



# THE ECONOMIC COST OF IPR INFRINGEMENT IN THE RECORDED MUSIC INDUSTRY





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## PROJECT TEAM

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## ACKNOWLEDGEMENTS

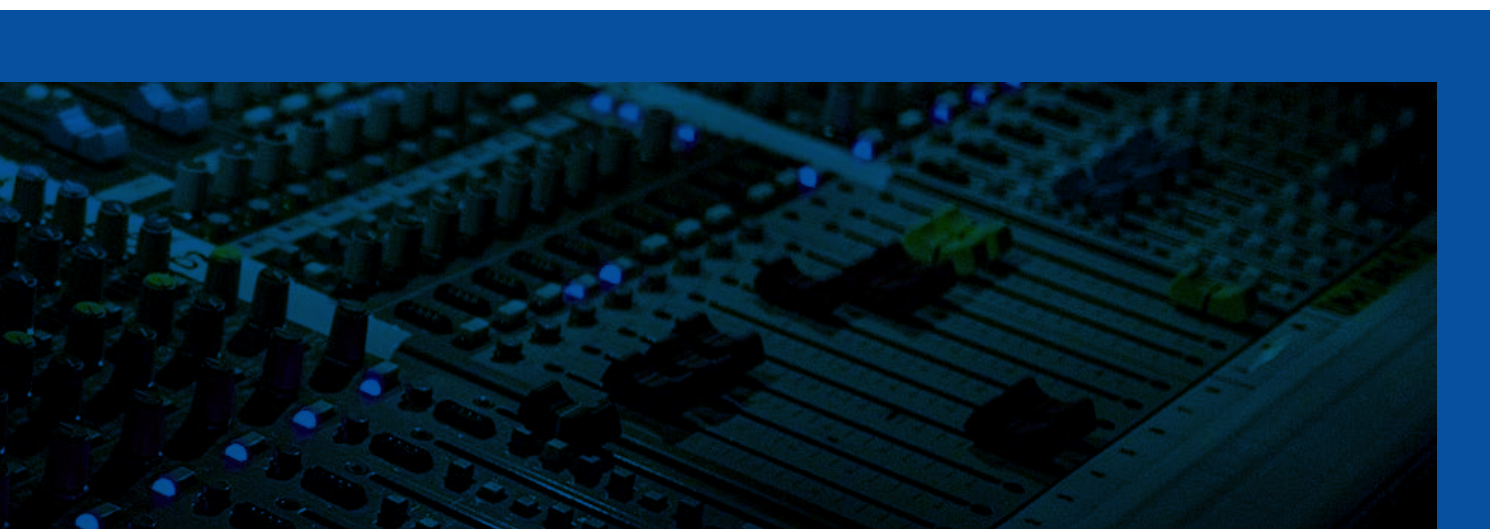
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The authors would like to thank members of the IP Economics team at the UK Intellectual Property Office for helpful comments on an earlier draft of this report. Members of the Economics & Statistics Working Group of the Observatory have also provided useful comments on the reports in this series and on the methodology used. The International Federation of the Phonographic Industry furnished supplementary information about the data used for the study and about the recorded music industry in general.



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# EXECUTIVE SUMMARY

THE ECONOMIC COST OF IPR INFRINGEMENT IN THE RECORDED MUSIC INDUSTRY

The European Observatory on infringements of Intellectual Property Rights (the Observatory) was created to improve the understanding of the role of Intellectual Property and of the negative consequences of Intellectual Property Rights (IPR) infringements.

In a study carried out with the European Patent Office<sup>1</sup> in 2013, the European Union Intellectual Property Office (EUIPO)<sup>2</sup>, acting through the Observatory, estimated that approximately 39% of total economic activity and 26% of all employment in the EU is directly generated by IPR-intensive industries, with a further 9% of jobs in the EU arising from purchases of goods and services from other industries by IPR-intensive industries. Perceptions and behaviours of European citizens regarding Intellectual Property and counterfeiting and piracy<sup>3</sup> were also assessed as part of an EU-wide survey. This survey revealed that although citizens recognise the value of IP in principle, they tend to justify their infringements as a consequence of individual circumstances as opposed to the recognition of the principle.

The Observatory has now embarked on an effort to complete the picture by assessing the economic impact of counterfeiting and piracy. Infringement of IP rights in the music sector can occur through physical or digital channels (for instance, through the purchase of fake CDs or downloading of illegal content). This sectorial study analyses the effect of piracy<sup>4</sup> on the recorded music industry, independent of the format independently of the infringing good or service.

This means that both types of IPR infringements are covered, i.e. physical piracy when the infringing product involves the use of media such as CDs or DVDs and digital piracy when it does not<sup>5</sup>.

This exercise is challenging from a methodological perspective, as it attempts to shed light on a phenomenon that by its very nature is not directly observable. To pave the way towards quantification of the scope, scale and impact of IPR infringements in the European Union, as identified in its mandate, the Observatory has developed a step by step approach to evaluate the negative impact of infringement of IPR and its consequences for legitimate businesses, governments and consumers, and ultimately for society as a whole.

Several IPR-intensive industries whose products are known or thought to be subject to counterfeiting have been selected for analysis. Previous studies have examined the following sectors: perfumes & personal care; clothing, footwear and accessories; sports goods; toys & games; jewellery & watches; and handbags & luggage. This report presents the results of the

1 - "Intellectual Property Rights intensive industries; contribution to economic performance and employment in the European Union", OHIM/EPO, September 2013.

2 - Until 23 March 2016, the name of the Office was Office for Harmonization in the Internal Market (OHIM). The name was changed to EUIPO as part of the trade mark reform legislation which came into force on that date.

3 - "European citizens and intellectual property: perception, awareness and behaviour", OHIM, November 2013.

4 - Piracy consists of making an unauthorised exact copy – not a simple imitation- of an item covered by an IPR, as defined in the TRIPS Agreement.

5 - "Piracy of Digital Content", OECD, 2009.

6 - More specifically, the analysis is based on wholesale value which refers to record companies' revenue from the sale/licensing of recorded music products to domestic retailers/ intermediaries, net of discounts, returns, handling charges and taxes. Premium sales (physical and digital) are included. Promotional goods, non-music/ non-sound recording artist related income, deletions, cut-outs, distribution fees and income from legal settlements are excluded.

seventh sectorial study, covering the recorded music industry<sup>6</sup>. This is the first study covering a sector that is a victim of physical as well as digital piracy so some adaptations to the general methodology are necessary.

7 - Core copyright-intensive industries are industries that are wholly engaged in creation, production and manufacturing, performance, broadcast, communication and exhibition, or distribution and sales of works and other protected subject matter.

The recorded music industry is a core copyright-intensive industry, as defined by WIPO<sup>7</sup>. The EPO/EUIPO (2013) study revealed that the recorded music industry is also intensive in the use of trade marks and designs.

It is important to note that in contrast to previous reports, the estimates of lost music sales have not been based on Eurostat data. This is due to data classification issues in the Eurostat data and the availability of a richer dataset from the International Federation of the Phonographic Industry (IFPI).<sup>8</sup>

8 - NACE is the official classification of economic activity used by Eurostat, the statistical office of the EU. NACE class 5920 covers "sound recording and music publishing activities".

The main finding of the present study is that in 2014, the recorded music industry lost approximately €170 million of sales revenue in the EU as a consequence of the consumption of recorded music from illegal sources. This total corresponds to 5.2% of the sector's revenues from physical and digital sales. These lost sales are estimated to result in direct employment losses of 829 jobs.

9 - Other NACE classes involved in the music sector but whose IPR infringement effect are not included in this report are: 4763 "Retail sale of music and video recording in specialised stores" and 4791 "Retail sale via mail order houses or via internet". For a complete list of NACE codes related to the music industry, see Appendix C.

If the knock-on effects on other industries and on government revenue are added, when both direct and indirect effects are considered, infringement of IPR in this sector causes approximately €336 million of lost sales to the EU economy, which in turn leads to employment losses of 2,155 jobs and a loss of €63 million in government revenue.

Recorded music industry sales include wholesale value of the sale/licensing of recorded music products to domestic retailers/intermediaries. Revenues from music distributors and retailers are therefore not included here<sup>9</sup>. For this reason, the absolute numbers in this report cannot be directly compared to those previously presented for the cosmetics and personal care and for the clothing and footwear sectors, both of which were based on consumer prices.

# 1. INTRODUCTION

THE ECONOMIC COST OF IPR INFRINGEMENT IN THE RECORDED MUSIC INDUSTRY

A major problem which has hindered the effective enforcement of Intellectual Property Rights (IPR) in the EU is a lack of knowledge of the precise scope, scale and impact of IPR infringements. Many attempts to quantify the scale of counterfeiting/piracy and its consequences for businesses, consumers and society as a whole have suffered from the absence of a consensual and consistent methodology for collecting and analysing data on counterfeiting and piracy across various sectors. Different approaches have been used, such as surveys, mystery shopping, monitoring of online activities, making it all the more difficult to aggregate information for the whole economy. The very nature of the phenomenon under investigation makes it extremely challenging to quantify reliably, as obtaining comprehensive data for a hidden and secretive activity is by necessity difficult.

These challenges have in turn hindered the tasks of those involved in enforcing IP rights and in charge of establishing precise priorities, programmes and targets for enforcement, as they limit the possibilities to design more focused as well as evidence-based public awareness campaigns.

To help overcome these challenges while taking full account of methodological constraints, the Observatory developed a specific approach that has so far been applied to the perfumes & personal care; clothing, footwear and accessories; sports goods; toys & games; jewellery & watches; and handbags & luggage sectors.

In the present report the Observatory focuses its attention on the infringement of IP rights in the music sector.

Following the official NACE classification, activities related to the music industry are spread across 11 classes named in Appendix C, covering one class in the manufacturing sector, four in trade services and six in other services. But only one of them is specific to music (5920). The other classes combine music with other activities such as motion pictures, video recording, radio, television, theatre etc.

Therefore, a study of the music sector based on official statistics would be limited to sound recording and music publishing activities (NACE class 5920). Unfortunately, this class was only defined in the new NACE Rev.2 and there is no one-to-one correspondence with the older NACE Rev 1.1. As a consequence, the available data series starts in 2008, which is too short to allow for the application of the methodology followed in the six previous sectorial studies.

