

**The Effect of Graduated Response Anti-Piracy Laws on Music Sales:
Evidence from an Event Study in France**

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ABSTRACT

Despite the problem that filesharing poses to creative industries, there is little research on the effectiveness of governmental anti-piracy policies. This study analyzes how the HADOPI graduated response law in France affected music sales on the iTunes store.

We obtained a panel of iTunes sales data from the four major labels across a broad set of countries. We applied a difference-in-difference approach, comparing sales trends in France to a control group of European countries. Our results suggest that increased consumer awareness of HADOPI caused iTunes music sales to increase by 22-25% relative to changes in the control group. These sales changes are similar for each of the four major labels, suggesting that our results are not peculiar to any particular label. The observed sales increase is much larger in high piracy genres than low piracy ones, strengthening the causal interpretation of our results.

Keywords: *Piracy, regulation, digital distribution, music industry, natural experiment.*

1. Introduction

Since the rise of Napster, global recorded music sales and licensing have plunged from nearly \$27 billion US dollars in 2000 to \$15 billion in 2010,¹ with some countries witnessing a coinciding decrease in investment in developing local talent (IFPI 2010). Concurrently, a strain of economics literature has emerged demonstrating that at least some of this decrease was due to online filesharing. While great debate exists over if and how intellectual property policy should be adapted to the digital era, we are aware of no economic evidence regarding the effectiveness of legislated anti-piracy interventions on changing consumer behavior. Our goal in this paper is to provide such evidence by evaluating the effect of HADOPI, a highly-publicized anti-piracy law in France, on French digital music sales.

In May of 2009 the French Parliament passed an anti-piracy law known as HADOPI, or the Creation and Internet Law. The law empowers the HADOPI administrative authority to monitor online infringement and to act against Internet “pirates” on the basis of information submitted by rightholders. For the first two cases of infringement by an internet account holder, the HADOPI authority would send a warning notice to the user (first by email and then by registered mail). For a third infringement within a period of one year, HADOPI had the option to escalate the case by referring it to the criminal court where a judge is empowered to order a range of penalties, including account suspension for up to one month.² Since inception, this law has been clouded in controversy over its direct costs as well as its potential intangible costs such as violation of net neutrality or legal issues surrounding suspension of Internet access.

The purpose of this study is not to debate the broader social and policy merits of this law. Instead, our goal is to analyze whether this law had an impact on consumer behavior and digital music sales. In this regard, we evaluate the effectiveness of HADOPI using a panel of iTunes sales data for the four major music labels (Universal Music, Warner Music, EMI Music and Sony Music) across a broad set of countries. We employ a difference-in-difference approach, using sales trends in selected European

¹ Source: IFPI. This includes both digital and physical sales of recorded music.

² See the HADOPI law itself in articles L 331-25 and L 336-2. Or an explanatory memorandum from the French government at <http://www.culture.gov.fr/culture/actualites/conferen/albanel/creainterenglish.pdf>.

countries to simulate the counterfactual of what music sales in France would have been if HADOPI had not been passed. Using Google Trends, we find that public awareness of HADOPI became widespread in Spring 2009, and our difference-in-difference model suggests that this awareness then caused a 22-25% increase in both iTunes song and album unit sales in France (over and above any change in the control group). To test the validity of causal inference, we also add a third difference to the model, hypothesizing that if HADOPI caused an increase in French digital music sales it should be larger for known high-piracy genres than for low-piracy genres. Our results are consistent with this hypothesis: low piracy genres experienced only a 7% sales increase in France after HADOPI, while high piracy genres experienced a 30% increase in sales.

2. Background of HADOPI

In June 2008 the HADOPI Law was first presented to the French Senate by several politicians, and in October 2008 the Senate backed the law, meaning that it would next go before the French National Assembly. During this time there was little publicity surrounding the law. In March 2009 the HADOPI law was presented to the National Assembly, where it was at first supported but then rejected in April. The debate during this time gave rise to a number of media articles generating awareness and controversy.³ Importantly, this may have led to some confusion among the general populace over whether the law was yet effective or not. In May 2009 both the National Assembly and the Senate backed an amended version of the law, leading opposition Parliamentarians to send it to the French Constitutional Council for review. In June 2009 the Constitutional Council rejected the main part of the law. This section was then amended so that judicial review was required before penalties could be applied to 3rd time infringers, and the Constitutional Council accepted the amended law in October 2009, putting the law into effect.⁴

³ For example, <http://news.bbc.co.uk/2/hi/europe/7992262.stm>

⁴ For references regarding the political timeline of the HADOPI law, see law <http://www.senat.fr/dossier-legislatif/pjl07-405.html> and <http://www.conseil-constitutionnel.fr/decision.42666.html>.

