Economic Analysis of the TV Advertising Market

Preface

This report, commissioned by Ofcom from PwC, combines the latest econometric modelling techniques with industry thinking and expertise to build an economic model of the UK television advertising market. The results update and supplement the work of David Hendry on TV advertising elasticities carried out in 1992. Given the fundamental changes to the TV advertising market since Hendry's work, this updated model will be of critical importance to future analysis in the TV advertising market.

Ofcom is responsible for regulating broadcasting and related services. In order to inform our work in the broadcasting sector, and to develop a strong evidence base for further analysis, Ofcom commissioned PwC to build an econometric model of the UK television advertising market. This model was used to:

- Determine the elasticities for TV advertising on 'traditional' channels (channels 3, 4, and 5) and multichannel channels; and
- Produce forecasts of TV net advertising revenue (NAR) to 2014 for traditional and multichannel channels.

PwC's key conclusions are as follows:

- Multichannel advertising is increasingly becoming a competitive constraint on, and substitute for, traditional advertising. This is supportive of a single relevant economic market for TV advertising in the UK.
- In the short term, changes in the supply of advertising impacts have little overall effect on TV NAR as any change in quantity is almost exactly offset by a change in price (ie the price elasticity is close to -1).
- In the longer term, the price elasticity is greater than -1 (ie TV advertising is price elastic) and therefore changes in the supply of impacts will affect total NAR.
    - For traditional channels, the price elasticity is -1.4, indicating that an increase in the supply of impacts will result in a small overall increase in NAR.
    - For multichannel channels, the price elasticity is greater, at around -4, meaning that changes in the supply of impacts have a much greater effect on multichannel revenues than on traditional revenues.
- Audience fragmentation does not have a significant impact on total TV NAR, but the distribution of NAR is changing from analogue to multichannel as multichannel increases its share of viewing.
- Loss of audience to the BBC (as a result of the launch of new BBC channels, or through the BBC acting more commercially and drawing more viewers) will have an impact on TV advertising revenues for both traditional and multichannel channels. However, it will have a relatively greater impact on the revenues of multichannel operators, due to the higher elasticity of multichannel as compared with traditional advertising.

The report notes the challenges of producing a robust long term forecast of TV NAR, given recent structural changes in the TV advertising market, and future uncertainty around issues such as digital penetration. However, the report provides two illustrative scenarios of NAR growth to 2014. These scenarios indicate that future growth in NAR is likely to be derived entirely from multichannel, with traditional revenues remaining roughly flat in real terms.

The results provided a baseline forecast in the market modelling of future scenarios for Phase 2 of the "Ofcom Review of Public Service Television Broadcasting". The results of the econometric modelling were taken into account in the analysis of the new BBC services, to inform the debate about the impact of BBC services on commercial TV channel advertising revenues, and will also inform any review of the Channel 3 and Channel 5 licence terms in 2005.

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Economic Analysis of the TV Advertising Market

Commissioned by

Ofcom

December 2004

PwC Economics, the PricewaterhouseCoopers LLP economics practice, embraces around 150 professionals in the UK, as well as many more economists in the rest of Europe and the United States. Our core services are wide ranging, covering competition and regulation issues, litigation support, bids and business cases, public policy and project appraisals, financial economics, the economics of sustainability and macroeconomics.

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1 Executive summary

PricewaterhouseCoopers LLP was commissioned by the UK Office of Communications ("Ofcom") to produce forecasts and elasticities for UK television net advertising revenue (TV NAR).

This study combines the latest econometric modelling techniques with industry thinking to build an economic model for the UK television advertising market. In this report we describe the key findings of this analysis, including the estimated market elasticities and illustrative forecasts produced by the model. The results update and supplement the pioneering work of Hendry (1992), which has been quoted by the Competition Commission and other regulatory bodies when assessing the TV advertising market.

This analysis provided a baseline in the modelling of future scenarios for Phase 2 of the Ofcom review of Public Service Broadcasting (PSB) and an input into the Ofcom review of new BBC services. The analysis was also conducted to provide an input into Ofcom's assessment of the Channel 3 licences, which requires forecasts of Channel 3 revenues over the next ten years.

1.1 Key findings

How strong is the TV advertising market?

After a decade of strong growth, traditional TV advertising revenues fell sharply in 2001-2003. It remains uncertain whether this decline was merely 'cyclical', following the end of the Internet bubble, or 'structural', reflecting a move by advertisers away from traditional media. However, what seems clear is that the UK economic cycle can only partially explain the downturn. This suggests that the TV advertising market may now have begun to follow a new path, with advertising of the traditional channels barely growing while revenues in the multi-channel arena grow relatively briskly.

How does the TV advertising market work?

The TV advertising market can be characterised as a single market with two differentiated products: advertising on the 'traditional' commercial TV channels (Channels 3, 4 and 5); and advertising on the more recent 'multi-channel' commercial TV channels (all other commercial channels).

Commercial TV channels create opportunities for advertisers by attracting audiences and broadcasting advertisements. But in the short to medium term, the commercial broadcasters have little opportunity to affect the supply of TV advertising 'impacts' as programme scheduling and production decisions cannot be easily changed and the number of advertisements broadcast per hour is controlled by Ofcom regulation.

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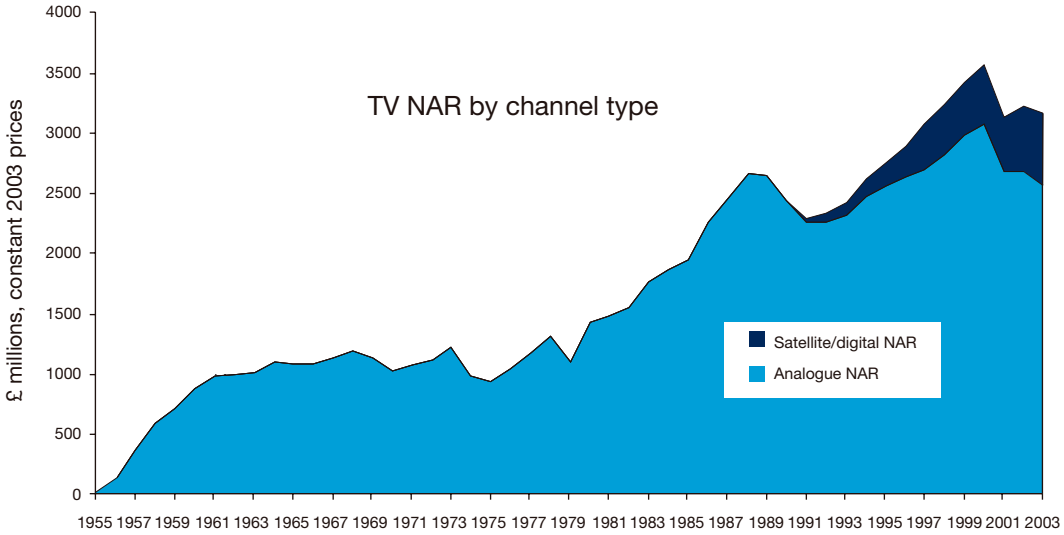
Figure 1.1 Real Television Net Advertising Revenue (TV NAR), 1955-2003



Source: PricewaterhouseCoopers calculations using Advertising Statistics Year Book (ASY) data

Demand for TV advertising comes primarily from private sector companies selling consumer products, although demand from government and NGOs[1] is also significant. Corporate expenditure on TV advertising is relatively fixed in the short term, as companies usually determine marketing expenditure on an annual basis and contracts are usually agreed one year ahead. In the longer term, however, companies are able to shift their marketing expenditure between different forms of marketing (which includes traditional advertising media, such as radio, print and outdoor, and other marketing activities, such as direct mail, interactive and sales promotions).