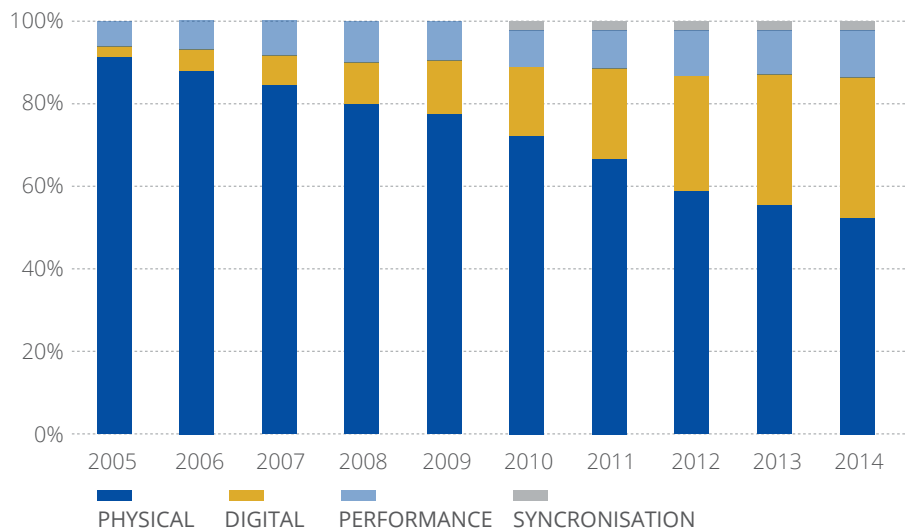
Another source of information is the International Federation of the Phonographic Industry (IFPI), with 1,300 members worldwide. IFPI represents recording and music licensing companies that administer rights and collect revenues for the public performance of recorded music in 57 countries. This association compiles and publishes information annually on music revenues worldwide, including those generated in 19 EU Member States. These 19 countries account for 99% of total EU28 turnover of NACE 5920. The coverage of the recording music revenues in EU Member States has been checked and is considered to be of sufficient quality to allow the Observatory to base the analysis on these data.

The recorded music industry revenues are generated through a diverse portfolio of channels and formats of music consumption. The information available includes revenues detailed by format, including:

- 1. Physical music:** broken down into seven categories: singles; albums (LPs); music cassettes (MCs); compact discs (CDs); Minidiscs; Super Audio CDs (SACDs); and music video. CD sales via internet are included as physical sales.
- 2. Digital music:** includes permanent downloads, mobile personalisation, subscription streams income (both free and premium tiers), ad-supported streams income (e.g. YouTube or VEVO) and others.
- 3. Performance rights:** income received for licenses granted to third parties for the use of sound recordings and music videos in broadcasting (radio and TV), public performance (nightclubs, bars, restaurants, hotels) and certain internet uses.
- 4. Synchronisation revenues:** fees or royalties from the use of sound recordings in TV, films, games and adverts.

<sup>10</sup> - IFPI: "Recording industry in numbers. The recorded music market in 2014" (April 2015). <http://www.ifpi.org/resources-and-reports.php#/recording-industry-in-numbers.php>

For the purposes of this study, the Observatory purchased sales data from IFPI<sup>10</sup> for these four formats for 19 EU Member States. Developments in the sales of each format are displayed in the figure below. One of the key features to note here is the decline in physical sales and the growth in the importance of digital sales between 2005 and 2014. For instance, physical sales represented an average of 75% of total sales across the period, although this figure masks a significant decline from 92% of total sales in 2005 to 53% in 2014.



At the country level, the shares of physical and digital sales vary significantly. In 2014 for instance, physical sales in Sweden represented 15% of total sales, whilst in Germany and Poland physical sales accounted for 70%.

Infringement of IP rights in the music sector can occur through physical or digital channels (for instance, through the purchase of illegally copied CDs or unauthorised downloading of digital content). This sectorial study analyses the effect of IPR infringement on the recorded music industry, independent of the format of the infringing good or service.

The study aims to estimate the direct and indirect costs to industry and the wider costs to government and society resulting from IPR infringement in the recorded music sector.

### 1) DIRECT COSTS TO INDUSTRY

The costs to industry are mainly comprised of lost sales due to infringement of IP rights. Estimation of lost sales (in physical or digital formats) is therefore a necessary first step, both because it constitutes a major economic consequence in itself and because it drives other consequences, for example loss of public fiscal revenue.

It is important to note that the lost sales estimated in this report represent hypothetical additional revenue that the recorded music sector would have earned, had infringement not taken place. It is not an estimate of the value of the illegally acquired music recordings; nor is it an estimate of the substitution effect—that is, the question of the extent to which the illegally



consumed music would have been bought from legal sources had piracy not been possible, which is outside the scope of this study.

Lost sales in physical and digital formats are estimated using two independent models that aim to quantify the effects of IPR infringements in physical and digital markets. The focus of the study is on sales in both formats, and both can be affected by physical or digital infringement. For example, sales of illegally copied CDs can lead to a decrease in legitimate physical music sales and in fewer revenues from digital formats. Conversely, illegal downloading could lead to a decrease in sales of legal CDs and digital formats.

11 - RAND (2012): Measuring IPR infringements in the internal market. Report prepared for the European Commission. RAND proposed to analyse ex-post the forecast errors on the level of individual companies, using company-specific explanatory variables. However, attempts at implementing the methodology in this manner were not successful, mainly due to the fact that most companies are not able or willing to provide the required data on past budgeted and actual sales revenues. Therefore, the methodology has been modified to allow its use on sector-level data which can be obtained from public sources.

The methodology builds on an adaptation of an approach developed by RAND Europe for the European Commission<sup>11</sup> so that it can be used on a sectorial level rather than on a firm level (as originally contemplated in the methodology but which proved very difficult to apply in practice).

Variations in the sector's sales are analysed using statistical techniques which allow the researcher to relate them to economic and social factors and thereby estimate the amount of sales lost by rights holders due to infringement of IP rights.

Loss of sales also leads to loss of employment in the affected sector, which can be derived from EU statistical data on employment for the sector in question.

## 2) INDIRECT EFFECTS OF PIRACY

12 - Those sectors include: Wholesale trade, legal and accounting services, real estate, telecommunications, creative arts and entertainment services, security and investigation, financial services, and electricity.

In addition to the direct loss of sales in the recorded music sector, there are also impacts on other sectors of the EU economy<sup>12</sup>. These indirect effects are a result of the fact that the different sectors of the economy buy goods and services from each other for use in their production processes. If one sector's sales are reduced because of piracy, then this sector will also buy fewer goods and services from its suppliers, causing sales declines and corresponding employment effects in other sectors<sup>13</sup>.

## 3) IMPACTS ON PUBLIC FINANCES

13 - It must be noted that the size of the indirect effect is likely to be affected by the ongoing switch from physical to digital formats. This is likely to reduce the indirect impact over time, since production of digital content requires fewer inputs from other sectors than production of the same content on physical media.

Since the activity in question is illegal, it is likely that those engaged in it do not pay taxes on the resulting revenues and incomes. Therefore, an additional impact of music piracy is the resulting loss of tax revenue by government, specifically income taxes and social contributions, corporate taxes, and indirect taxes such as excise taxes or VAT.

In order to approximate these costs, several relationships are estimated. The methodology is fully explained in the Appendices and is briefly outlined below.

### Step 1: Estimation of lost sales due to infringement of IP rights

Predicted sales of the sector in physical and digital formats are generated and compared with actual sales in each country, as reported by IFPI. The difference can then be explained by socio-economic factors such as GDP growth or GDP per capita. In addition, factors related to infringement of IP rights are considered, such as the behaviour of consumers<sup>14</sup>, and the characteristics of the country's markets and its legal and regulatory environments<sup>15</sup>. The difference between forecast and actual sales is analysed in order to extract the effect of illegal consumption of music on legitimate sales.

14 - Results from the IP perception study published by EUIPO are used, such as percentage of people considering it acceptable to download illegal content for personal use or people wondering if a site was legal.

### Step 2: Translation of lost sales into lost jobs and lost public revenue

Since the legitimate industry sells less than it would have sold in the absence of piracy, it also employs fewer workers. Data from Eurostat on employment in this sector are used to estimate the employment lost related to the reduction of legitimate business as a result of lost sales due to piracy. Although direct lost sales are estimated separately for physical and digital formats, employment and indirect effects are only estimated for the aggregate of both formats, as official data does not consider the breakdown of music sales by formats.

15 - The Worldwide Governance Indicator of Control of Corruption from the World Bank is used in this study.

In addition to the direct loss of sales in the sector being analysed, there are also indirect impacts on other sectors as this sector will also buy fewer goods and services from its suppliers, causing sales declines and corresponding employment effects in other sectors.

Furthermore, the reduced economic activity in the private sector has an impact on government revenues as well, primarily tax revenue such as VAT, household income tax and tax on company profits, but also social security contributions.

It should be noted that the indirect effects of sales lost due to infringement of IP rights only include losses in sectors that provide inputs to legal distribution in the EU. Possible positive effects of inputs provided for illegal distribution of music are ignored in this study. In other words, the indirect effect calculated is a gross effect that does not take into account the long-term effect of sales displacement from legal to illegal distributors. The net employment effect could therefore be smaller than the gross effect calculated here.

Unfortunately, data currently available do not allow for calculation of these net effects with any degree of accuracy.

The next section presents the main findings of the study.

## 2. Impact of piracy in the Music Sector

THE ECONOMIC COST OF IPR INFRINGEMENT IN THE RECORDED MUSIC INDUSTRY

The basis for the analysis is data on the expenditure on recorded music in EU Member States. In previous studies official data from Eurostat was used to estimate the total value of consumption in each country, at consumer or producer prices depending on the availability of data on trade margins.