From that point onward, filesharers in France could theoretically begin to receive notices of infringement. However, it was over a year before the HADOPI agency began sending out first notices, with the first wave of infringement notices going out in September 2010. Later, in the spring of 2011, the HADOPI agency began the initial wave of second notices, and as the end of our data period no third notices had been sent out and no penalties had yet been applied.⁵

In our empirical context, it is also important to note that while the most publicized responsibility of the HADOPI agency is to send out infringement notices, as part of the HADOPI legislation the agency started an education campaign to inform citizens about the illegality of sharing copyrighted materials online, the dangers it may pose to content generation in the future, and the various legal channels in which media can be obtained. These campaigns are an ongoing part of HADOPI's responsibilities and do not represent discrete events. Thus their effects cannot be separated from the effects of the graduated response/penalty portion of the law, and as such our results should be seen as measuring the combined effect of both these education campaigns and the warning and penalty system (although we discuss below that the timing of our results does give some indication as to the source of the effect we observe).

3. Literature Review

Our research is novel in that despite the current debate over copyright policy reform, we are aware of no studies that examine the impact of anti-piracy legislation on consumer behavior or media sales. Thus our research progresses in a new direction from the large existing literature that analyzes how piracy has impacted media sales. This literature has used a variety of empirical methods from cross-country or cross-city variation in piracy levels (for example, Zentner 2005, Liebowitz 2008) to survey data (Rob and Waldfogel 2006, Rob and Waldfogel 2007) to exogenous shocks in the availability of pirated or legitimate content (Oberholzer-Gee and Strumpf 2007, Smith and Telang 2009, Danaher et al. 2010). What this literature has in common is that nearly all of the academic studies find that media piracy has a significant negative impact on sales.

⁵ Details at <http://www.hadopi.fr>.

Notably, one study that we are aware of addresses the effectiveness of private sector legal responses to filesharing: Bhattacharjee et al. (2008) find that the RIAA's legal threats (in the form of highly publicized lawsuits) against file sharers had a statistically significant negative impact on the availability of pirated content, but that a substantial amount of illegal content was still available even after the lawsuits.

4. Data

Our study uses a panel of total weekly iTunes sales units (songs and albums, separately) for a number of European countries (including France) from July 2008 to May 2011. The data were obtained directly from the four major music labels — EMI, Sony, Universal, and Warner — and aggregated to reflect total iTunes sales for these labels. According to the IFPI, the four major labels reflect roughly 70% of music industry sales while independent labels reflect the other 30% of sales, which are not observed in our data.⁶ Importantly, about 20% of French music sales in 2011 were digital while 80% were physical. Unlike digital data, there are no comprehensive sources of physical sales data.⁷ We chose the five European countries (other than France) with the highest iTunes sales levels as our control group for France, under the theory that overall market trends would have the most similar impact on countries with closer sales levels.⁸ Thus, in this study we observe weekly iTunes sales units for France, the UK, Italy, Spain, Germany, and Belgium. These five countries also serve as a useful control for France in that the iTunes music store opened in all six of these countries within a 5-month window in 2004, and so we might expect these countries to be at similar points in the diffusion of this technology.

We also have a separate dataset provided to us by just two of the four major labels. This dataset is similar to the dataset above except that for each country-week, we also observe total iTunes song sales units for each genre of music. We use this dataset as a further test of our main effect, focusing on the following

⁶ Data from the Syndicat National de L'édition Phonographique (SNEP) (<http://www.disqueenfrance.com/fr/catalogpage.xml?id=420906&pg=1&cat=251362>).

⁷ Previous studies have shown that illegal Internet downloaders prefer digital sales channels over physical ones when purchasing legally. For example, see Danaher et al. (2010) or Smith and Hu (2012). Thus we believe that if HADOPI dissuaded illegal downloaders, they would be more likely to turn to digital channels than to physical ones.

⁸ However, results remain roughly the same (and completely the same in sign and significance) when choosing a variety of other control groups.

genres: Rap, Hip Hop, Rock, Pop, Classical, Christian, Folk, and Jazz. Our purpose in choosing these genres was to keep only genres which had a significant share of the market and for which we had reasonable priors regarding relative piracy levels for the genre.