[1] Non-Governmental Organisations

What are the key drivers of TV advertising revenues?

The key drivers of TV advertising revenues include the economic environment, trends within TV broadcasting and the dynamics between supply and demand. The major current trend in TV broadcasting is the rise in multi-channel viewing, and the resulting intensification in competition with traditional commercial broadcasters. Going forward, the market will be affected by a number of developments whose impact is hard to quantify, including: the analogue switch-off expected between 2008 and 2012; new technology such as Personal Video Recorders (PVRs); the likelihood of increasing distribution of TV content over broadband; and potential changes in the attitudes and behaviour of advertisers.

How responsive is the price of advertising to changes in the supply of impacts?

The true economic price of TV advertising is the cost per advertising impact. Our research shows that in the short term, changes in the supply of TV advertising impacts have little effect on TV NAR, as a fall (rise) in impacts leads to a rise (fall) in the price per impact (the price elasticity is close to unity). This means that roughly the same amount of money continues to chase a smaller or larger number of advertising opportunities.

However, in the longer term, changes in the supply of TV advertising impacts have a more substantial effect on TV NAR. We have estimated that the long term price elasticity for traditional channel advertising is -1.44. Our results also suggest that multi-channel TV is substantially more 'price elastic' than the traditional channels, which indicates that any change in audiences has a proportionally greater impact on multi-channel advertising revenues than traditional channel advertising revenues.

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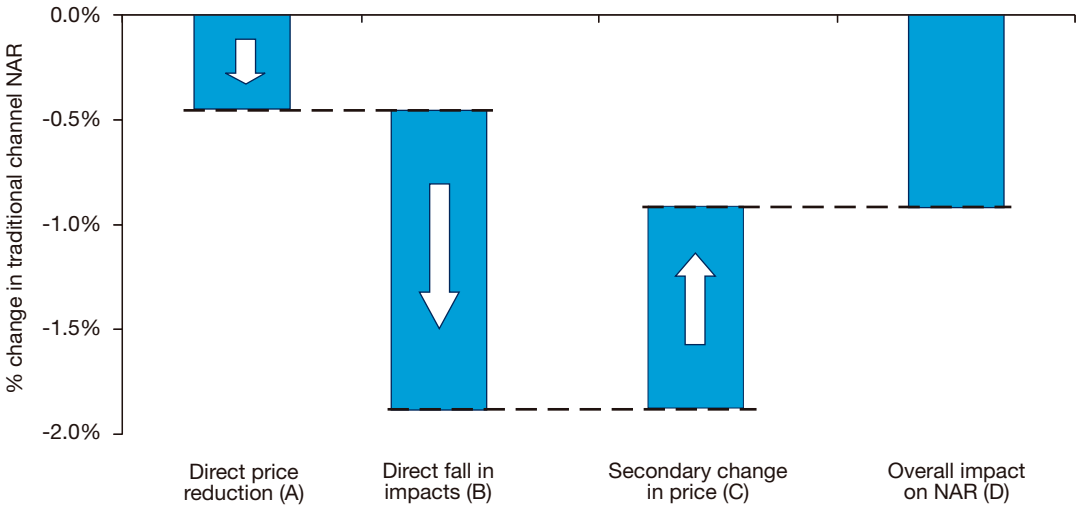
Is this evidence to support the proposition that this is a single TV advertising market?

There is evidence of competition between the two types of advertising, suggesting that they are both part of a single advertising market. We found that growing audiences for multi-channel TV push down the price of advertising impacts on traditional channels, suggesting that multi-channel channels are placing increasing competitive pressure on the traditional channels. This effect on traditional channel advertising revenues is in addition to any loss of revenue due to the loss of audience. This would suggest that multi-channel advertising is a substitute for traditional channel advertising. Figure 1.2 summarises the results of the model for the effect of multi-channel viewing increasing by an extra one percentage point of total viewing – this leads to a fall in traditional channel NAR [D], due to both the direct price reduction through increased competition [A] and the direct fall in impacts [B] (although this is partly offset by a consequent secondary increase in price per impact [C]).

Figure 1.2 Impact of multi-channel viewing on traditional channel NAR



Source: PricewaterhouseCoopers analysis

How does audience fragmentation affect total TV advertising revenues?

A shift of audience from traditional channels to multi-channel TV ('audience fragmentation') should have little overall effect on total TV advertising revenues - while traditional channel revenues would fall, multi-channel revenues increase due to larger audiences (and hence more impacts) and so the overall effect is broadly neutral. Audience fragmentation could reduce the value of TV advertising by potentially reducing the availability of programmes offering large audiences, although this may be offset by increased availability of programmes offering clearly-defined audience types sought by advertisers ('audience segmentation').

Our econometric model suggests that a shift in audiences from traditional channels to multi-channel results in a small increase in total TV NAR, because multi-channel advertising revenues are more sensitive to changes in impacts than traditional channel advertising revenues (i.e. multi-channel advertising is more 'price elastic'). It should be noted, however, that our estimate of the price elasticity for multi-channel advertising is subject to a greater degree of uncertainty (both statistical and in terms of possible structural change) than our estimate of the price elasticity for traditional channel advertising.

Executive summary

How do increased BBC audiences affect TV advertising revenues?

Increased BBC audiences do not create additional competitive pressure in the TV advertising market, as these audiences do not provide TV advertising impacts, although they do draw audience away from commercial channels. So if the traditional commercial channels lose audience (and hence supply of advertising) to the BBC, then the resultant impact on traditional channels' advertising revenues is less than if the audience shifted to multi-channel TV. However, the impact on total TV advertising revenues would be greater, as there would be no consequent increase in multi-channel advertising revenues.

Loss of audiences to the BBC would have a proportionally more adverse impact on total TV advertising revenues if the audiences were drawn from commercial multi-channel TV rather than from the traditional commercial channels, as multi-channel revenues are more sensitive to changes in impacts.