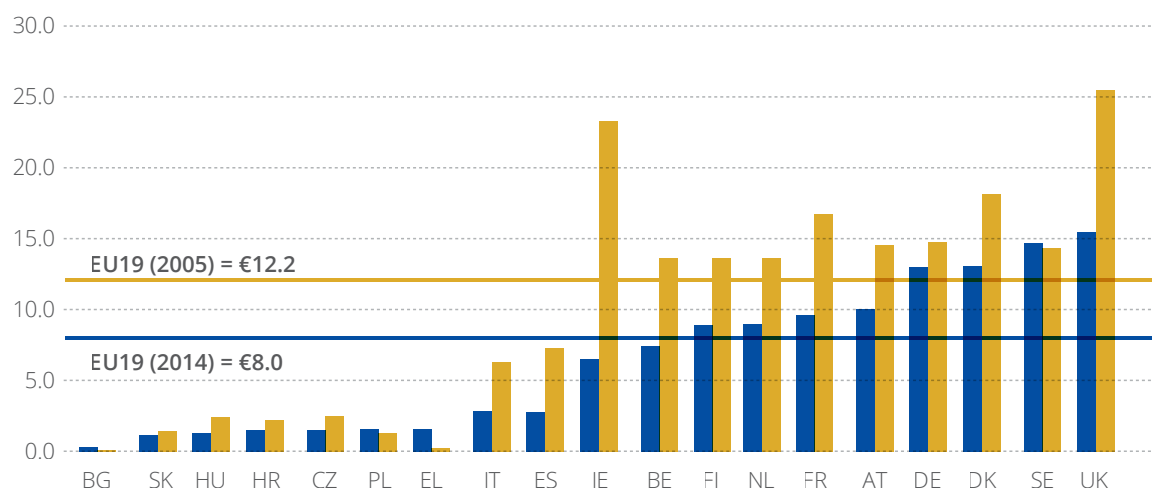
For the music sector, NACE class 5920 includes sound recording and music publishing activities. Production data covering this class can be obtained from the Structural Business Statistics (SBS). Due to changes in official classification, however, these data are only available for the period 2008-2013. Consequently, as a result of an insufficient time span, this data source could not be used to produce robust forecasts of recorded music sales.

16 - Performance rights account for 9% of recorded music revenues in the EU, and the remaining 4% are synchronisation revenues.

Instead, comprehensive data, covering sales of recorded music for 19 EU Member States (2005-2014), was purchased from IFPI. This data can be disaggregated by country, year and recording format, and allows the construction of robust forecasts including physical and digital sales, which together in 2014 accounted for 87% of all recorded music revenues<sup>16</sup>.

Total music sales across the four formats for 19 EU countries amounted to €3.7 billion (approximately one third of the world total according to IFPI's data) or €8 per capita in 2014. This average disguises big differences among countries and also over time as is shown in the following figure.

### PER CAPITA TOTAL MUSIC SALES (EUR)



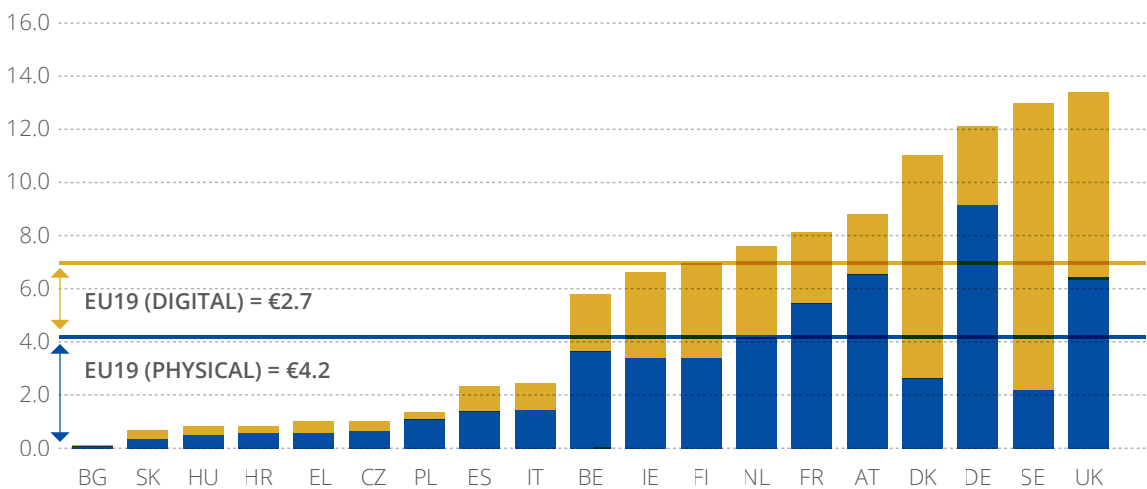


Overall, per capita music sales in these 19 EU Member States have declined by one third during the past decade, from €12 in 2005 to €8 in 2014. However, as discussed earlier, the trends of music sales in physical and digital formats are completely different. During the decade in question, physical sales declined by 60% (from €5 billion in 2005 to €2 billion in 2014) while sales in digital formats increased tenfold during the same period (from €130 million to €1.3 billion).

The figure below shows per capita music sales in 2014 by country, covering sales in physical and digital formats. Music sales in both formats totalled €3.2 billion in 2014 or €7 per capita. This total rises to €3.7 billion (and €8 per capita) when performance rights and synchronisation revenues are included.

Two countries in particular illustrate the different music market structures found in Europe. Despite Sweden and Germany having similar per capita music expenditure, the split between digital and physical sales in their respective markets is very different. In Sweden per capita expenditure on physical formats totals €2.2, whilst in Germany this figure rises to €9.1. The corresponding figures for digital sales, however, are reversed: €10.8 in Sweden and €2.9 in Germany.

PER CAPITA PHYSICAL AND DIGITAL MUSIC SALES 2014 (SALES)



These differences in market structures provided the rationale for the use of separate (but linked) models to analyse and forecast developments in physical and digital sales of recorded music.

## Direct impact

Based on IFPI data on physical and digital sales, the difference between forecast and actual sales has been estimated for each country by format (physical and digital)<sup>17</sup>. For this sector, bivariate forecasting models have been considered so that forecast models for physical (digital) sales estimate expected revenues based on the past values of both formats. In this manner, the relationship between physical and digital sales is incorporated into forecasts.

Differences between expected and actual sales in both formats are independently analysed using statistical methods (described fully in Appendix B), relating the sales shortfall to factors (called variables in economic parlance) such as:

- **GDP growth rate and per capita GDP** (socio-economic variables);
- the percentage of the population **wondering if a site from which they were about to download music or videos was legal or not** and the percentage considering it **acceptable to download content from the internet when it is for personal use** as reflected in the IP Perception study; and the growth rate of the **World Bank Index of Control of Corruption**<sup>18 19</sup> (variables related to piracy).

17 - The methodology is described in detail in Appendix A.

18 - The Control of Corruption index captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.

19 - According to WCO (2012), "the predominance of the informal economy is then associated with corruption and the degree of regulation..." So, to the extent that counterfeiting and piracy are part of the informal economy, a measure of corruption could be considered explanatory for infringement of IP rights.

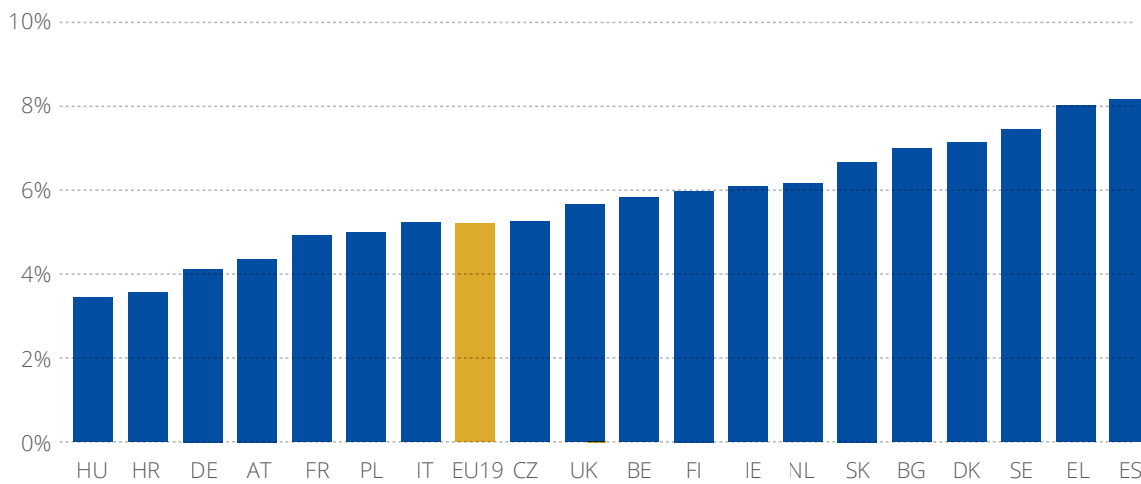
The rationale behind the selection of explanatory variables lies in the idea that differences between predicted and actual sales in a given country can be partly explained by economic or social factors (including both cyclical factors such as recessions and structural ones such as per capita income or demographic composition of the population), and partly by the consumer's willingness to infringe IP rights in both the physical and digital sphere, as evidenced by responses to surveys such as the 2013 IP Perception Study by EUIPO, similar questions from Eurobarometer surveys, and indices related to corruption and quality of governance published by organisations such as the World Bank. The specific variables selected for inclusion in the analysis vary slightly from sector to sector, but inclusion of a variable from each of the two groups has been a common feature of all previous sectorial studies in this series. As in all analyses of this type, there is a risk that there are other factors, not detected by the researcher, behind the observed variations in sales. One can utilise econometric methods to attempt to minimise such omitted variable bias but as in all empirical work it cannot be guaranteed with certainty that all relevant factors have been taken into account. The music industry is particularly complex in this regard due to the structural shifts taking place.

With those caveats, the resulting estimates of lost sales due to infringement of IP rights for all 19 Member States are shown in the figure below. This is the direct impact of piracy discussed



above, showing the combined effects on physical and digital formats sales. For each country, the bar indicates the impact of infringement of IP rights on the recorded music sector, expressed as a percentage of legitimate sales and estimated as an average in the period 2010-2014.

LOST SALES / TOTAL SALES (%)



For the 19 EU Member States considered, the estimated total effect of infringement of IP rights amounts to 5.2% of recorded music sales. This ratio is a result of 2.9% lost sales in physical formats and 8.8% of digital formats sales.

Total lost sales in 2014 amount to €170 million of which €57 million are lost sales in physical formats and €113 million are lost in digital formats.

This is the direct estimate of sales lost by the legitimate recorded music industry in the EU due to piracy.