Table 1 shows the average sales levels per week (both track and album) across each of the countries and provides some indicators of the level of variance within each country. The UK is clearly the largest country in terms of iTunes sales, and Spain is the smallest. While Table 1 shows that there is significant variation across countries in terms of sales levels, we will show that, before HADOPI, the average time trend of our control group (on a logarithmic scale) closely maps the time trend of France.

Table 1: Descriptive Statistics

Country	<i>iTunes track unit sales (thousands)</i>			<i>iTunes album unit sales (thousands)</i>		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
Belgium	133.4	130.1	21.3	9.8	9.7	2.2
Germany	728.1	691.6	148.9	87.4	85.0	22.9
Spain	65.7	64.1	11.6	10.1	9.8	2.3
France	447.7	473.9	96.6	49.7	53.4	14.7
Italy	183.9	187.7	37.1	18.7	18.6	4.6
UK	2899.3	2801.9	594.0	270.7	275.2	82.7
Total	743.0	252.6	1022.3	74.4	25.9	98.6

Finally, we postulate that because citizens may be confused over when the law actually became effective, we may be more likely to see an effect begin when people first became aware of the law rather than when it finally became effective in October 2009. To measure awareness, we collected Google Trends data on Google searches (from France) for the search term “HADOPI.”⁹ Google Trends reports the “relative search index” for a search term in a given country, meaning that for each week we observe the number of searches for that term relative to the average number of all searches in that country across each week in

⁹ Google Trends data for other related search terms such as “French Three Strikes Law” show the same pattern.

the date range. We therefore know when awareness of HADOPI peaked as measured by Google searches, and the relative height of that peak, which we use below as a measure of national awareness of the law.

5. Results

Our basic strategy for determining the impact of HADOPI is to use a difference-in-difference approach, comparing the change in French sales before and after HADOPI to the average change in sales across the control group. A necessary condition for this approach to have a casual interpretation is that, conditional on other covariates, French sales would have trended similarly to the control group's in the absence of HADOPI. We begin our analysis with the following model:

$$\ln Sales_{it} = \beta_0 + \beta_1 \Omega_t + \beta_2 \Omega_t * France_i + \mu_i + e_{it} \quad (i)$$

where $\ln(sales_{it})$ is equal to the natural log of song sales units in country i during week t , Ω_t is a vector of dummy variables for each week of the data (time fixed effects), $France_i$ is an indicator variable equal to 1 for French observations, μ_i is a vector of country fixed effects, and e_{it} is the idiosyncratic shock term.

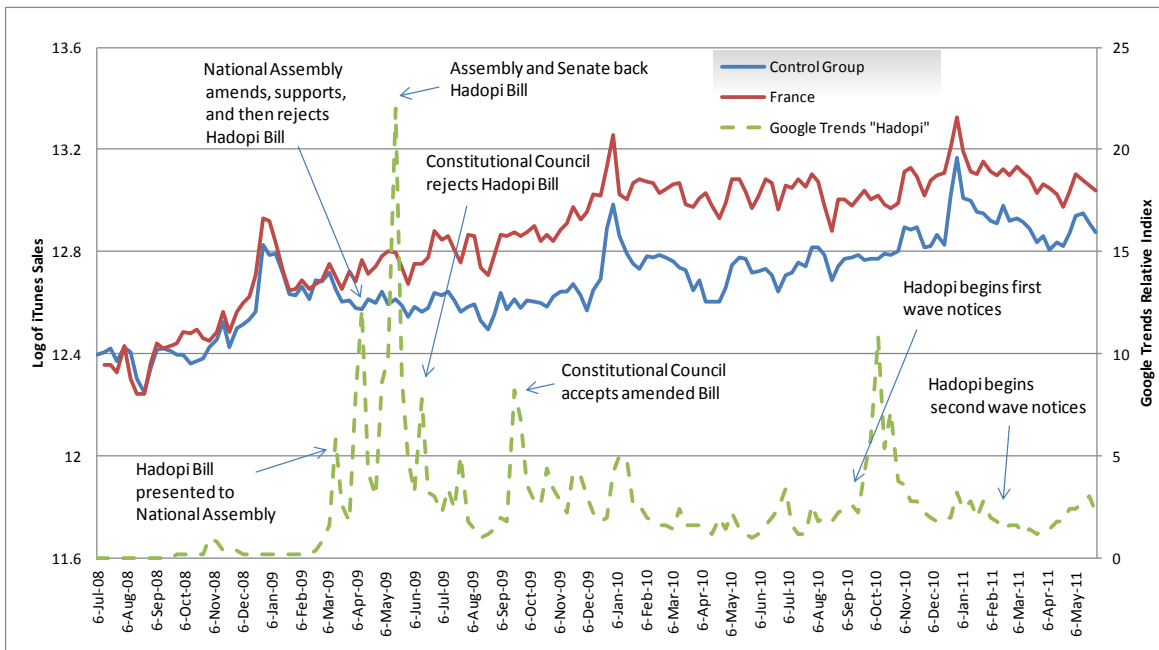
With this specification, β_1 tracks the average time trend for log sales units over time for the control group, while β_2 estimates how the French time trend differs from this average.