Who tends to win viewers from whom?

Traditional commercial channels' lead in terms of audience figures is being squeezed by the multi-channels broadcasters on the one hand and the BBC on the other. Our research shows that if multi-channel channels were to capture an extra 1% of total TV viewing, then commercial traditional channel viewing would fall by about 0.6% of total TV viewing in the long term. Hence approximately 60% of new multi-channel viewing is taken from the commercial traditional channels, and the remainder from BBC channels (assuming that overall TV viewing remains broadly unchanged).

In the past, BBC channels have drawn viewers mainly from the commercial traditional channels (our model suggests that roughly 70% of new viewers were from the traditional channels), although this relationship may be changing as new BBC services (e.g. BBC3 and BBC4) compete more directly with commercial multi-channel TV.

How fast will total TV advertising revenue grow during the next decade?

There is a considerable amount of uncertainty surrounding the future for TV advertising in the UK, as the structure of the market is changing rapidly with new technologies and changing competitive pressures. Our approach was first to understand the direction of change predicted by historic relationships, and then to consider how future developments might change these relationships going forward.

Based on our analysis of historic relationships, we estimate that total TV NAR is likely to grow broadly in line with expected GDP growth for the UK economy over the next decade, meaning that TV advertising revenue's share of the UK economy over the period should remain relatively unchanged. We find that most, if not all, of this growth is likely to be driven by the new 'multi-channel' commercial TV channels (which are defined here to include all commercial channels except Channels 3, 4 and 5), whose share of the TV advertising market could approximately double over the forecast period to 2014.

Executive summary

The overall advertising revenues of the 'traditional' commercial TV channels (Channels 3, 4 and 5) are likely to show little, if any, real growth over the forecast period. The two illustrative scenarios presented in Table 1.1 below suggest slightly negative average real growth rates over the 2003-14 period.

Table 1.1 Econometric forecasts (pooled) for two illustrative scenarios

Illustrative TV NAR forecasts (in constant 2003 prices)		Traditional	Multi-channel	Total
Scenario A (weak digital penetration)	2003	£2,570m	£590m	£3,160m
	2014	£2,530m	£1,470m	£4,000m
	Annual growth rate	-0.2%	+8.6%	+2.1%
Scenario B (strong digital penetration)	2003	£2,570m	£590m	£3,160m
	2014	£2,430m	£1,620m	£4,050m
	Annual growth rate	-0.5%	+9.6%	+2.3%

Source: PricewaterhouseCoopers analysis.
Note: These illustrative forecasts are based on two scenarios for the adoption of digital TV technology, which is a driver of both the mix of traditional and multi-channel viewing, and the total amount of commercial TV viewing. All of the other key drivers are assumed to be the same in these two illustrative scenarios (and therefore it is possible to construct a broader range of scenarios by introducing scenarios for the other key drivers as well). The scenarios exclude any impact of possible future drivers (such as PVRs), which are discussed in Section 7. All prices are in constant 2003 price levels.

But we must also consider how the historic relationships could change in the future, in order to improve our understanding of how the TV advertising market may evolve over time. Analogue switch-off, which is expected to occur across the regions of the United Kingdom over the period 2008-2012, is set to be a key driver of change, particularly for how advertising revenues are split between traditional channel and multi-channel NAR. New technology could also affect the TV advertising market, as Personal Video Recorders (PVRs) could allow viewers to more easily skip advertising slots, and in the longer term, Internet broadband could create alternative platforms for TV broadcast. Perhaps even less certain are potential changes in the behaviour of advertisers themselves, as changing attitudes and methods result in changes in the perceived value of TV advertising, relative to other forms of marketing.

So how uncertain are forecasts for the TV advertising market?

The greatest uncertainty surrounds separate forecasts for traditional channel and multi-channel NAR, as crucially these depend on the competition between these two groups of channels for audiences. Total TV NAR growth is likely to be more stable and predictable.

2 Introduction

2.1 Scope of this report

This is the final PricewaterhouseCoopers LLP ("PwC") report from a study for the UK Office of Communications ("Ofcom"). Ofcom required a comprehensive, detailed and defensible economic model of the TV advertising market in the UK. In developing the required model we adopted four criteria that the approach should:

- be based on statistically robust and defensible relationships identified using appropriate econometric techniques;
- identify the relationships between price and quantity, and hence estimate price elasticities;
- identify drivers that can themselves be forecast based on reputable sources, to assist the development of forecasting models; and
- provide both a plausible explanation of the past and credible forecasts of the future.

The model also identified the changing relationship between the 'traditional' commercial TV channels (Channels 3, 4 and 5) and new commercial multi-channel services (which includes all other broadcast channels available on satellite, cable and digital terrestrial platforms). The model was used as the basis for constructing a forecasting model for the market, to allow forecasts of TV advertising revenues to be developed.

The study was completed between April and July 2004, based primarily on data up to the fourth quarter of 2003.

2.2 Context

The immediate purpose of the study was to provide a baseline forecast in the market modelling of future scenarios for Phase 2 of the "Ofcom Review of Public Service Television Broadcasting".[2] The forecasts for TV NAR were also required to provide an input into Ofcom's assessment of the Channel 3 licences, which would require forecasts for the revenue of Channel 3 (which would be likely to make up a large fraction of total TV NAR over the next ten years).[3] Ofcom also required the results of the econometric modelling to feed into their analysis of the new BBC services, for instance to inform the debate about the impact of BBC services on commercial TV channel advertising revenues.[4]

[2] Phase 2: Meeting the Digital Challenge. Published September 2004, available from http://www.ofcom.org.uk

[3] See "Statement on methodology for reviews of financial terms for Channel 3, Channel 5 and Teletext licences", October 2004, http://www.ofcom.org.uk

[4] See "Assessment of the market impact of the BBC's new digital TV and radio services", October 2004, http://www.ofcom.org.uk

2.3 The expert panel

A small panel of experts provided invaluable assistance with the scoping of the work, specification of the model and provided quality review work on all aspects of the econometric and forecasting work. The members of this expert panel were:

- Professor David Hendry of the Economics Department, Oxford University. David is a leading academic expert in the field of econometric forecasting.
- Professor Patrick Barwise of London Business School. Patrick is a leading academic expert for the TV and marketing industries.
- John Billett, Chairman of Billetts, which is a management consultancy specialising in marketing communications, including TV advertising. John provided expert advice on the TV advertising industry. John was supported by his colleague, Keith Tiley.

We were also provided considerable advice and assistance from the Ofcom team - including Nicola Floyd (project leader), Matthew Bennett (econometrician) and Paula Guest (data and model development). Robin Foster, Partner, Strategy and Market Developments, was the Ofcom partner with overall responsibility for this project.