Since the legitimate industry sells less than it would have in the absence of piracy, it also employs fewer workers. Data from Eurostat on sectorial employment-to-sales ratios are used to estimate the corresponding employment loss in the legitimate music sector due to piracy, resulting in a total of 829 lost jobs across the 19 Member States in 2014.

Country-level estimates of lost sales expressed both as a percentage of total sales and in Euro are shown in the table below.

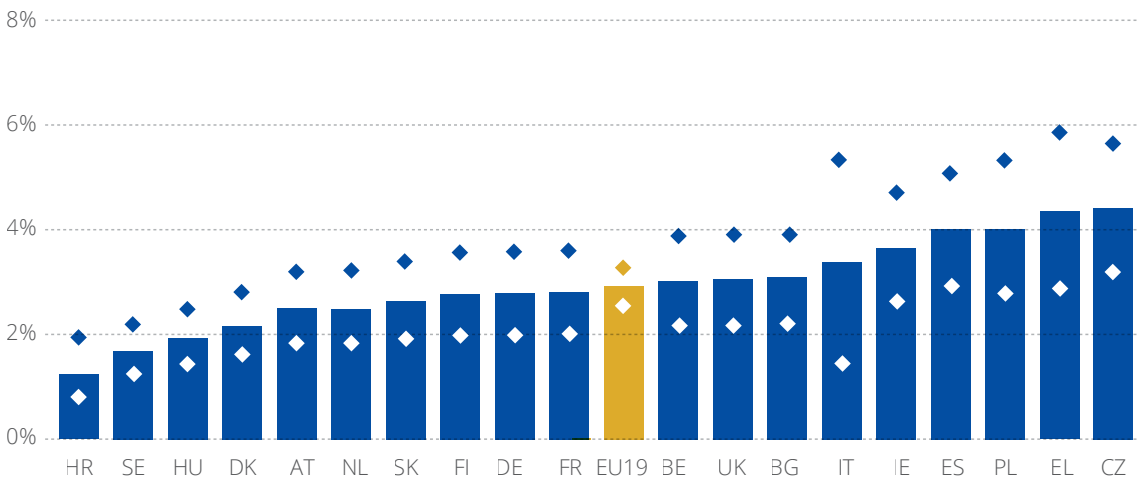
	Average % (physical+digital sales)	Lost sales 2014 (thousand €)
AUSTRIA	4.3	3,206
BELGIUM	5.9	3,807
BULGARIA	7.0	74
CZECH REPUBLIC	5.3	589
GERMANY	4.1	40,375
DENMARK	7.1	4,415
GREECE	8.0	923
SPAIN	8.2	9,068
FINLAND	6.0	2,268
FRANCE	4.9	26,376
CROATIA	3.6	127
HUNGARY	3.5	282
IRELAND	6.1	1,872
ITALY	5.2	7,766
NETHERLANDS	6.2	7,922
POLAND	5.0	2,631
SWEDEN	7.4	9,273
SLOVAKIA	6.7	257
UNITED KINGDOM	5.7	48,647
<b>EU19</b>	<b>5.2</b>	<b>169,878</b>

The biggest absolute impacts are found in the United Kingdom, Germany and France. This is in spite of the relative losses in Germany and France being below the average for the EU19, and that of the UK only slightly surpassing the average. In aggregate, these three countries account for 73% of the total lost music sales in the 19 Member States included here.

**Physical music subsector:**

The figure below shows country-level lost physical sales as a result of infringement of IP rights. For each country, the bar indicates the impact of piracy on the physical music subsector, expressed as a percentage of sales, while the diamonds indicate the 95% confidence interval of that estimate<sup>20</sup>. The figures represent an annual average for the years 2010-2014.

LOST PHYSICAL SALES (%)



<sup>20</sup> - The 95% confidence interval is a statistical calculation which means that there is a 95% probability that the true figure lies between the lower and upper bounds of that interval. For example, for the 19 EU countries, the estimated percentage of lost sales is 2.9%, with a 95% probability that the true percentage lies between 2.5% and 3.2%, as shown in the table.

The greatest absolute impacts are found in countries with large music markets, including Germany, France and the UK, accounting for 35%, 22% and 18% of total lost sales, respectively.

In general, the losses in sales of physical media resulting from IPR infringement are lower than the losses in digital media sales.

The following table shows the relative effects in lost sales by country, the associated confidence intervals, and the absolute value of the direct effect of IPR infringement on the physical music subsector in 2014.

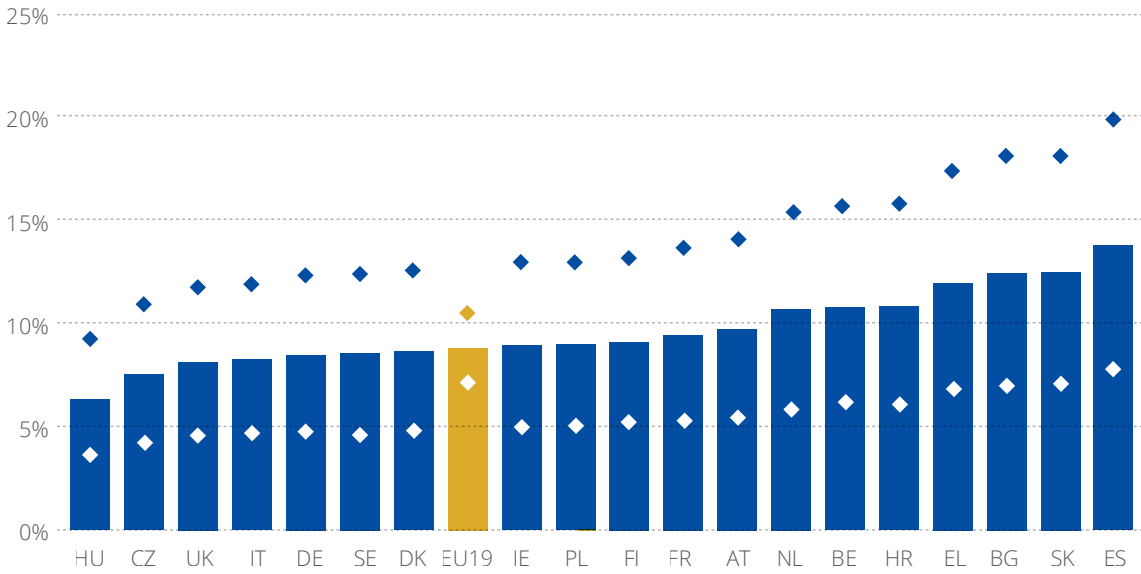


Lost physical sales	Lower 95%	Average	Upper 95%	Lost sales 2014 (thousand €)
AUSTRIA	1.8	2.5	3.2	1,383
BELGIUM	2.2	3.0	3.9	1,253
BULGARIA	2.2	3.1	3.9	19
CZECH REPUBLIC	3.1	4.4	5.6	288
GERMANY	2.0	2.8	3.5	20,333
DENMARK	1.6	2.2	2.8	323
GREECE	2.8	4.3	5.8	294
SPAIN	2.9	4.0	5.1	2,619
FINLAND	2.0	2.8	3.5	510
FRANCE	2.0	2.8	3.6	10,028
CROATIA	0.5	1.2	2.0	32
HUNGARY	1.4	1.9	2.5	125
IRELAND	2.6	3.6	4.7	570
ITALY	1.4	3.3	5.3	3,036
NETHERLANDS	1.8	2.5	3.2	1,727
POLAND	2.7	4.0	5.3	1,696
SWEDEN	1.2	1.7	2.1	362
SLOVAKIA	1.9	2.6	3.4	43
UNITED KINGDOM	2.2	3.0	3.9	12,358
<b>EU18</b>	<b>2.5</b>	<b>2.9</b>	<b>3.2</b>	<b>56,999</b>

### Digital music subsector:

The figure below shows the lost sales due to infringement of IP rights in the digital music subsector. The figure represents an annual average for the years 2010-2014 and includes the relative effect as a percentage of sales as well as 95% confidence intervals, indicated by the diamonds.

LOST DIGITAL SALES (%)



The table below shows the 2014 lost sales for the digital subsector in each country.

Lost digital sales	Lower 95%	Average	Upper 95%	Lost sales 2014 (thousand €)
AUSTRIA	5.4	9.7	14.0	1,824
BELGIUM	6.0	10.9	15.7	2,555
BULGARIA	6.9	12.5	18.0	56
CZECH REPUBLIC	4.2	7.5	10.9	301
GERMANY	4.7	8.5	12.2	20,042
DENMARK	4.8	8.7	12.5	4,092
GREECE	6.7	12.0	17.3	629
SPAIN	7.6	13.7	19.9	6,449
FINLAND	5.1	9.1	13.1	1,758
FRANCE	5.2	9.4	13.6	16,347
CROATIA	6.1	10.9	15.8	94
HUNGARY	3.5	6.4	9.2	157
IRELAND	5.0	8.9	12.9	1,302
ITALY	4.6	8.2	11.9	4,730
NETHERLANDS	5.9	10.6	15.3	6,195
POLAND	5.0	8.9	12.9	935
SWEDEN	4.8	8.6	12.4	8,910
SLOVAKIA	7.0	12.5	18.1	214
UNITED KINGDOM	4.5	8.1	11.7	36,289
<b>EU19</b>	<b>7.1</b>	<b>8.8</b>	<b>10.5</b>	<b>112,878</b>

The United Kingdom exhibits the highest absolute effect and accounts for one third of total lost digital sales. Germany accounts for 18% of total lost sales, although both show a relative effect below the EU 19 average. Lost sales in France represent 14% of the total, whilst having a relative effect slightly above the average.

A higher relative effect is estimated for Spain, but as a result of a lower value of digital music sales, total lost sales are estimated at €6.4 million, which represents only 6% of total lost sales across the 19 Member States. Sweden has a ratio of lost sales below the average, but due to

the importance of digital music sales in this country, total lost digital sales are higher than in Spain, at €8.9 million, or 8% of the 19-country total.

As noted earlier, the share of physical and digital formats in total music sales is different across the 19 Member States. Sweden and Denmark are interesting examples. The ratio of lost sales due to infringement in both physical and digital formats is below the respective EU average in these markets, although both countries have a relative effect in total sales significantly above the average. This is explained by the high share of digital formats in total sales (83% in Sweden and 76% in Denmark)—and as shown in this section, the percentage of sales lost is highest for digital music.