We estimate this model and then plot the results visually in Figure 1, with $\beta_0 + \beta_1$ representing the average sales time trend for the control countries and $\beta_0 + \beta_1 + \beta_2$ representing the French sales time trend. Both of these time trends are plotted and measured on the left axis in Figure 1. We also added to this graph the Google Trends relative index for the search term HADOPI (in France), measured on the right axis.

We first note that the initial peak for the Google Trends Index occurs in March 2009, corresponding to the presentation of the HADOPI law to the National Assembly. Prior to March 2009, the French sales trend appears to follow closely the sales trend of the control group. A Wald test of joint significance for all β_2

between July 6, 2008 and March 30, 2009 could not reject the null hypothesis that the coefficients are jointly zero at the 95% confidence level. Thus, prior to the first Google Trends spike, the time trend for French sales is statistically indistinguishable from the sales trend of the control group. In March, April, and then May of 2009 we see three successively higher peaks of HADOPI awareness (corresponding with major legislative events related to the bill) — during this time, the French sales trend first begins to increase above the control group and then remains higher than the control group throughout the entire period. It also appears as if the difference between France and the control group may diminish toward the end of the period studied. However, we cannot statistically reject the null hypothesis (with 95% confidence) that the difference-in-difference estimates for each successive 6-month period following March 30 are all statistically equal, and so we cannot say much about whether the effect of HADOPI was diminishing later in our study.

Figure 1: iTunes Single Track Unit Sales Trends (4 majors combined), France vs. Control



If we accept the identifying assumption that France would have followed the sales trend of the control group if not for HADOPI, then the average effect of HADOPI can be measured as the average gap

between the two sales trend lines after March 30, 2009.¹⁰ In order to measure this gap and test for statistical significance, we estimate the following slightly different version of the first model:

$$\ln Sales_{it} = \beta_0 + \beta_1 \phi_t + \beta_2 \phi_t * France_i + \mu_i + e_{it} \quad (ii)$$

The only difference between (ii) and (i) is that in (ii), ϕ_t is an indicator variable equal to one if the observation occurs after March 30, 2009. Thus, this model measures the average post-HADOPI change in sales across the control countries (β_1) and then estimates any change in French sales over and above the change in the control group (β_2). This means that β_2 is the coefficient of interest and under our identifying assumptions, it represents the average causal effect of HADOPI on weekly iTunes sales units in France from March 2009 until May 2011.

In column (i) of Table 2 we display the results of estimating this model for all songs. Accounting for the fact that our independent variable is in log terms, these estimates indicate that iTunes track sales units rose about 25.5% in the control group after March 1, 2009 but by 48% in France, indicating that French iTunes track sales were 22.5% higher on average than they would have been in the absence of HADOPI.¹¹ We compute robust clustered standard errors as suggested by Bertrand et. al. (2004) and we report these in parentheses. However, because there is only one treated cluster, even these standard errors may be inappropriately small for the coefficient of interest. Thus for β_2 we conservatively calculate p-values from a permutation test: we run the model five additional times specifying each country as the “treated” country and obtain estimates for the coefficient of interest in each case. We then impute p-values for the French coefficient of interest as the probability that the French estimate was drawn from a t-distribution (with four degrees of freedom) containing the estimates for the other five countries. These p-values are

¹⁰ We note that the use of March 30, 2009 as the treatment date will likely yield a slightly conservative estimate of the impact of HADOPI. In Figure 1, it appears as if French sales may have begun to diverge from the control group during March and that the awareness of the law began to spike in early March, and so our conservative use of March 30 as the start date of HADOPI will bias our difference-in-difference estimate slightly toward zero.