2.4 Report structure

Section 3 of this report provides a qualitative review of historical trends in the UK TV advertising market and a review of the factors which drive TV advertising at an aggregate level. Section 4 sets out the methodological approach that was adopted to quantify the impact of these drivers on TV advertising. Section 5 presents the models we estimated, and an evaluation of their robustness. Section 6 sets out the results of the forecasting models, including illustrative forecasts for the 2004-14 period. Section 7 explores the uncertainties that surround these forecasts, including some sensitivity analysis.

Annex 1 sets out definitions for the terms we have used in this report. Annex 2 provides details of the references in the report. Annex 3 sets out the data which we collated for this analysis. Annex 4 provides an overview of our academic literature survey. Annex 5 summarises analyses which were considered but not included in the main report. Annex 6 provides technical detail of the econometric modelling results.

3 The economics of TV advertising

3.1 Introduction

Commercial TV advertising has existed in the UK since the launch of ITV in 1955. Over the past five decades the TV advertising market has been through numerous structural changes as it has matured as an advertising medium and the number of commercial TV broadcasters has increased. In order to forecast the future we require a realistic model of how this advertising market works - which must be based on sound economic theory and be calibrated to match the dynamics we have witnessed in the past.

Our analysis considers advertising on the 'traditional' commercial channels (Channel 3, Channel 4 and Channel 5) separately from the 'multi-channel' channels (all other commercial TV stations available on digital terrestrial, satellite and cable platforms - including ITV2, E4 and Sky channels, for instance). As we discuss further in Section 4.3 below, this distinction is made as our analysis identified different trends from past data for these two elements of the TV advertising market.

In this section, we provide a review of past trends in the TV advertising market to help inform our understanding of the dynamics of this market in the past. This provides the industry context to help explain the economics that underlie the market, in terms of the supply of, and demand for, TV advertising and how supply and demand determine price.

3.2 Past trends in the TV advertising market

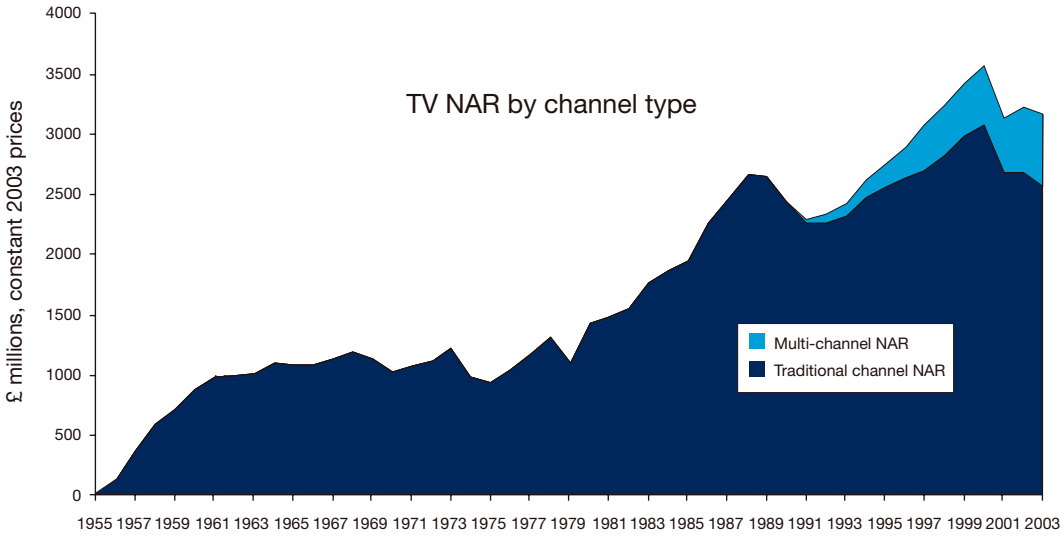
The forecasts of TV NAR produced in this report are based on statistical analysis of factors which have influenced TV advertising volumes (i.e. 30 second advertising impacts) and prices (defined to be average net advertising revenue per impact) historically. The purpose of this section is to describe the historic trends in these variables to build our understanding of the underlying trends (see Appendix 3 for details of data sources).

The economics of TV advertising

Figure 3.1 presents the real value of TV NAR since the introduction of commercial television in 1955, split between traditional commercial channel NAR and multi-channel NAR.[5] Since 1955, the TV advertising market has experienced distinct periods of both strong growth and relative decline. After a short period of rapid growth upon the introduction of commercial television, TV advertising revenues stagnated during the 1960s and early 1970s. But from the mid 1970s, despite general economic weakness, revenues grew strongly, until this trend came to an end in the late 1980s, and TV advertising revenues began to more closely follow the UK economic cycle.

[5] For definitions of the terms used in this report, please see Annex 1. All estimates of prices and NAR are expressed in real terms, to remove the impact of price inflation in the economy.

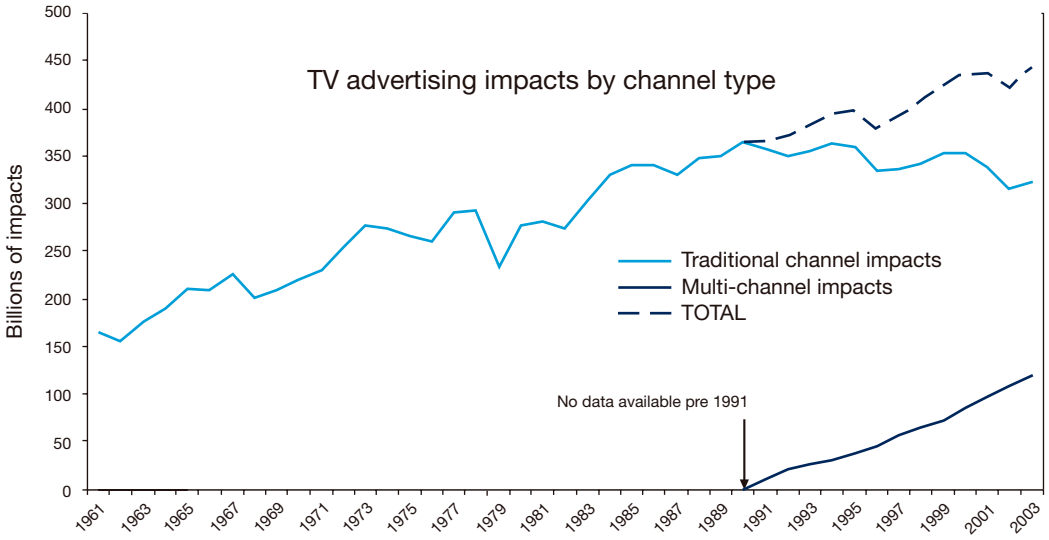
Figure 3.1 Real Television Net Advertising Revenue (TV NAR), 1955-2003



Source: PricewaterhouseCoopers calculations using ASY data

Figure 3.2 presents the number of (30 second) advertising impacts on traditional and multi-channel channels from 1961 to 2003. The number of traditional channel impacts grew up to the mid 1970s, then levelled off before being boosted again by the introduction of Channel 4 in 1982. Traditional channel impacts then remained at a relatively stable level until they began to decline in 2001-2. In contrast, multi-channel impacts have grown steadily since the available data began in 1991.