Indirect impact

In addition to the direct loss of sales in the music sector, there are also impacts on other sectors of the EU economy, as the sector suffering lost sales due to piracy will also buy fewer goods and services from its suppliers, causing sales declines and corresponding employment effects in other sectors.

To assess this indirect impact, data from Eurostat<sup>21</sup> is used to calculate how much the music sector buys in the EU from other sectors in order to produce what it delivers<sup>22</sup>.

Across the 19 EU Member States in 2014, the total direct and indirect effects of lost sales due to piracy amounted to €336 million.

Thus, beyond the direct effects on the music sector of €170 million, a similar amount is lost in other sectors of the economy due to piracy. This is the indirect effect of piracy<sup>23</sup>.

Turning to employment, adding losses in the supplier sectors to the direct employment loss, the total employment loss resulting from infringement of IP rights in the music sector is estimated at 2,155 in 2014.

Finally, the reduced economic activity in the legitimate private sector has an impact on government revenue as well<sup>24</sup>. If this assumption is accepted, the lost taxes that sales of music valued at €170 million would have generated can be calculated, as well as the tax revenues corresponding to the total (direct + indirect) loss of €336 million calculated above.

21 - Input-Output Tables (IOT) published by Eurostat provide the structure of input requirements for the production of a certain level of final demand acknowledging whether the origin of these inputs are either domestic or imported. The IOT used in this report are based on ESA 2010, unless otherwise indicated.

22 - The input-output tables are provided by Eurostat at division level (2 digit NACE level) or aggregation of divisions instead of class level (4 digit level). This means that for calculating the impact of the sales reduction in 5920 NACE class, it is necessary to use the structure of 'Motion picture, video and television programme production services, sound recording and music publishing: programming and broadcasting services' industry (NACE 59-60).

23 - As mentioned in Section 1, 23 - this calculation assumes that the counterfeit or pirated products are produced outside of the EU. If they are (partly) produced inside the EU, then the impact would be less than shown here since those illicit producers would presumably source some of their inputs from EU producers.

24 - According to WIPO (2010) and OECD (2008), most of the empirical work assumes that counterfeiting occurs in informal markets that usually do not generate tax revenues.

25 - National Accounts tax aggregates are published by Eurostat and provide information on total payments for these three taxes to all levels of government.

26 - VAT generated by indirect effects is not estimated because inputs are intermediate uses that in general do not pay VAT.

27 - For the estimation of indirect impacts at country level, harmonized Input-Output tables based on ESA 2010 and provided by Eurostat are used.

The three main types of tax considered are<sup>25</sup>: Value Added Tax (VAT), taxes on household income, and taxes on the income or profits of companies.

- 1) Lost VAT is estimated on the basis of household consumption of direct lost sales in music (€170 million)<sup>26</sup>, at approximately €27 million.
- 2) Lost household income tax, estimated on the basis of the share of wages corresponding to lost employment in total wages, accounting for both direct and indirect employment effects, amounts to €14 million.
- 3) Lost tax on corporate profits is estimated from the share of direct and indirect costs to industry and amounts to €4 million.

In addition, social security contributions linked to the direct and indirect employment losses are also estimated. Social security contributions data by industry are available from Eurostat, so that social security contributions per employee in each industry can be used to calculate lost contributions as a consequence of piracy. These lost social security contributions amount to €18 million.

The total loss of government revenue (household income taxes and social security contributions, corporate income taxes and VAT) can therefore be roughly estimated at €63 million.

### Country-level total impact

The table below provides detail on both the direct and indirect impacts on sales of piracy for selected Member States<sup>27</sup>.

million euros	Direct effects	Total effects
UNITED KINGDOM*	48.6	78.7
GERMANY	40.4	66.6
FRANCE	26.4	48.1
SWEDEN	9.3	15.4
SPAIN	9.1	18.9
NETHERLANDS*	7.9	14.7
ITALY	7.8	14.9
<b>EU19</b>	<b>169.9</b>	<b>336</b>

*\*Harmonized Input-Output tables for UK and the Netherlands available in Eurostat are based on ESA 1995.*

### 3. CONCLUSIONS AND PERSPECTIVES

THE ECONOMIC COST OF IPR INFRINGEMENT IN THE RECORDED MUSIC INDUSTRY

The studies attempting to quantify the scale and impact of IPR infringements in cosmetics and personal care, clothing and footwear, sports goods, games and toys, jewellery and watches, handbags and luggage and now the music sector, have provided coherent estimates of the size of the problem of counterfeiting and piracy for legitimate businesses and society in terms of lost sales, leading to lost jobs and loss of public revenue. These studies have used a common methodology and demonstrated the benefits from working in cooperation with stakeholders to take advantage of their high quality data and knowledge of market conditions while also relying on harmonised European statistical data for the analysis.

The present study is the most complex of the sectorial studies carried out to date, due to the inherent complexity in the recorded music industry<sup>28</sup>. During the past two decades, the sector has been profoundly transformed by technological change and by the emergence of new business models. The invention of the MP3 format and the rise of the Internet have facilitated both licit and illicit consumption of music. The resulting new business models and delivery methods, such as streaming, have reduced the revenues of the recorded music sector, with apparent stabilisation at a lower level during the most recent two years<sup>29</sup>.

The question of whether piracy reduces sales of recorded music has been the subject of many studies, sometimes with contradictory results. Some authors have claimed that piracy actually increases sales by allowing consumers to sample music they would not otherwise have considered purchasing. However, a recent literature survey by Danaher et. al. (2016) shows that out of 25 studies reviewed, 22 found that piracy reduced the revenue of the legal industry. Thus, the results of the present study are in line with the prevailing consensus, albeit utilising a completely different methodology.

The sectorial studies published to date will be followed in the coming months by other similar studies covering additional sectors, applying the same methodology and combining it with knowledge from industry stakeholders. These sectors include medicines; wine and spirits; computers; and other sectors, such as smartphones, depending on availability of data.

In parallel, the Observatory has carried out joint study with the Organization for Economic Cooperation and Development (OECD) to estimate the value of counterfeit and pirated goods in international trade. That study, published in April 2016, estimated the value of international trade of counterfeit goods in 2013 at €338 billion (USD 461 billion) globally, corresponding to 2.5% of world trade. The corresponding figures for the EU were €85 billion (USD 116 billion), representing 5% of EU's imports from the rest of the world.

28 - It is important to acknowledge that the scope of the present study is not "the music industry" but only a part of that industry, namely sales of recorded music. Other revenue streams such as concert ticket sales or merchandising are not considered.

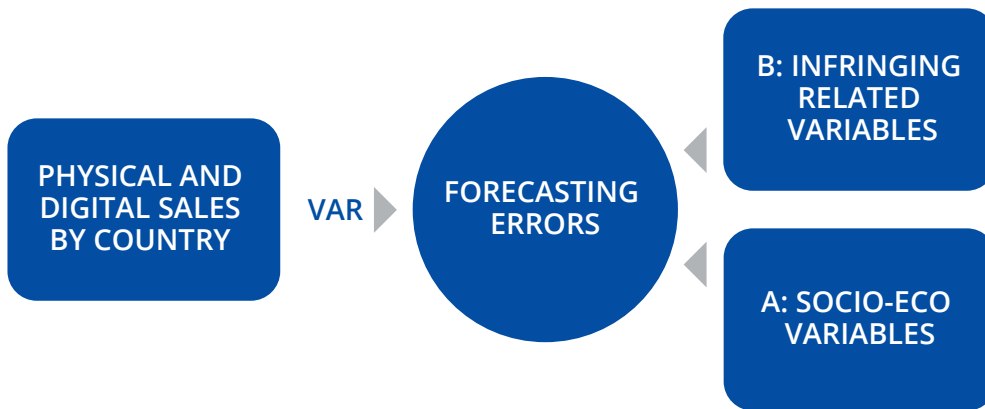
29 - See IFPI's Global Music Report 2016.

Taken together, these studies complement each other and will provide a complete and objective picture of the impact of IPR infringements in Europe, in order to help policy makers develop effective enforcement policies.

# APPENDIX A: THE FIRST STAGE FORECASTING MODEL

THE ECONOMIC COST OF IPR INFRINGEMENT IN THE RECORDED MUSIC INDUSTRY

The estimation of economic effects of infringement of IP rights in the music sector is conducted via a two stage model. The first stage is comprised of a prediction model which provides forecasts and forecast errors of recorded music sales revenues. The second phase seeks to decompose these forecasting errors into shares attributable to economic and piracy effects.



In contrast to previous analyses, instead of considering total music sales as the target variable, two time series by country are considered, namely physical and digital sales. This approach provides a comprehensive picture of trends in the music market and allows sales in the two channels to be correlated. Another advantage of this approach is that one can consider different explanatory variables for physical and digital sales models in the second phase.

The starting point of this analysis is the estimation of forecasting models of sales at country level based on IFPI data. As recorded music sales are considered in two formats (physical and digital), the main difference with previous models estimated for physical goods, such as cosmetics or clothing, is the creation of two time series of sales for each country.

For the two music sales formats, two options were considered:

1. To estimate two independent univariate ARIMA models for each country and one bivariate econometric model in the second stage that includes the relationship between sales in both formats.



2. To estimate one bivariate Vector Autoregressive (VAR) model for each country and two univariate econometric models in the second stage. VAR models are a multiple time series generalisation of univariate AR models that take into account the interdependence between sales in both formats. These models are used when the value of one variable is not only related to the value in the past of the same variable but, in addition, depends on past values of other variables.

30 - Results using different forecasting models are available on request.

Both alternatives were estimated and bivariate VAR model results were found to generate better and unbiased forecasting errors<sup>30</sup>. These models also have the added benefit of allowing the estimation of different relationships between sales in physical and digital formats in each country.

The VAR model, for country  $i$ , where subscripts 1 and 2 represent physical and digital music sales, respectively, is represented by the next two equations:

$$\begin{aligned}
 Y_{1it} &= f(Y_{1it-1}, Y_{1it-2}, \dots, Y_{1it-n}, Y_{2it-1}, Y_{2it-2}, \dots, Y_{2it-n}) + u_{1it} \\
 Y_{2it} &= f(Y_{1it-1}, Y_{1it-2}, \dots, Y_{1it-n}, Y_{2it-1}, Y_{2it-2}, \dots, Y_{2it-n}) + u_{2it}
 \end{aligned}$$

In this model, physical (digital) sales of country  $i$  in year  $t$  is explained by past values of sales in the same format and also sales in the other format. In the extreme but improbable case that digital sales are not influencing physical sales (or vice versa), two univariate models explaining sales in each format would result.

