

# **CA2 Paper 2 Specimen Paper – Sample summary**

## **Objective**

The purpose of this project is to use data on historic sales of music singles and albums, each separately in physical and digital format, to project forwards future expected sales numbers from 2013 to 2021. This is done using three different projection approaches and then a combined preferred approach.

The projected sales numbers are then combined with price information to project forwards also the expected sales revenues from each format. Hence the year in which annual sales revenue from digital sales is expected to exceed that from physical sales can be estimated.

The projections (numbers and sales revenue) are also performed allowing for adjustment for one particularly high selling album in the most recent data year, and allowing for different assumed future price growth rates.

## **Data**

The main data provided comprises numbers of sales of each of the four music formats (physical singles, physical albums, digital singles, digital albums) from 2007 to 2012 inclusive. This was provided by the Actuarial Recorded Music Industry.

High level checks (performed by eye and graphically) suggest that the sales data is broadly accurate and complete.

Information has also been provided on prices of one unit of each format in 2007 and in 2012.

## **Assumptions**

- The historic sales data provided is correct.
- Historic observed trends in music sales over the period 2007 to 2012 will continue into the future.
- Sales of the Yodelle album were split between physical and digital in the same proportions as all other albums sold in 2012.
- Sales of the Yodelle album occurred uniformly over the twelve months.
- There are no distortions in the historic data other than as described for the Yodelle album.
- No other such material distortions to sales will occur in the future projection period.
- No other musical formats will be introduced in the future projection period.
- Other musical formats (box sets, mini-discs, cassettes, data stick, streaming services, ringtones etc.) are either included in the given data figures or are immaterial and therefore can be ignored.

- There are no other impacts on prices over the projection period, i.e. there is a stable economic situation and underlying inflation remains broadly zero.
- There are no impacts on future volumes as a result of assumed higher prices under the alternative scenario (i.e. prices and sales volumes are independent).

## Projected sales numbers

The following have been determined:

Let  $n_i$  denote the number of sales of a particular format in year  $i$  ( $i = 2007$  to  $2102$ ), as provided in the data.

$x_i$  = the % change (year on year) of sales numbers, for  $i = 2008$  to  $2012$ , for each of the four formats. This is calculated as  $\{n_i / n_{i-1}\} - 1$ .

$X$  = the mean of all  $x_i$  (from  $i = 2008$  to  $2012$ ).