Figure 3.2 TV advertising impacts, 1961-2003



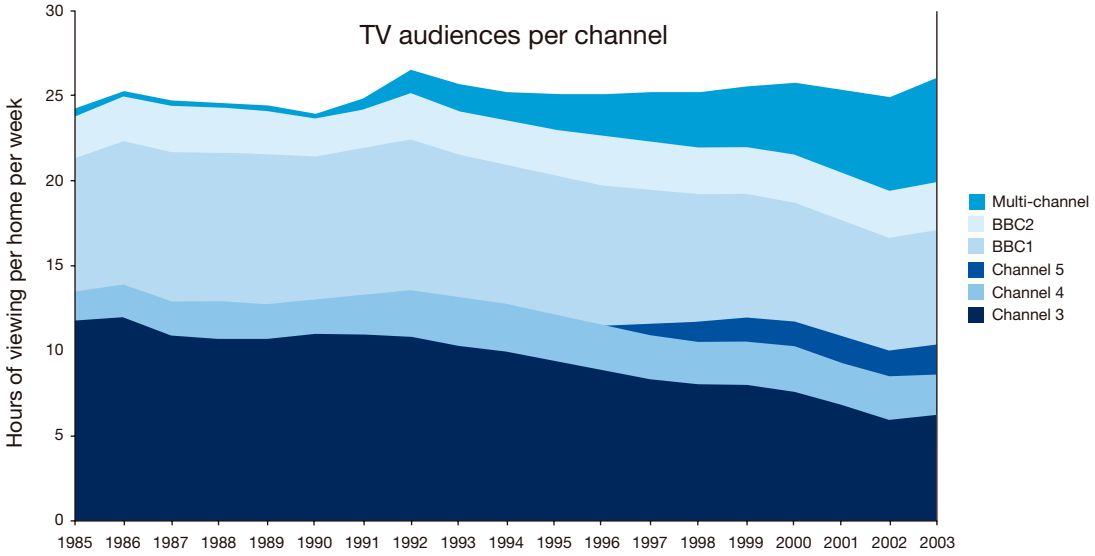
Source: ASY. Pre-2002 data rebased to reflect 2002 BARB measurement change

The economics of TV advertising

The number of impacts reflects the hours of TV viewing by households, as the number of advertising minutes per hour has remained relatively constant over time (although the number of advertising slots has varied, as the average number of seconds per slot has varied). Figure 3.3 presents figures on viewing by channel for the period 1985 to 2003.[6] It is clear that up until the early 1990s, viewing levels were relatively stable, but the advent of Channel 5 and multi-channel TV has exerted a significant impact on BBC1 and, to a greater extent, Channel 3.

[6] We did not have available consistent data separating quarterly channel viewing pre-1985.

Figure 3.3 TV audiences by channel, 1985-2003

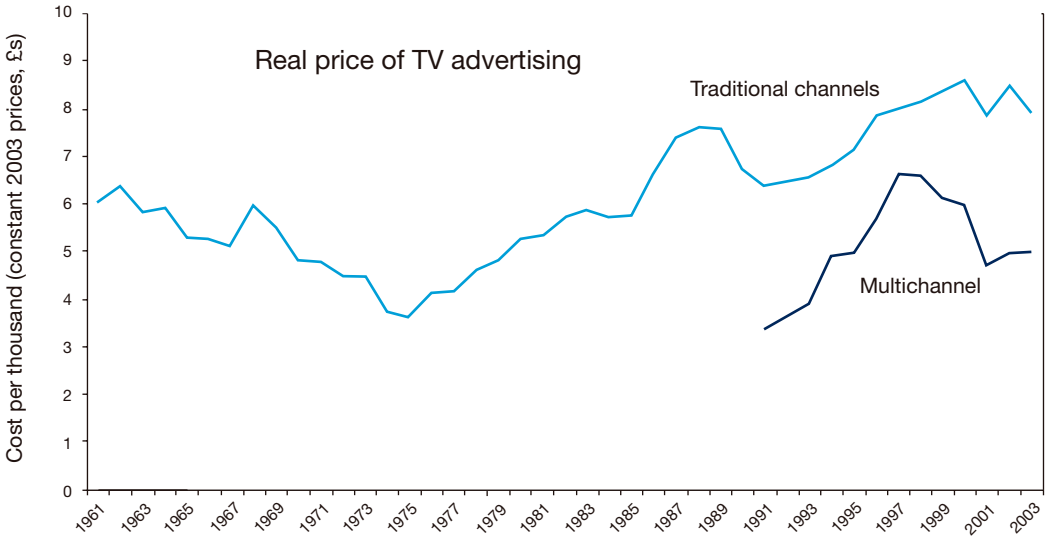


Source: Ofcom supplied data

Figure 3.4 presents the real price of TV advertising impacts for traditional and multi-channel channels. The real price of traditional channel advertising slowly declined during the 1960s and early 1970s, but was offset by slowly rising volumes, until real prices fell more sharply in the post-oil crisis inflationary 1974-5 period. Real prices then recovered, and began to increase quite strongly until the late 1980s. Since the 1980s, real prices have followed a more distinctly cyclical pattern, with prices falling quite sharply during 2001-3.

Notably, the real price of multi-channel advertising impacts has followed a more pronounced cyclical trend over the past decade, with the discount relative to traditional channels declining sharply during the Internet boom, before increasing sharply in 2001.

Figure 3.4 Real price of TV advertising per thousand impacts



Source: PricewaterhouseCoopers estimates from ASY

Note: 'Price' is defined here as the average net advertising revenue received per thousand impacts. This measure of 'price' takes account of the negotiations between advertising buyers and sellers, and so differs from other measures of 'price', such as that defined on rate cards.