A VAR( $p$ ) model is represented as follows, with a 2-dimensional vector as the dependent variable and each parameter a 2x2 matrix. In matrix notation,  $Y_t$ ,  $\mu$  and  $u_t$  are 2x1 vectors and  $A_i$  2x2 matrices:

$$Y_t = \mu + A_1 * Y_{t-1} + A_2 * Y_{t-2} + \dots + A_p * Y_{t-p} + u_t$$

Developing the elements of each vector and matrix yields:

$$\begin{pmatrix} Y_1 \\ Y_2 \end{pmatrix}_t = \begin{pmatrix} \mu_1 \\ \mu_2 \end{pmatrix} + \begin{pmatrix} \alpha_{111} & \alpha_{121} \\ \alpha_{211} & \alpha_{221} \end{pmatrix} * \begin{pmatrix} Y_1 \\ Y_2 \end{pmatrix}_{t-1} + \begin{pmatrix} \alpha_{112} & \alpha_{122} \\ \alpha_{212} & \alpha_{222} \end{pmatrix} * \begin{pmatrix} Y_1 \\ Y_2 \end{pmatrix}_{t-2} + \dots + \begin{pmatrix} \alpha_{11p} & \alpha_{12p} \\ \alpha_{21p} & \alpha_{22p} \end{pmatrix} * \begin{pmatrix} Y_1 \\ Y_2 \end{pmatrix}_{t-p} + \begin{pmatrix} u_1 \\ u_2 \end{pmatrix}$$

It is assumed that  $u_t$  is a 2-dimensional white noise process, with 0 mean and covariance matrix  $\Sigma_u$  nonsingular, such that,

$$E(u_t u_t') = \Sigma_u \text{ and } E(u_t u_s') = 0 \text{ for } s \neq t.$$

The errors  $u_t$  for different periods are therefore uncorrelated but there is correlation between  $u_{1t}$  and  $u_{2t}$  as expressed in elements out of the diagonal of the  $\Sigma_u$  matrix.

The most appropriate lag length of the VAR(p) model was determined through the use of test statistics, including the Final Prediction Error (FPE) and three different Information Criteria: Akaike (AIC), Hannan-Quin (HQIC) and Schwarz (SBIC).

In general, variables describing music sales are not stationary (or integrated), as demonstrated by the negative trend in physical music sales versus the positive trend in digital music sales. If both series were integrated one could model their relationship by taking differences of each series and including the differences in a VAR, instead of analysing the data in levels.

However, a better approach to modelling the data could be obtained if an order of co-integration between the two sales series could be identified.

If the series are cointegrated they move together in the long run. In this case, there exists a linear combination of the variables which is stationary:

$$Z_t = \alpha Y_t$$

This equation expresses the long-run equilibrium relation between the two variables.

If two components of  $Y_t$  are  $I(1)$  and  $\alpha Y_t$  is  $I(0)$  then  $Y_t$  is  $CI(1,1)$ . The vector  $\alpha$  is called the cointegration vector and the process consisting of cointegrated variables is called a cointegrated process.

The order of integration and the presence of a co-integrated process between physical and digital sales are tested for each country<sup>31</sup>. If the variables are found to be integrated and a cointegration relation is detected, the VAR representation in first differences is not used and a VECM (Vector Error Correction Model), of the following form is employed instead:

$$\Delta Y_t = \mu + \alpha' Y_{(t-1)} + \pi_1 \Delta Y_{(t-1)} + \dots + \pi_{p-1} \Delta Y_{t-p+1} + u_t$$

31 - Augmented Dickey-Fuller test is used for the selection of the order of integration and Johansen test for testing cointegration relations between physical and digital sales.

Where  $\alpha$  is the cointegration vector and the  $\Pi$  coefficients describe the deviations from the equilibrium relation.

VECM is a restricted VAR that includes cointegration restrictions and is designed for use with nonstationary series that are known to be cointegrated.

For each country the relationship between sales in physical and digital formats was analysed to determine the appropriate forecasting model: VAR or VECM and the optimal lag structure. Finally, diagnosis tests based on residuals (Lagrange multiplier test for autocorrelation and Jarque-Bera test for normality) were used to check compliance with time series models assumptions.

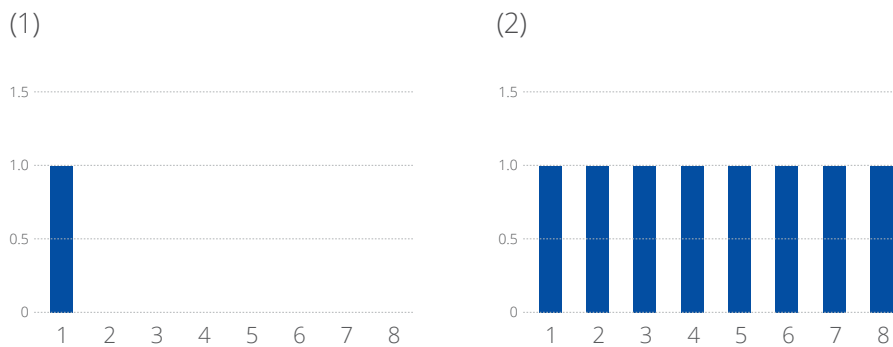
	Integration		CI rank	VECM		VAR		Residual tests	
	Physical	Digital		p	Cointegr vector	p	Level/diff	Lagrange	JB
AT	I(1)*	9.7	1	2	ok			Ok	ok
BE	I(3)*	10.9	1	2	ok			Ok	ok
BG	I(1)	12.5	1	1	ok				
CZ	I(3)*	7.5	1	2	no	1	Diff	Ok	ok
DE	I(2)	8.5	+1	2	ok			Ok	ok
DK	I(2)	8.7	+1	2	ok	2	Level	Ok	ok
EL	I(3)*	12.0	0			1	Diff		ok
ES	I(2)	13.7	+1			2	Level		ok
FI	I(3)*	9.1	0			1	Diff	Ok	ok
FR	I(1)	9.4	1	2	ok			Ok	ok
HR	I(2)*	10.9	+1	1	ok				
HU	I(1)	6.4	1	2	no				ok
IE	I(3)	8.9	+1			2	Level		ok
IT	I(2)	8.2	1	2	no			p=2	ok
NL	?	10.6	1	2	no			Ok	ok
PL	I(2)	8.9	0			1	Level	Ok	ok
SE	I(2)	8.6	0			1	Diff	Ok	ok
SK	I(2)	12.5	1	1	no				
UK	I(1)*	8.1	0			1	Level	Ok	ok

\*with 90% confidence level



Once appropriate models were identified, and before calculating forecasts for both formats in each country, further improvements in each bivariate model were considered. For instance, the effects of exceptional external events that might alter the trend paths of music sales were included in models via the use of dummy variables. Such events might include a new law or the emergence of new formats or types of business (a change in copyright law, the launch in a country of iTunes, Spotify, or relevant new services or new competitors in a specific country). Variables representing these changes are then tested to examine whether they have any influence on sales trends.

Intervention analysis is applied to test these changes. Pulse (1) and Step (2) functions are considered in model testing and are applied to models using growth rates and level data respectively. Consequently, a Pulse function examines the sales impact of an event in one time period, whilst a Step function considers a permanent change in sales as a result of one of the events.



Dummy variables, incorporating Pulse and Step functions were introduced to country bi-variate models to test the impact of the launch of Spotify and iTunes on the sales (Physical and Digital) of the recorded music sector. The impact was found to be significant on digital sales in five countries, with a corresponding decline in physical sales detected in Denmark.

	Digital sales	Physical sales
Denmark (Spotify 2012)	+0.20	-0.13
Spain (Spotify 2009)	+0.16	
Poland (iTunes 2012)	+0.33	
Sweden (Spotify 2009)	+0.68	
UK (Spotify 2009)	+0.19	

Incorporating the Intervention variables in VAR and VEC models, country forecasts of both physical and digital sales are produced for 2010 to 2014. Letting  $\hat{Y}_{1it}$  and  $\hat{Y}_{2it}$  be the forecasts in both formats, relative forecasting errors for physical and digital sales for each country and year are:

$$q^*_{1it} = \frac{\hat{Y}_{1it} - Y_{1it}}{Y_{1it}}$$

$$q^*_{2it} = \frac{\hat{Y}_{2it} - Y_{2it}}{Y_{2it}}$$

Relative forecasting errors are the difference between the prediction and the actual sales in a specific format, expressed as a percentage of actual sales of each format and are shown in the following table (grey cells indicate outliers or missing data not included in the econometric model):

	PHYSICAL					DIGITAL				
	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
AT	-1.6	4.1	-2.7	1.7	-3.9	-5.5	-0.3	3.3	3.0	20.9
BE	2.7	-0.6	-0.6	4.6	-2.3	-3.3	5.6	8.5	-9.4	2.5
BG	-1.3	6.0	-7.7	6.6	-2.8	-0.7	18.8	-28.5	9.4	8.4
CZ	3.1	-4.8	9.1	11.0	-5.7	0.2	11.9	-16.3	13.1	-16.0
DE	4.2	0.1	3.6	-2.1	-2.6	3.2	-1.8	-3.9	1.3	2.3
DK	-1.6	2.1	1.9	-2.1	0.2	5.3	4.9	3.2	2.1	-5.1
EL	59.7	123.6	-31.8	-14.2	-52.2	13.2	26.4	-7.5	6.7	-29.2
ES	11.7	-1.1	-7.3	7.9	-2.5	-2.4	-1.5	6.1	-4.5	0.8
FI	-6.0	-2.4	-13.8	0.1	24.7	-15.0	12.2	9.0	-3.0	17.9
FR	-3.7	-0.5	-1.5	0.0	3.8	0.0	-14.5	7.8	3.4	6.7
HR	-1.4	-2.4	-1.0	-3.1	8.3	18.8	21.8	-13.8	-0.1	-19.8
HU	-2.8	1.4	0.7	6.0	-3.7	133.7	-43.7	-18.5	-1.1	-2.6
IE	3.9	-7.3	7.6	6.9	-7.0	-0.7	1.2	-1.5	-1.1	1.5
IT	-2.4	-9.8	14.2	-0.1	-3.6	6.0	3.2	-5.9	-2.8	3.7
NL	0.4	-1.0	2.3	-1.3	0.0	-10.1	10.8	-7.7	-2.9	8.6
PL		7.4	-5.9	10.0	-3.4		-3.8	4.2	-6.1	2.3
SE	9.3	2.9	-8.7	14.3	6.8	-18.7	-16.8	-14.6	3.4	14.9
SK	-13.4	31.6	-0.1	0.9	-13.0	16.3	-25.8	0.3	10.7	4.4
UK	0.6	-0.1	10.5	-2.9	-1.1	4.2	-2.4	-2.0	-2.1	6.3



It must be underlined that the forecasting errors from VAR/VECM models follow a bivariate white noise process, that is, stationary and thus uncorrelated in time, with zero mean and a stable variance-covariance matrix.