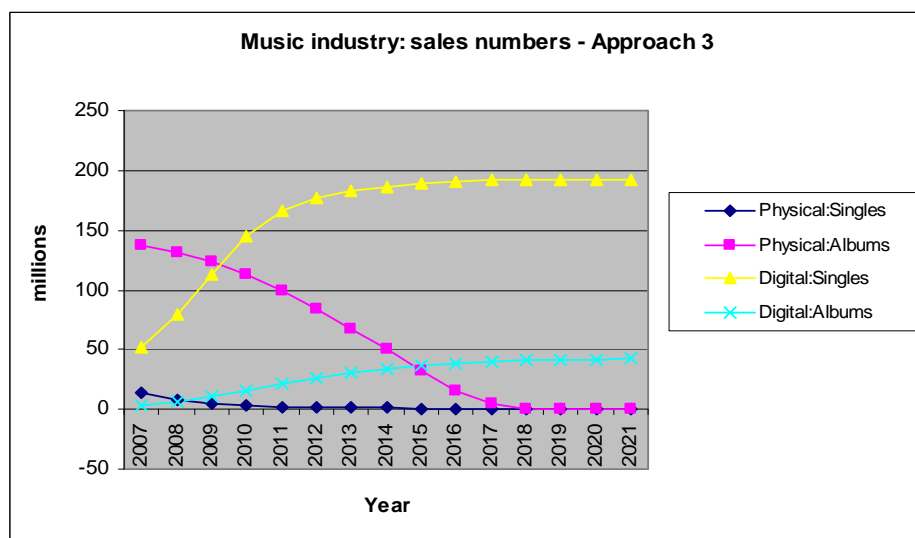
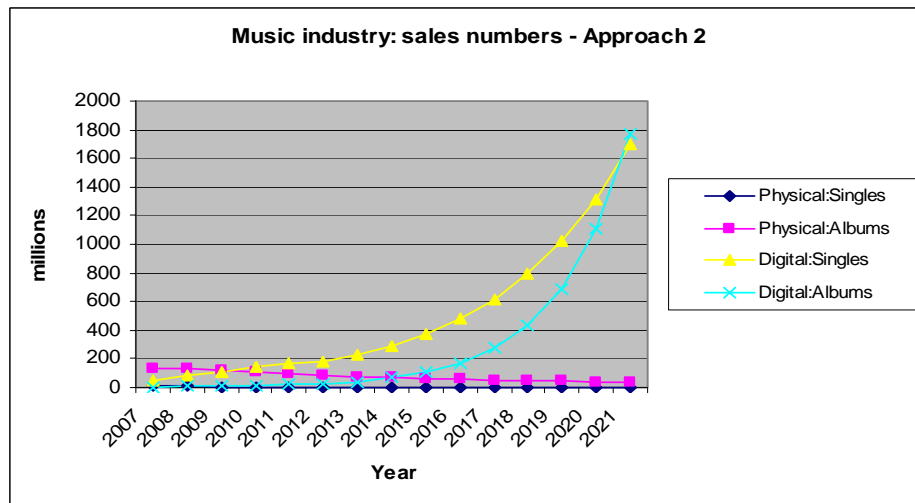
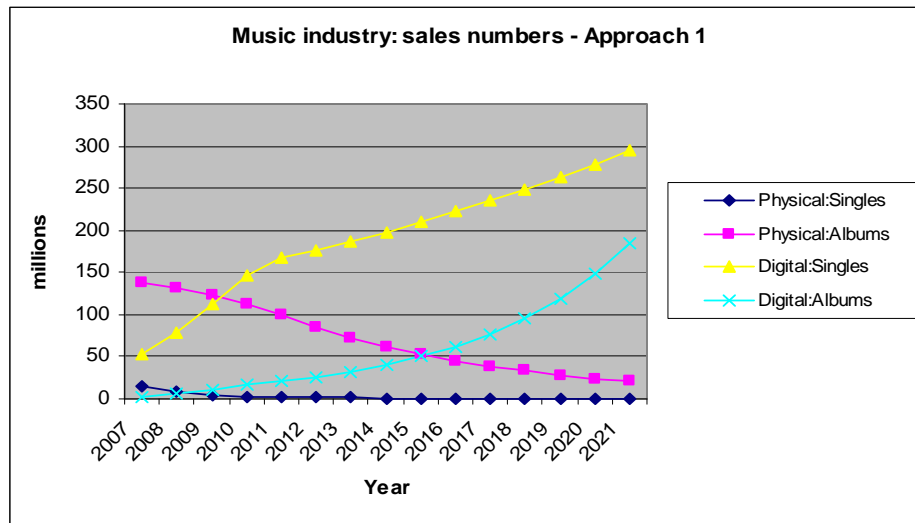
$y_i$  = the ratio of year on year % changes, for  $i = 2009$  to  $2012$ , for each of the four formats. This is calculated as  $x_i / x_{i-1}$ .

$Y$  = the mean of all  $y_i$  (from  $i = 2009$  to  $2012$ ).

Future sales numbers for years  $i = 2013$  to  $2021$  are projected as:

- For Approach 1,  $n_i = n_{i-1} * (1 + x_{2012})$  (i.e. future year on year % change is constant and at the same level as it was from  $2011$  to  $2012$ ).
- For Approach 2,  $n_i = n_{i-1} * (1 + X)$  (i.e. future year on year % change is constant and at the same level as the mean of the % changes over the historic data period)
- For Approach 3,  $n_i = n_{i-1} * (1 + x_{2012} * Y^N)$  (i.e. future year on year % change varies, in line with patterns in the historic % changes) where  $N = i - 2012$ .

The historic and projected sales numbers under each of the four formats and using each of the three projection approaches is illustrated in the following charts:



The preferred chosen approach was Approach 3, other than for physical albums where Approach 1 was chosen.

This can be supported by observing that:

- Approach 2 illustrates rather extreme projections, particularly for digital formats which increase materially in future years. This is because the approach uses historic average increases rather than the most recent, noting also that increases in digital sales have been slowing down over recent years and so the historic average increase is higher than recently.
- Approach 3 is probably the best approach since it takes into account the fact that the level of historic increases in digital sales has been decelerating, and it projects this deceleration forwards: digital sales continue to increase but level out (satiation of demand after initial growth of new market).
- However, Approach 3 generates negative sales numbers for physical albums so an alternative approach is preferred.
- Approach 1 illustrates projection trends which are most consistent with those in the final historic year, therefore likely more realistic than Approach 2 for physical albums.