¹¹ We also tested a model that included a full set of week dummies instead of just the “after HADOPI” dummy. In this model the post-HADOPI effect for the control group cannot be estimated as it is subsumed by the week dummies. However, the coefficient of interest and its p-value are very similar when estimated this way.

presented in square brackets below the robust clustered standard errors. Our difference-in-difference results are statistically significant at a 95% confidence level.¹² In column (ii) we include linear country trends in the model, asking if the post-HADOPI French deviation from this trend was different from the control countries' deviations from their trends — this approach yields a similar result for the coefficient of interest.¹³ Finally, we replicated Figure 1 and Table 2 for album unit sales and found very similar results in sign, magnitude, and significance.

In addition to these aggregate results, we estimated the same models for each of the four major labels individually, and the results for each individual label exhibit roughly the same patterns as the aggregated results (particularly in sign). Thus, it is unlikely that our results are driven by the marketing efforts or release schedule of an individual firm. As well, marketing, advertising, and release schedule decisions must — by law — be made non-cooperatively, making it less likely that they will be correlated across labels. In short, the effects we have observed thus far appear to be industry-wide and not specific to any particular label's music or strategy.

6.1 Genre Analysis

To test the validity of our causal interpretation, we add an additional level of difference to the model based on priors about the popularity of piracy across various genres of music. Specifically, EMI conducted surveys of French citizens showing that Rap and Hip Hop are the most heavily pirated genres, even relative to popularity in legal sales channels. Rock and Pop, which experience average levels of piracy while genres such as Classical, Christian, Folk, and Jazz experience significantly lower levels of

¹² We also collapsed the data into 12 observations, summing up track sales for each country before and after March 30, 2009. When we estimate the model on these 12 observations, the coefficient of interest is still estimated as 0.2 and is still significant at the 95% confidence level.

¹³ The post-HADOPI coefficient for the control group in the model with linear trends is very different from the model without trends — this is because the linear trends soak up most of the increases in iTunes sales in all of the countries but France.

piracy.¹⁴ We note that other published studies suggest a similar distribution of pirated downloads across genres (See for example Liebowitz 2008). If the observed increase in French sales is due to a reduction in piracy triggered by HADOPI, we would expect the increase in Rap sales to be larger than that for Rock and Pop and the increase for Classical, Christian, Folk, and Jazz to be quite low relative to both Rap and Rock/Pop.

Table 2: Estimate Effects of HADOPI

	(i)	(ii)	(iii)	(iv)	(v)
	All genres	All genres	Classical / Folk / Modern Christian / Jazz	Rock / Pop	Rap / Hip Hop
After Hadopi	0.228* (0.037)	-0.045 [†] (0.032)	-0.042 (0.072)	0.142 (0.068)	0.846* (0.205)
After Hadopi * France	0.203** (0.037) [0.031]	0.220** (0.032) [0.026]	0.068 (0.072) [0.628]	0.158+ [†] (0.068) [0.092]	0.260 (0.205) [0.531]
Constant	12.520* (0.023)	12.452* (0.004)	7.715* (0.044)	11.411* (0.042)	8.731* (0.127)
Linear Country Trends	No	Yes	No	No	No
Observations	918	918	912	912	912
# of Countries	6	6	6	6	6
R-squared	0.361	0.991	0.082 [†]	0.103	0.42

Robust standard errors clustered at country level appear in parentheses

Two-tailed P-values derived from permutation test appear in square brackets

+ significant at 10%; ** significant at 5%; * significant at 1%

March 30, 2009 is counted as the beginning of Hadopi

Columns (i) and (ii) include data from all four majors, while columns (iii) through (v) reflect data from only two.

In columns (iii), (iv), and (v) of Table 2 we see that that the difference-in-difference increase in French sales after HADOPI is indeed highest for the most heavily pirated genres (column v) and is small and statistically insignificant for the least pirated genres (column iii). We conducted an F-test across each estimation to test whether the estimate of the effect of HADOPI on French sales is different across genres. Due to relatively large standard errors we cannot reject the null hypothesis that the post HADOPI French

¹⁴ These genre findings are based on surveys performed by EMI Music in France during October and November 2010. 8,173 interviews were completed and results were weighted to nationally representative figures. The data are not publicly available but were available to the authors.

increase is the same across genres. Nonetheless, the point estimates indicate that while HADOPI increased iTunes sales of Classical, Christian, Folk, and Jazz genres in France by 7%, the point estimate of the effect on Rock and Pop was 17% and the effect on Rap and Hip Hop was 30%. This is important for our results because unobserved changes that might increase French music sales at the same time as HADOPI would be unlikely to have this same pattern across genres. For example, if Apple began to heavily promote the iTunes store in France more so than in the control countries around the same time as HADOPI, one would expect such promotions to affect each genre equally. Instead, we see French sales of heavily pirated genres rising higher than for less pirated genres, which suggests that this sales increase is causally related to a reduction in French piracy levels caused by HADOPI.