The economics of TV advertising

From reviewing these four charts, we might categorise some long run stages in the development of TV NAR:

- *Mid 1950s to early 1960s -* a period of rapid increase in the real level of total TV NAR as ITV developed its national network and advertisers discovered the new medium;

- *Early 1960s to mid 1970s -* a period of relatively stable real NAR as gradually declining real prices offset gradually rising numbers of impacts; demand for mainly black-and-white TV advertising was limited to only a few sectors of the UK economy, restraining growth in expenditure on TV advertising;

- *Mid 1970s to late 1980s -* a period of rapidly increasing TV NAR, despite general UK economic weakness, primarily due to rising real prices; demand for TV advertising grew strongly as a wider base of sectors from the UK economy were attracted to this advertising medium (perhaps related to the growth of colour TV); increased demand pushed up real prices (per impact) even though viewing (and therefore the quantity of advertising) was also rising;

- *Late 1980s to the late 1990s -* a period of strong cyclical fluctuations in TV NAR, primarily due to changes in real prices linked to the economic cycle; multi-channel channels progressively increased their audiences, at the expense of traditional channels (including the BBC); and

- *Late 1990s to the present -* the end of the Internet boom caused sharp falls in real prices, particularly for multi-channel advertising that had seen strong price growth during the boom; meanwhile, continued increases in multi-channel audiences has begun to reduce terrestrial advertising impacts.

While TV could be described as a “mature medium”, given the slowdown in growth since the late 1980s, the market is characterised by quite large apparently cyclical fluctuations and a growing alternative multi-channel market. The question that we seek to answer is ‘how strong will NAR growth be over the next 10 years?’ The answer will depend on the drivers of supply and demand for TV advertising, and the relationship between supply and demand in the future.

3.3 The supply of TV advertising

Commercial TV channels create advertising opportunities for advertisers by broadcasting advertisements at regular intervals during their programming schedules. The amount of TV advertising that is supplied by the broadcaster is defined to be the number of advertising impacts,[7] which is a function of audience viewer-hours and the average number of advertisements per hour. Supply can therefore be boosted by attracting large audiences or broadcasting more advertisements.

In the short to medium term, the traditional commercial broadcasters can do little to affect the supply of TV advertising impacts. The size of audiences is determined by programme scheduling and production decisions often made many months in advance, and cannot be easily changed. The number of advertisements broadcast per hour is controlled by Ofcom regulation which sets maximum, minimum and average levels.[8] Consequently, quantity (impacts) is independent of price in the short term (technically, we can assume 'weak exogeneity' in the econometric modelling - see Annex 1 for definitions). We therefore, in the diagrams that follow, draw a vertical short term supply curve, to indicate that supply is fixed.

In the longer term, broadcasters should have some influence on the supply of TV advertising impacts, through their influence on viewer numbers (e.g. through investment in programming). Competition with other broadcasters may, however, make it difficult for a channel to increase significantly its share of viewers (and hence impacts) even in the long term, although there have been a few cases where broadcasters have been able to change the profile of their viewers over time (e.g. Channel 5). In diagrammatic terms, we might expect the long term supply curve to be upward sloping, as higher prices would provide the revenues required to improve programme quality and hence attract larger audiences.

One might expect the supply of advertising impacts on multi-channel channels to be more flexible than for traditional channels. Multi-channel is not regulated to the same extent as traditional channels, allowing more control by the multi-channel operators over the number of advertisements per hour (although multi-channel broadcasters do tend to employ all of their available advertising slots). Control over audience numbers is still difficult, however, due to competition with other broadcasters.

Other factors outside of the control of the broadcaster will also affect the supply of advertising impacts. Audience numbers are dependent on population size and demographic structure (e.g. young adults tend to watch less TV than older generations), and socio-economic factors may also affect TV viewing (although broadcasters can commission and schedule programmes that appeal to these audiences). The audience for a particular group of channels can be negatively affected by the success of other channels, including the BBC, as total TV viewing tends to be relatively fixed over time. Similarly, TV competes with other forms of entertainment (and so in the short term, at least, the weather, for example, affects audience numbers). And Ofcom could alter policy to affect the number of advertisements per hour on traditional channels.

For our analysis of the historical dynamics of the TV advertising market, we also needed to take account of specific one-off events. For instance, the broadcasting of ITV was brought to a complete halt by industrial action in 1979. The introduction of Channels 4 and 5 could also have impacted on the TV advertising market. As described further below, there have also been some data measurement changes which also need to be considered in the analysis.

[7] An advertising impact is equivalent to a single viewer watching a 30 second advertisement. See Annex 1 for further definitions.

[8] For further details, the full advertising minutes regulations are available at:

http://www.ofcom.org.uk/codes_guidelines/broadcasting/tv/advertising/rules_amount_scheduling_adv/?a=87101

and

http://www.ofcom.org.uk/consultations/past/adsalesarangements/combinations/

3.4 The demand for TV advertising

Demand for TV advertising comes primarily from private sector companies selling consumer products, although demand from government and NGOs is also significant. For companies, advertising is a type of investment in future sales, and therefore the value of advertising (in real terms) is determined by advertisers' expectations of the future strength of consumer spending (often called "animal spirits" by economists). A strong empirical link between advertising expenditure and corporate profits has also been observed, possibly reflecting the tendency for companies to be more willing to undertake discretionary spending of any sort when profits are strong.

Our previous econometric analysis (and that of academic papers described below) also identified colour TV penetration to be a key driver of demand for TV advertising in the past, as colour improved the quality of the picture and hence the effectiveness of advertising, particularly during the 1970s and 1980s when it rose sharply and steadily. As colour TV penetration increased, TV channels were able to sell TV advertising to a wider range of sectors. We believe that colour TV penetration should act as a useful proxy for the effectiveness of TV channels in encouraging demand in the past, which we would need to include in our analysis of the historical dynamics of the market.

Corporate expenditure on TV advertising is relatively fixed in the short term. Companies usually determine marketing expenditure on an annual basis and contracts are usually agreed one year ahead. In the longer term, however, one would expect companies to be able to shift their marketing expenditure between different forms of marketing (which includes traditional advertising media, such as radio, print and outdoor, and other marketing activities, such as direct mail, interactive and sales promotions). Demand should, therefore, be more flexible in the longer term.

3.5 Expenditure on TV advertising

To model the TV advertising market, we need to understand the relationships between supply and demand, both in the short term and the long term, and how these relationships determine expenditure on TV advertising. In this section we set out our approach to modelling the relationships between supply and demand.

In the market for TV advertising, advertisers purchase opportunities to present their products to TV viewers from the commercial broadcasters, often through the use of intermediary media buyers. Typically, advertisers will pay according to the number of impacts that are achieved for their target audience (or, in some cases, expected number to be achieved), and the price negotiations begin at the prices indicated on the relevant advertising 'rate card', expressed as 'cost per thousand' impacts. But the true price paid is determined through negotiations that determine a discount on the rate card, considering many factors (including deal size, share of expenditure on the channel, nature of the product and timing of the advertisements).[9] The rate card does not strictly dictate the true economic price of TV advertising (i.e. revenue per impact). Ultimately, the price is determined through the relationship between supply and demand, as with most other products in the commercial environment.

[9] The discount is usually determined on an annual or multi-year contract basis. See Competition Commission (2003), section 5 for further details.