The second part of the estimation process seeks to determine to what extent these forecasting errors can be explained by economic variables and variables related to piracy.

# APPENDIX B: THE SECOND-STAGE ECONOMETRIC MODEL

THE ECONOMIC COST OF IPR INFRINGEMENT IN THE RECORDED MUSIC INDUSTRY

Piracy might be one of a number of factors impacting on the level of legal sales of music in physical or digital formats. There are also, as outlined earlier, a series of economic factors which can explain the forecast errors from the first stage, such as variables related to the economic capacity of households, (e.g. GDP growth) or any other driver of consumption expenditure.

Having accounted for the influence of economic variables on the sales differential, an attempt is made to assess the extent to which variables related to IP rights infringement, or relevant proxies, can explain the propensity to purchase music illegally. Such variables might include measures of consumer and market characteristics, as well as the evolution of a country's legal environment. Since physical and digital formats sales are considered separately, one can estimate different models for explaining sales differential in both formats.

Combining the economic and infringing-related variables allows for the specification of a model whose aim is to explain the aggregate differential (forecast errors) between expected and real sales. The model with two equations is specified in the following format where subscripts 1 and 2 represent physical and digital music sales:

$$q_{1it}^* = \alpha_1 * X_{1it} + \beta_1 * Z_{1it} + \varepsilon_{1it}$$

Where  $X_{it}$  are two matrices of explanatory variables unrelated to piracy and  $Z_{it}$  are two matrices of variables related to infringement. Finally,  $\varepsilon_{it}$  are two vectors of the remaining errors.

Explanatory variables can be specific for only one format or common to both equations.

As the 1<sup>st</sup> stage included the relationship between sales in both formats, it is expected that the two equations can be estimated independently.

32 - Another advantage of the estimation of two independent econometric models is that it allows the consideration of different weights in Weighted Least Squares (WLS) estimations.

This presumption is confirmed in the first instance by a low correlation of 0.11 between the two series of forecasting errors. Test results arising from the bivariate models indicated that there is no gain in using models including both music formats.<sup>32</sup>

Based on  $\beta$  coefficients in both equations and the value of Z variables in each country the value of sales that are lost by the recording industry due to infringement of IP rights can be estimated as follows:

$$\hat{\beta}_1 * Z_{1i} + \hat{\beta}_2 * Z_{2i}$$

The first term will estimate lost sales in physical formats and the second one lost sales in digital formats due to infringement of IP rights in the music market.

Socio-economic explanatory variables unrelated to piracy include:

- 1 - Population growth rate;
- 2 - Population 15-29 years, percentage and growth rate;
- 3 - GDP and GDP growth;
- 4 - Per capita music sales (IFPI);
- 5 - Percentage of performance rights revenues over total music revenues and growth rate (IFPI);
- 6 - Percentage of ad-supported stream revenues over total digital sales (IFPI);
- 7 - Variables selected from Eurobarometer on e-communications (such as percentage of people with CD players, smartphones or Internet access).

The second term of the equation,  $Z_{2i}$ , contains the matrix of variables thought to be related to piracy<sup>33</sup>. These variables include:

33 - A list of factors affecting demand and consumption for counterfeit goods is available in OECD (2008).

- 1 - Attitudes of population to IP rights (from the Observatory's IP perception study);
- 2 - Variables from Eurobarometer on corruption;
- 3 - Variables from Eurobarometer on IPR infringement;
- 4 - Corruption Perception Index;
- 5 - Worldwide Governance Indicators (World Bank), covering Government effectiveness, regulatory quality, rule of law and control of corruption (level and growth).

Variables 1 to 3 in the list are considered to be consumer-related drivers of demand for piracy.

The variables considered for inclusion in the Z matrix from the IP Perception study and the Eurobarometer include: the percentage of the population that had bought counterfeit products intentionally, those who have acquired music in an illicit manner, the percentage of the population that considered, in certain circumstances, buying counterfeit products or illegally downloading to be acceptable or people who wondered or researched if a site was legal, among others.



Variables 4 and 5 in the list are considered to be drivers of piracy related to institutional characteristics of each country.

The Corruption Perception Index is published by Transparency International and measures how corrupt public sectors are seen to be by the public in each country. In this study the updated index is used as a time invariant variable with reference year 2012.

Finally, the Worldwide Governance Indicators reflect the perception of government effectiveness, regulatory quality, rule of law and corruption. They are published annually and range from 2.5 for favourable aspects of governance to -2.5 for poor governance. These indicators are considered as potential proxies for the perceived risk of buying or selling pirated goods.

The rationale behind these variables is that in countries where the population exhibits a high degree of acceptance of counterfeit products and where governance and rule of law are perceived to be weak there is a higher likelihood of consumption of music to be illicit than in countries with good governance, strong rule of law and low corruption. Of course, it must be admitted that other factors, for example, the availability of legal offers in each country, can also be at play. However, in the case of music, there is widespread availability across all EU Member States<sup>34</sup>.

34 - See, for example, Gómez, Estrella and Martens, Bertin, Language, Copyright and Geographic Segmentation in the EU Digital Single Market for Music and Film (May 6, 2015). JRC/IPTS Digital Economy working paper 2015-04.

Selecting only variables that have significant correlation with any of the two dependent variables, different econometric models have been estimated.

35 - Panel data are observations on individual cross-sectional units (countries) over a period of time. The random-effects models are preferred as they allow the inclusion of time-invariant explanatory variables.

Two methods have been applied considering random-effects in panel data models<sup>35</sup>: Generalized Least Squares (GLS) and Between-effects methods. The 1<sup>st</sup> one allows clustered robust standard error (SE) estimation (by country) and it is a combination of 'between' and 'within' estimators. Between-effects method attempts to model the mean response of each country and allows Weighted Least Square (WLS) estimation. In all cases, both methods have been applied for physical and digital sales models.

### Physical music subsector model:

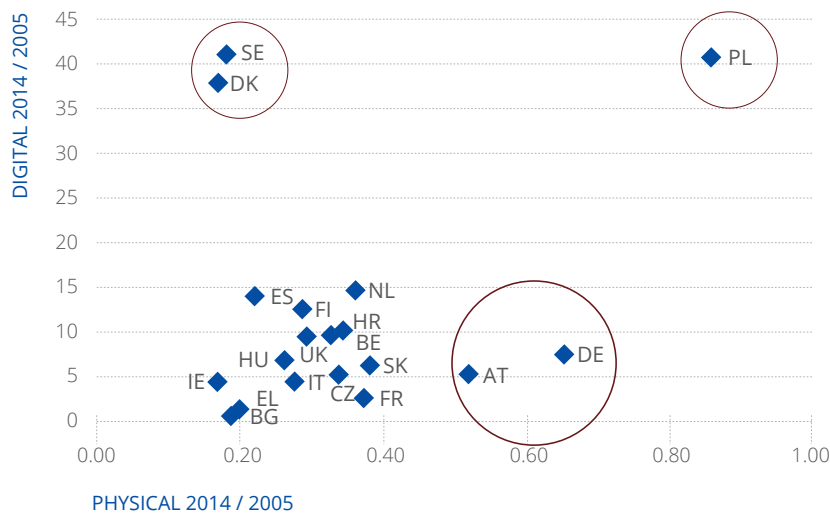
Initially, the only significant explanatory variables of forecasting errors identified for physical sales were demographic, such as the % of population of 15-29 years old and the population growth rate. Other non piracy-related variables, such as the availability of smartphones, mobile subscription access and broadband connexion were also tested, but were not significant.

Across the 19 Member States no significant variables related to infringement were identified to explain forecast errors of physical sales. Analysing the forecasting errors (table in appendix A),

data from Greece appeared to be an outlier and was consequently removed from the analysis.

As confirmed by the figures on per capita music sales of physical and digital formats in section 1 above, the structures of the music markets in Sweden and Denmark are completely different to those of other EU countries. This degree of observation heterogeneity, stemming from these two countries, ensured that it is difficult, if not impossible, to identify a stable econometric model to describe the evolutions of the aggregate EU 19 physical music market.

To propagate this work, therefore, the growth in sales of both formats in all countries, was further analysed as shown below.



As can be seen, physical sales in Sweden and Denmark at the end of the period are 20% of the value of sales 10 years before, while the value of digital sales in 2014 is 40 times higher than the value in 2005, a feature which is not comparable with any other countries in the EU.

Acknowledging these developments, it is also clear (Appendix A) that there is a significant differential between Swedish and Danish forecasting errors of physical sales. It could be that the errors for Denmark are smaller than those for Sweden as a result of the significant Danish Spotify dummy.

These differences for Sweden and Denmark provided sufficient rationale to consider removing these countries from the analysis. Subsequently correlations among forecasting errors and explanatory variables were re-calculated. Once Sweden had been removed correlations changed dramatically, revealing significant coefficients on several infringing-related variables.

36 - These two countries' (Sweden and Greece) sales in physical formats account for 1.4% of physical sales in 19 Member States for which data from IFPI are available.

This confirms that Swedish forecasting errors of physical music sales are influential observations. Removing Denmark only from the analysis does not change the initial results significantly, so a model is re-estimated including data from 17 countries (excluding Sweden and Greece<sup>36</sup>).

37 - All results of diagnostic tests are available on request.