## **Adjusted sales projections**

The sales number projections have been repeated, but including an adjustment to allow for the potential distortion of high sales of the Yodelle album in 2012. These “one-off” sales have been reversed out of the 2012 historic data.

The amount reversed out is 10/12 of the first twelve month sales of the album (since it was issued at the start of March 2012), split between physical and digital in the same proportion as all other albums sold during 2012 (from the historic data).

## **Projected sales revenue – base scenario**

Expected sales revenue from 2012 to 2021 has then been projected as the number of sales multiplied by the price per unit.

The average annual growth rate ( $g$ ) for each of the four formats was calculated as:

$$g = (\text{Price in 2012} / \text{Price in 2007}) ^ {1 / (2012 - 2007)} - 1$$

Price in projection year  $i$  (2013 to 2021) was then determined as price in 2012 multiplied by  $(1 + g) ^ (i - 2012)$ .

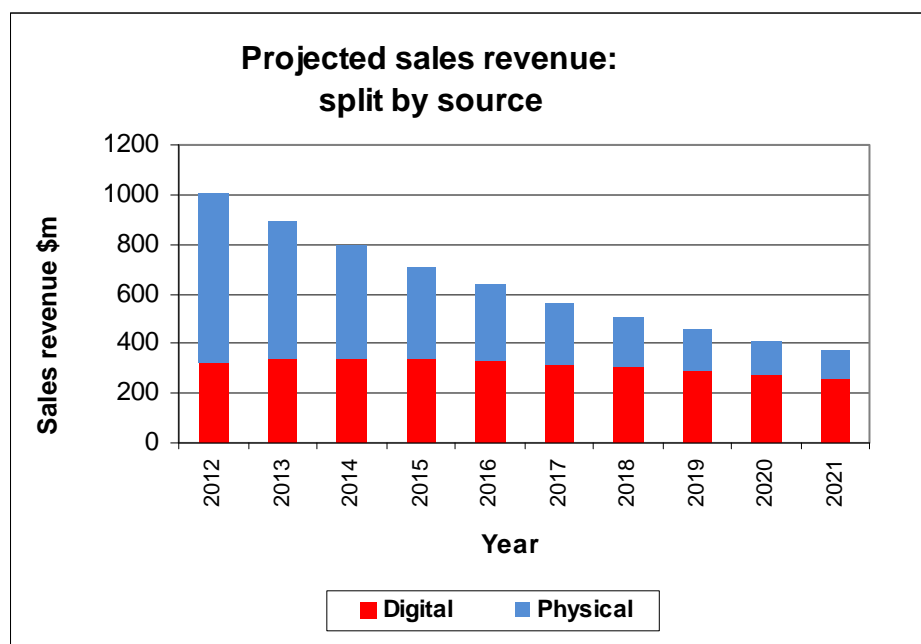
The sales revenue projections were performed for each of the four formats and then totalled for physical and for digital.

The year in which annual digital sales revenue is expected to exceed that from physical was determined by identifying the first year of the projection period in which digital sales revenue exceeds 50% of the total sales revenue in that year.

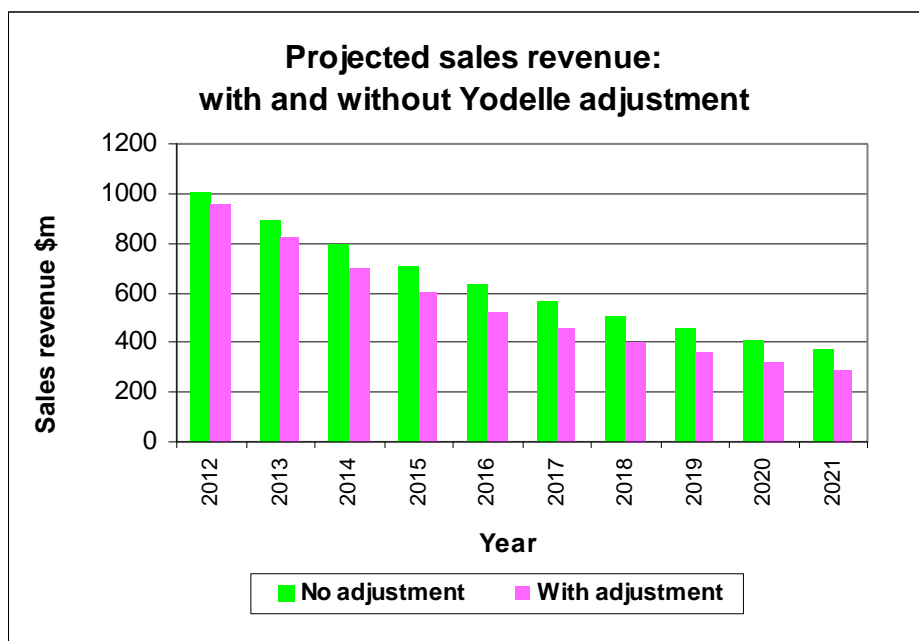
The above was performed first without any adjustment to the sales numbers for the Yodelle album, and then with that adjustment.