Importantly, TV channels tend to sell all of their available advertising slots, and therefore all of their available advertising impacts, to advertisers (regulation actually requires that traditional channels sell all of their advertising slots). As the supply of impacts is relatively fixed in the short term, the price of TV advertising impacts is therefore determined by the highest price that will just clear the market, so that all advertising impacts are sold. We might characterise this as being similar to price setting in an auction process in which "everything must go".

The economics of TV advertising

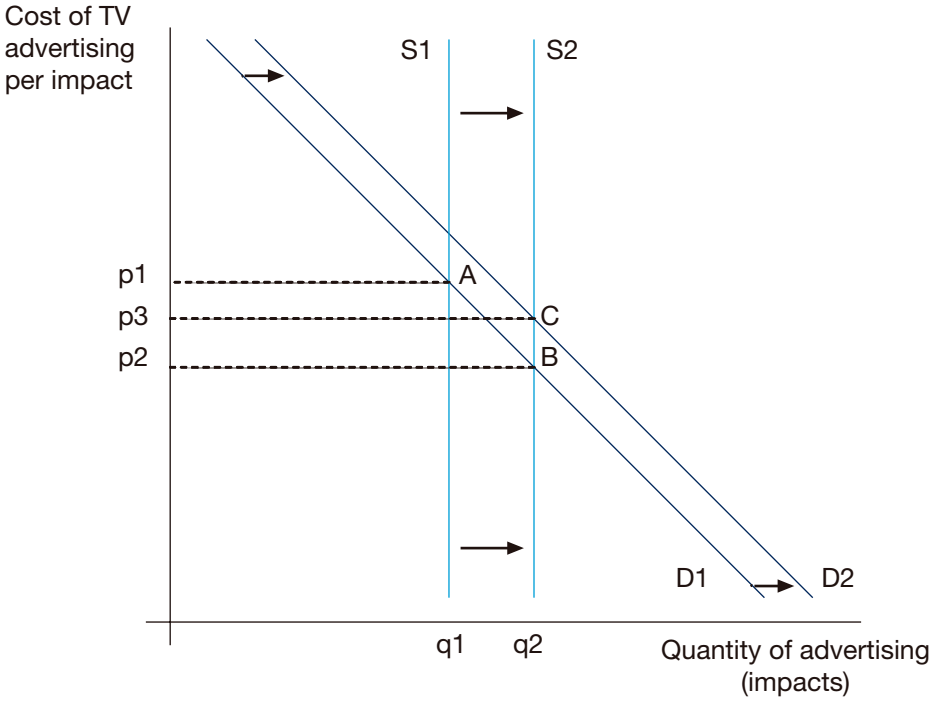
As we suspect that total expenditure on TV advertising is also relatively fixed in the short term, we might expect to find that the price shifts in the opposite direction to short term changes in quantity so that total expenditure remains broadly unchanged. This would suggest that the price elasticity of demand for TV advertising should be close to minus one in the short term. Consequently, a change in the supply of impacts would have little overall impact on TV advertising revenues in the short term (as it would result in a roughly equal but opposite shift in the price).[10]

[10] This does not necessarily mean, however, that the availability of impacts does not affect significantly advertising revenues for an individual channel in the short term. These results only refer to the two groups of channels traditional and multi-channel.

In the longer term, the TV advertising budgets of companies will be flexible and we might expect companies to increase their advertising budgets (or sign new contracts) if TV advertising becomes more effective. Therefore we might expect a rise in viewers (and therefore the quantity of advertising) to result in an increase in advertising revenue in the longer term – implying a long term price elasticity of demand in excess of minus one. Consequently, a change in the supply of impacts would have a larger impact on advertising revenues in the longer term, compared to the short term.

For example, in Figure 3.5 below, an increase in viewers results in the supply of advertising impacts rising from q1 to q2, which results in the price falling from p1 to p2 in the short term. But in the longer term, the demand curve may shift from D1 to D2 (as advertisers increase their advertising budgets), resulting in the price rising to p3. Consequently, the supply increase would have little effect on advertising revenue in the short term, but a larger positive impact in the longer term.

Figure 3.5 Demand and supply of TV advertising revenue



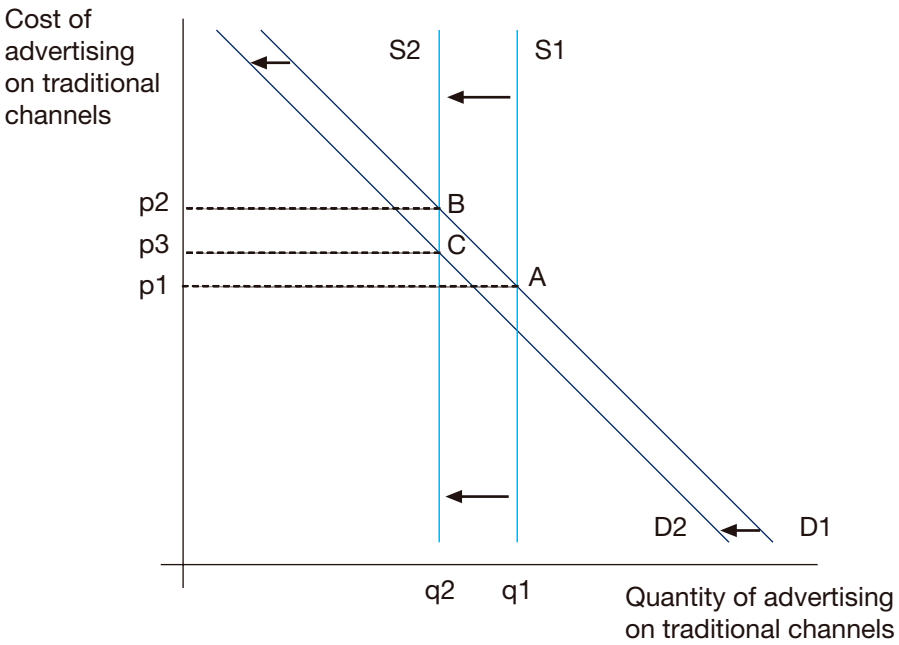
Source: PricewaterhouseCoopers analysis

3.6 Audience fragmentation and changes in viewing patterns

In this report we separate the TV advertising market into two sections defined by two types of commercial channel: 'traditional' and 'multi-channel'. As multi-channel TV captures an increasing share of audiences, the traditional channels will face increasing competition in the TV advertising market, and they will be less able to supply the large audiences that they have previously been able to do. Consequently, one might expect to find that multi-channel viewing is a negative driver of the price of traditional channel advertising, and we have therefore included this variable in our analysis.