The preferred model produces the following results<sup>37</sup>:

Variable	Coefficient	Robust Standard Error	t Statistic	95% Confidence interval	
				Lower	Upper
Constant	-0.0142	0.0092	-1.54	-0.0323	0.0038
GDP growth	-0.0071	0.0035	-2.05 **	-0.0140	-0.0003
IP Perception: wondered site was legal	0.1811	0.0583	3.11***	0.0669	0.2953
WB Index Control of Corruption (growth)	-0.0061	0.0092	-6.10***	-0.0081	-0.0042

R-square between = 17.8%

Wald Chi-2 statistic = 51.58 \*\*\*

\* significant at 90% confidence level

\*\* significant at 95% confidence level

\*\*\* significant at 99% confidence level

**GDP growth** is a variable not related to infringement and, as is usual in this type of models, has a negative coefficient, meaning that higher values of GDP growth are associated with smaller forecasting errors.

The two variables related to infringement are significant at the 99% confidence level:

- 1. IP Perception variable: % of people wondering if a site was legal.** This variable is time invariant and highly correlated with people declaring that they had bought counterfeit goods intentionally or had been misled and with those who had accessed illegal internet content intentionally. The variable presents high correlation with penetration rates of electronic communication services from the Eurobarometer. The model coefficient has a positive sign implying that it has a positive relationship with 1st stage forecasting errors.
- 2. World Band index of control of corruption (growth rate)** has a negative coefficient, so that a higher value of the growth rate of this index corresponds to better governance and is related to smaller forecasting errors.



The model was estimated using the random-effects GLS method. As the main objective of the model is to estimate the coefficients of the infringing-related variables, the characteristics of these coefficients should be investigated.

To check the stability of these coefficients, other explanatory variables were introduced into the 2nd stage model and also different methods were applied. The resulting estimated coefficients of the infringing-related variables are presented in the following table.

	IP Perception	WB Control Corruption
1	0.1811	-0.0061
2	0.1375	-0.0028
3	0.1482	-0.006
4	0.1837	-0.0069
5	0.1884	-
6	-	-0.0061

These tests show that the coefficients of IPR infringement variables are stable, with the IP perception variable the one with the highest explanatory capacity.

Having optimised the second stage specification model, the impact of piracy is estimated via the following relationship:

$$C^*_{it} = \hat{\beta}_1 * Z_{1i} + \hat{\beta}_2 * Z_{2it}$$

Where  $C^*_{it}$  represents the physical sales lost due to infringement in country  $i$  and year  $t$  (expressed as the fraction of the sector's actual physical sales),  $Z_{1i}$  is the percentage of population that wondered if a site was legal and  $Z_{2it}$  is the value of the World Bank Index of Control of Corruption growth in that country and year<sup>38</sup>. The  $\beta$ 's are the estimated coefficients from the table at the beginning of this section.

38 - It should be noted that in this case, the value of  $Z_{1i}$  is the same for all  $t$  since this variable is time-invariant during the period covered by this study.

Interpretation of this specification is made on the following basis. For a country where 10% of the population wondered if a site was legal and the average growth rate of the Control of Corruption index in 2010-2014 is -1%, the effect of IPR infringement on legitimate sales of music in physical formats is a sales loss of 1.8% ( $0.1811 * 0.10 - 0.0061 * (-0.01) = 0.018$ ).

Finally, based on the value of these two variables in each country, lost music sales in physical format as a percentage of sales are estimated.

### Digital music subsector model:

The potential explanatory variables of forecasting errors of digital sales included: population growth, per capita GDP, ad-supported streams income as a proportion of total digital sales (IFPI), percentage of people declaring that it is acceptable to download content from the internet when it's for personal use (IP Perception study) and percentage of people with mobile subscription access to the internet (Eurobarometer).

Several models were estimated to confirm that **the key variable related to piracy is the % of people considering it acceptable to download content for personal use**. This variable has significant and positive correlations with the percentage of people declaring having accessed illegal content intentionally, having bought fakes intentionally or justifying counterfeiting by price, supporting its use as a proxy for infringement of IP rights in the digital music subsector. Due to problems of multicollinearity, however, additional explanatory variables relating to the infringement of IP rights cannot be included in the same model.

39 - All results of diagnostic tests are available on request.

The preferred model produced the following results<sup>39</sup>:

Variable	Coefficient	Standard Error	t Statistic	95% Confidence interval	
				Lower	Upper
Constant	-0.1362	0.0594	-2.29**	-0.2621	-0.0103
GDP per capita	0.0013	0.0008	1.67	-0.0003	0.0029
IP Perception: acceptable download for personal use	0.2334	0.1183	1.97*	-0.0173	0.0029

R-square between = 24.7%

F-statistic = 2.62 \*

\* significant at 90% confidence level

\*\* significant at 95% confidence level

\*\*\* significant at 99% confidence level

The IP Perception variable is a time invariant variable whose coefficient has a positive sign, implying that a higher percentage of people considering it acceptable to download illegal content from the internet when it is for personal use, is associated with higher forecasting errors estimated in the first stage. This coefficient is significant at the 90% confidence level,



and consequently this results in wider confidence intervals of estimations of the effect of piracy both at the country and EU level.

The final model was estimated using the between-effects Weighted Least Squares (WLS) method that attempts to model the mean response of each country and corrects for problems of heteroscedasticity.

Again, the main objective of this model is to estimate the coefficient of the infringing-related variable, therefore characteristics of this coefficient should be investigated. To check the stability of this coefficient, other explanatory variables were introduced into the model, including income from ad-supported streams, number of people with mobile subscriptions access or the World Bank index on Government Effectiveness. GLS and clustered robust estimation methods were also estimated. The resulting estimated coefficient of the infringing-related variable ranged from 0.194 to 0.228, providing a good indication of its stability.

Finally, estimates of lost digital music sales due to piracy are calculated multiplying the percentage of people declaring that it is acceptable to download content for personal use (IP perception study) in each country by the coefficient estimated for this variable (0.2334) for all 19 Member States.

# APPENDIX C: NACE REV.2 CODES RELATED TO THE MUSIC INDUSTRY

THE ECONOMIC COST OF IPR INFRINGEMENT IN THE RECORDED MUSIC INDUSTRY



## **18.20 Reproduction of recorded media**

This class includes:

- reproduction from master copies of gramophone records, compact discs and tapes with music or other sound recordings

This class excludes:

- ...
- production of master copies for records or audio material, see 59.20

## **46.43 Wholesale of electrical household appliances**

This class includes:

- ....
- wholesale of radio and television equipment
- wholesale of recorded audio and video tapes, CDs, DVDs

This class excludes:

- wholesale of blank audio and video tapes, CDs, DVDs, see 46.52

## **46.52 Wholesale of electronic and telecommunications equipment and parts**

This class includes:

- ....
- wholesale of blank audio and video tapes and diskettes, magnetic and optical disks (CDs, DVDs)

This class excludes:

- wholesale of recorded audio and video tapes, CDs, DVDs, see 46.43

### **47.63 Retail sale of music and video recordings in specialised store**

This class includes:

- retail sale of musical records, audio tapes, compact discs and cassettes
- retail sale of video tapes and DVDs

This class also includes:

- retail sale of blank tapes and discs

### **47.91 Retail sale via mail order houses or via Internet**

This class includes retail sale activities via mail order houses or via Internet, i.e. retail sale activities where the buyer makes his choice on the basis of advertisements, catalogues, information provided on a website, models or any other means of advertising and places his order by mail, phone or over the Internet (usually through special means provided by a website).

The products purchased can be either directly downloaded from the Internet or physically delivered to the customer.

This class includes:

- retail sale of any kind of product by mail order
- retail sale of any kind of product over the Internet

This class also includes:

- direct sale via television, radio and telephone
- Internet retail auctions

### **59.20 Sound recording and music publishing activities**

This class includes the activities of production of original (sound) master recordings, such as tapes, CDs; releasing, promoting and distributing sound recordings to wholesalers, retailers or directly to the public. These activities might be integrated or not with the production of master recordings in the same unit. If not, the unit exercising these activities has to obtain the reproduction and distribution rights to master recordings.

This class also includes sound recording service activities in a studio or elsewhere, including the production of taped ( i.e. non-live) radio programming.



This class also includes the activities of music publishing, i.e. activities of acquiring and registering copyrights for musical compositions, promoting, authorising and using these compositions in recordings, radio, television, motion pictures, live performances, print and other media. Units engaged in these activities may own the copyright or act as administrator of the music copyrights on behalf of the copyright owners. Publishing of music and sheet books is included here.

### **60.10 Radio broadcasting**

This class includes:

- activities of broadcasting audio signals through radio broadcasting studios and facilities for the transmission of aural programming to the public, to affiliates or to subscribers

This class also includes:

- activities of radio networks, i.e. assembling and transmitting aural programming to the affiliates or subscribers via over-the-air broadcasts, cable or satellite
- radio broadcasting activities over the Internet (Internet radio stations)
- data broadcasting integrated with radio broadcasting

This class excludes:

- the production of taped radio programming, see 59.20

### **60.20 Television programming and broadcasting activities**

This class includes the creation of creating a complete television channel programme, from purchased programme components (e.g. movies, documentaries etc.), self produced programme components (e.g. local news, live reports) or a combination thereof.

This complete television programme can be either broadcast by the producing unit or produced for transmission by a third party distributor, such as cable companies or satellite television providers.

The programming may be of a general or specialised nature (e.g. limited formats such as news, sports, education or youth oriented programming). This class includes programming that is made freely available to users, as well as programming that is available only on a subscription basis. The programming of video-on-demand channels is also included here.

This class also includes data broadcasting integrated with television broadcasting.



## **90 Creative, arts and entertainment activities**

This division includes the operation of facilities and provision of services to meet the cultural and entertainment interests of their customers. This includes the production and promotion of, and participation in, live performances, events or exhibits intended for public viewing; the provision of artistic, creative or technical skills for the production of artistic products and live performances.

### **90.01 Performing arts**

This class includes:

- production of live theatrical presentations, concerts and opera or dance productions and other stage

### **90.02 Support activities to performing arts**

### **90.04 Operation of arts facilities**

This class includes:

- operation of concert and theatre halls and other arts facilities

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## THE ECONOMIC COST OF IPR INFRINGEMENT IN THE RECORDED MUSIC INDUSTRY