## Results – base price scenario

Under this scenario, future prices per unit fall by 4% per annum for all formats other than digital albums, for which the price per unit falls by 7% per annum.



- Under the base price scenario, projected total annual sales revenue from physical formats is shown as reducing materially over time. This is the result of both falling numbers of sales and reducing prices. Sales revenue from digital formats is broadly unchanged from year to year (a slight rise followed by a slight fall), which reflects the combined impact of increasing numbers of sales but reducing prices.
- Projected overall total annual sales revenue falls over time, which is consistent with the total of the above effects. As well as the contribution from falling prices, this pattern is also consistent with the gradual shift from physical to digital formats within the future projections, digital having lower prices (and thus revenue) per unit (album price in 2012 around \$7–\$8, single price in 2012 around \$1–\$2).



- Projected total annual sales revenue with the Yodelle adjustment is lower in all future years than without the adjustment. This is because the adjustment removes material numbers of album sales from the data and hence from the future projections (i.e. it assumes that the Yodelle album was a “one-off” and such significant album releases do not reoccur in future years).
- However, the general run-off pattern remains broadly unchanged. This is because the historic trends continue to be projected forwards, albeit on a lower overall total.

The estimated “crossover” points at which digital sales revenue is expected to exceed physical sales revenue under the two alternatives are:

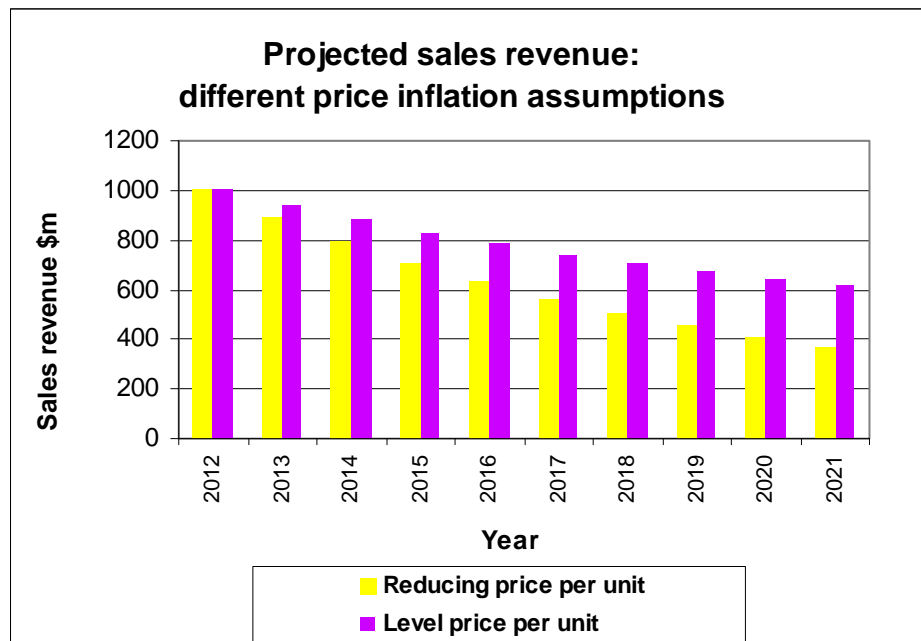
	<i>Annual revenues</i>
<i>No Yodelle adjustment</i>	<b>2016</b>
<i>With Yodelle adjustment</i>	<b>2015</b>

- The “crossover” happening in the years 2015/16 is consistent with the charts of projected sales numbers shown earlier in this document. These show the digital and physical album lines crossing (i.e. digital numbers sold being higher) at around that point for the chosen Approaches 1 and 3. Since sales revenue is dominated by albums (higher price per unit) this will be the greatest influence on the results.
- Allowing for the Yodelle album adjustment, digital sales are expected to exceed physical sales earlier than for the unadjusted data. This is because:
  - Albums have a higher weighting towards physical rather than digital; singles are almost entirely digital.
  - Reducing the total number of albums in the projections will therefore have a relatively greater reducing impact on revenues from physical than on revenues from digital.

