−0.700***	−0.682***	−0.659$***	−0.674***	−0.675***	−0.660***	−0.639***	−0.639***	−0.652***	−0.657***
	(0.072)	(0.069)	(0.067)	(0.066)	(0.062)	(0.060)	(0.058)	(0.057)	(0.057)	(0.055)
2nd order lag	−0.610***	−0.569***	−0.558***	−0.529***	−0.542***	−0.546***	−0.521***	−0.510***	−0.505***	−0.526***
	(0.070)	(0.068)	(0.066)	(0.066)	(0.064)	(0.062)	(0.061)	(0.060)	(0.059)	(0.056)
Deterministic Trend	1.106	1.002	0.933	0.443	0.429	0.103	−0.316	−0.204	−0.055	0.073

Table 3 (continued)

Independent Variable	1994–2004	1994–2005	1994–2006	1994–2007	1994–2008	1994–2009	1994–2010	1994–2011	1994–2012	1994–2013
	(0.861)	(0.849)	(0.849)	(0.870)	(0.846)	(0.834)	(0.719)	(0.626)	(0.563)	(0.512)
Deterministic Trend Squared	−0.003	−0.002	−0.002	0.000	0.000	0.001	0.001	0.001	0.000	0.000
	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)
Observations	129	141	153	165	177	189	201	213	225	237
R^2	0.444	0.409	0.398	0.382	0.394	0.393	0.376	0.368	0.371	0.392
Durbin-Watson	2.023	2.021	1.979	2.029	2.028	2.030	2.015	2.024	2.027	2.021

Source: Authors' calculations using data from the Bureau of Economic Analysis (2015) and Nielson Sound Scan (2015)

Notes: *, **, and *** represent significance at the 10, 5, and 1% respectively

Nevertheless, the implications of this research can be useful for other media. For example, the movie industry has, until recently, been somewhat immune from P2P piracy due to the size of MP4 video files. The recent explosion in broadband speeds has reduced the average time to share a movie and increased the capacity of pirated movies to be shared. The Motion Picture Association of America (MPAA), which is the lobbying arm of the movie industry, and the movie studios would be wise to take a less direct and aggressive approach towards fighting movie piracy via litigation. In short, the movie industry needs to drop the "stick" and find the proper "carrots".

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