6.2 iOS Devices

One alternate interpretation of our results could be that French iOS device sales (iPods, iPads, and iPhones) happened to spike above sales in the control countries at around the same time as the public awareness of HADOPI did. If iOS device ownership tends to increase iTunes music purchases (and disproportionately toward high-piracy genres), then this could explain our findings without HADOPI having an impact. In an online article¹⁵ we use IHS Screen Digest data to show that the increase in French iOS device penetration over the period of our study was similar to the average increase in the control group, and that the country with the largest increase in iOS device penetration (Spain) actually did not experience a statistically meaningful increase in iTunes sales compared to the control group. This leads us to conclude that iOS device ownership trends do not explain our empirical results.

6. Discussion

Combined, the four major labels sold an average of 491,000 tracks per week in France after March 2009. Our findings suggest that in the absence of HADOPI, sales would have averaged only 401,000 units per week. Thus, our results suggest that the awareness of HADOPI increased iTunes song sales by 90,000

¹⁵ Available at <http://infojustice.org/archives/8891>

units per week on average. If we also incorporate the similar album results and assume prices of €1 per song and €8.5 per album, we estimate that HADOPI increased iTunes revenues to the four majors by €9.6 million (\$13 million) per year. If we assume that independent labels (30% of the industry) received a similar increase in sales to the majors then HADOPI's effect was to increase iTunes music revenues in France by €13.8 million (\$18.6 million) per year. About 30% of this goes to iTunes and 70% goes to artists and labels. If one believes that our findings indicate that some consumers turned from piracy to legal digital sales as a result of HADOPI, then this also implies that filesharing displaces digital sales.

However, one challenge of our study is that we cannot disentangle the educational and promotional effects of HADOPI from the effect of the penalty system. Given this, one might wonder whether our results are driven entirely by HADOPI's promotion of digital channels creating demand in new consumers rather, than from converting pirates to legitimate channels. Alternatively, perhaps HADOPI's promotional campaign simply accelerated consumer conversion from physical to digital channels with no actual gain in total sales. However, these explanations seem unlikely for several reasons. First, it is not clear that such explanations would be consistent with our genre results. Second, the sales uplift was first observed in March 2009 upon awareness of the law and then remained relatively consistent for the next two years, but any actions (promotional or notice-related) of the HADOPI administration did not begin until mid-2010.¹⁶ Third, Elberse (2010) documents that as consumers turn from physical to digital channels, they strongly shift from album format to single song purchases. But in our study, we observed similar causal increases for both tracks and albums. Finally, the IFPI reports that, according to Nielsen data, use of filesharing networks in France decreased by 26% after HADOPI. Nonetheless in this study we cannot positively rule out these alternative explanations and so it may remain an open question how much of this €13.8 million in "new" iTunes sales is due to piracy deterrence. Indeed, even if awareness of the deterrence system initially sparked the sales increase, we do not know if it would have been maintained without HADOPI's promotional component.

¹⁶ Details at <http://www.hadopi.fr>.

Nonetheless, if we assume that the additional €13.8 million per year stems largely from conversion of pirates to legal purchases, this number bears putting into context relative to the tangible and intangible costs of the law. With respect to tangible costs, several online sources report that HADOPI costs approximately €12 million annually to administer.¹⁷ Unfortunately, the value of this comparison is limited because our analysis only applies to one channel (iTunes) and for one product category (music), and thus is likely to significantly underestimate the tangible “benefit” of the law to content producers. Conversely, it is also important to note that only considering the tangible costs of administering HADOPI ignores many potential intangible costs mentioned earlier. As such our study should not be viewed as measuring the overall value of the HADOPI law. Rather, we believe the contribution of this study is in demonstrating that a demand-side direct government anti-piracy intervention can be effective in influencing consumer behavior. Further studies might ask whether new revenues (to both content owners and to delivery channels) stemming from stronger intellectual property protection will lead to more or higher quality products being offered.

¹⁷ For example, http://www.theregister.co.uk/2012/08/06/hadopi_under_fire/

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