- Hence digital revenues are more likely to exceed physical earlier than otherwise.

## Results – alternative price scenario

Under this scenario, future prices per unit are assumed to remain unchanged, i.e. stay at their 2012 levels.



- Projected total annual sales revenue under the alternative price scenario is higher in all future years than under the base price scenario. This is because under the base price scenario all prices fall in each year in future, whereas the alternative scenario holds prices level.
- However, it should be noted that overall sales revenue still falls year on year under the alternative scenario, despite the level prices. This is due to increases in digital sales not making up for the decline in physical sales, particularly since the shift is mainly towards the lower revenue per unit singles rather than albums.

The estimated “crossover” points at which digital sales revenue is expected to exceed physical sales revenue under the various alternatives are now:

	<i>Annual revenues</i>
<i>No Yodelle adjustment</i>	<b>2016</b>
<i>With Yodelle adjustment</i>	<b>2015</b>

- The estimated revenue “crossover” points are now earlier than in the base price scenario. This is because under the base scenario the price of digital albums (a material component of the overall revenue) was falling faster than the price of the other three formats. The impact of reversing out the price reductions in this additional scenario therefore has most effect on projected digital revenue: it is increased by more than for the physical formats. Hence digital sales will be expected to exceed physical sales earlier than under the base scenario.

- The crossover is slightly more accelerated for the results without the Yodelle album adjustment, which is due to the slightly higher numbers of digital albums in that projection scenario (the price of this format being the main reason for the change, as noted above).

## **Recommendations**

Although it seems appropriate to make some adjustment for the exceptional sales of the Yodelle album in 2012, it should be borne in mind that individuals might have purchased another album if they had not bought the Yodelle album. Hence a slightly lower adjustment might be more appropriate.

There may be arguments to support prices continuing to fall, but the rate of fall might decline in future as the market stabilises and there are fewer technological advancements in the distribution of digital media. Indeed, some prices might even have to rise if the products become relative niche (e.g. very low volume physical album pressings). It might therefore be more appropriate to consider a future price projection somewhere between the two scenarios considered here.

## **Next steps**

- Validate the information provided by the Actuarial Recorded Music Industry on sales numbers and prices.
- Separate out physical sales numbers into vinyl and CD, and analyse each of these formats separately.
- Analyse relevant data and trends from other countries, particularly those which might have adopted digital formats earlier than Actuarial and so will be a little “ahead of the curve”.
- Investigate the actual split of Yodelle album sales between physical and digital.
- Investigate actual Yodelle album sales during 2012 calendar year, e.g. may need to allow for an uneven spread through year, perhaps due to a Christmas “bulge” in sales.
- Investigate whether there might have been any other similar distortions in the historic data that should also be reversed out.
- Investigate whether there were any particularly high selling singles related to the Yodelle album which should also be reversed out from the relevant sales figures in 2012.
- Scenario test significant changes in future buying patterns, e.g. the emergence of a new format, or a resurgence in the popularity of vinyl, or a collapse in physical purchases after the bankruptcy of the main high street retailer selling vinyl/CDs.
- Investigate the implications of other formats which might be becoming increasingly available e.g. streaming services.

- Consider the impact of economic cycles on buying patterns.
- Perform revenue projections using other sales projection approaches, or perhaps other combinations of the three suggested approaches.
- Model the correlation between price and volume, particularly for the alternative scenario.
- Extend the projection period further into the future to understand when revenues might fall to unacceptably low levels.
- Sensitivity test different price growth rates for different formats, e.g. some of the prices falling (e.g. digital) and some remaining the same or even increasing (e.g. physical).
- Model variable future rates of price change (i.e. varying over time rather than remaining constant year on year).
- Determine the future price increase rates that would be needed to keep projected sales revenues unchanged year on year.
- Build a stochastic model of possible sales revenues e.g. under varying price inflation assumptions.
- Backtest the model using historic data, and monitor actual sales going forwards and compare against projections.