As depicted in Figure 3.6, an increase in multi-channel audiences results in a drop in traditional channel audiences, that reduces the supply of traditional channel impacts from q1 to q2. All other things being equal, this would result in a short term rise in the price of traditional channel advertising from p1 to p2. But the multi-channel channels are now able to offer a greater supply of impacts to advertisers, and therefore are better able to compete with the traditional channels. We would expect this to reduce demand for traditional channel impacts from D1 to D2. This pushes the price of traditional channel advertisements down, to p3. Price p3 could be above or below the original price p1, depending on the extent of competition between traditional and multi-channel advertising markets.

Figure 3.6 Impact of multi-channel audiences on traditional channel TV advertising



Source: PricewaterhouseCoopers analysis

Viewing of BBC channels also affects the supply of TV advertising, by drawing viewers away from the commercial channels. Viewing of BBC will therefore affect the price of TV advertising through its effect on the quantity of TV advertising. But, unlike multi-channel viewing, BBC viewing is not likely to have any secondary affects on the price of TV advertising as the BBC does not offer any competing advertising opportunities. In the diagram above, a loss of audience to the BBC would reduce the quantity of advertising from q1 to q2, which would result in the price rising from p1 to p2 – but there would be no secondary impact and price would remain at p2. Therefore the negative impact on NAR would be substantially less.

In section 4, we discuss the econometric approach that was adopted to try to identify and quantify the economic relationships between the supply and demand of TV advertising (and their associated drivers) discussed in this section.

4 Econometric modelling approach

4.1 Introduction

In the last section we considered the economics of the TV advertising market and the possible drivers of real TV NAR. The purpose of this project was to develop these relationships into a quantitative economic model that would describe the TV advertising market and assist in the development of forecasts for TV NAR. In developing such a model we have adopted four criteria that the approach should:

- be based on statistically robust and defensible relationships identified using appropriate econometric techniques;
- identify the relationships between price and quantity, and hence estimate price elasticities;
- identify drivers that can themselves be forecast based on reputable sources, to assist the development of forecasting models; and
- provide both a plausible explanation of the past and credible forecasts of the future.

In this section we explain the methodological approach that was employed and the issues that were tackled to meet the four criteria set out above.

4.2 Time series econometrics

In order to determine statistically robust and defensible relationships between TV advertising real prices, volumes and their drivers, we employed standard techniques in time series econometrics. Time series econometrics based on historical data allows us to estimate the relationships that existed in the past. As we intended to use the econometric results to drive a forecasting model, we always kept in mind the need to identify relationships that are likely to be fundamental to future trends, as well as relationships that were fundamental in the past.

To ensure that we employed the most appropriate econometric techniques, we conducted a brief review of the available academic literature on econometric modelling of TV advertising markets. Annex 4 below provides a summary of the results of our literature review, which identified any estimated elasticities, key drivers and the econometric approach employed. These studies differ from ours in a number of respects that make straight comparisons difficult, including: the data period; geographical region; product (e.g. radio, press); and purpose of estimation.

Econometric modelling approach

4.3 Key modelling issues for the TV advertising market

As with any econometric modelling project, a number of modelling issues needed to be resolved in determining the nature of the econometric model that we were to estimate. Below we provide details of these issues, with explanations of the choices made.

Industry issues

TV advertising industry segmentation - As discussed above, we decided to model the TV advertising market split between traditional and multi-channel advertising. This reflects the competitive constraints faced by the two different parts of the TV advertising market. Historically this has been reflected by different prices for the two products within the TV advertising market. We did not model TV advertising at the channel level as we found that the high level of 'endogeneity' between the channel prices led to less satisfactory econometric results being identified.[11] For similar reasons, we did not seek to separate 'multi-channel' into the channels available of satellite/cable platforms from those available on digital terrestrial platforms.

Impact of audience fragmentation - We suspected that the growing number of new channels is likely to be a key driver of the TV advertising market over the next ten years. The increasing number of channels is likely to result in lower average audiences per channel ('audience fragmentation'), which may adversely affect the value of advertising (advertisers are thought to commonly prefer larger audiences as this helps to reduce duplication of advertising impacts on the same individuals). On the other hand, more channels could produce better audience segmentation (by defined audience type), that could actually increase the value of advertising (as a defined audience group can be reached). Either way, audience fragmentation would be a driver of advertising revenues, and we therefore included multi-channel viewing as a driver of traditional channel price.

Substitution between other marketing media - While we estimated the impact that multi-channel TV has on traditional TV advertising, we did not estimate the impact that other forms of marketing might have. Cross-price elasticities with other forms of marketing may be relatively weak, as advertisers tend to view TV advertising as a separate market (although we were aware that the degree of substitution between TV advertising and other forms of marketing may be growing, particularly for activity in sales promotions). Data for other forms of advertising/marketing were limited, particularly for sales promotions, but some econometric analysis based on data for radio and press advertising rates supported the assertion of weak cross-price elasticities.

[11] PricewaterhouseCoopers considered modelling the industry split between Channel 3, Channel 4 and 'Other' channels. The close inter-relationships between the prices of advertising on these three 'channels' made estimation of a model difficult, as we could not assume that any of these 'endogenous' variables (see Annex 1 – definitions) were at all contemporaneously independent of the others (i.e. we could not assume weak exogeneity). Consequently, we found that our models for traditional channel and multi-channel advertising were significantly more robust than our models for advertising split between individual traditional channels. As our primary goal was to forecast total TV NAR, we therefore chose to model traditional channel and multi-channel advertising, rather than advertising by individual traditional channels. See Annex 5 for further details.

Econometric modelling approach

Data and methodology issues

Annual versus quarterly data - We decided to use quarterly data for our analysis. In line with the debate described in full in Hendry (1992), we found that quantity was 'weakly exogenous'[12] of prices with quarterly data, but perhaps not with annual data. Our assumption that the price of advertising does not affect the quantity of advertising in the short term (i.e. the current time period) is more robust for quarterly data than for annual data, as broadcasters may be able to affect supply within one year, but not within one quarter. Therefore we believed that the econometric results would be more reliable with quarterly data.

[12] See Annex 1 – Definitions, for an explanation of this technical term.

Rebasing of BARB data in 2002 - We adjusted our data on impacts to reduce the impact of the measurement change in 2002. In 2002, BARB changed their method of calculating audiences (and therefore impacts) without concurrently continuing to produce estimates based on the old methodology. We therefore adjusted the figures pre-2002 so that the estimate of the number of minutes of advertising per hour[13] remained unchanged (except for common seasonal variations) between the fourth quarter of 2001 and the first quarter of 2002. There would not appear to be a standard methodology used by analysts in the industry for adjusting for the measurement changes, and given this our relatively simple adjustment methodology was as good as any available.

[13] Minutes of advertising per hour were calculated as number of impacts divided by audience viewing hours. This series remained quite stable, except for common seasonal variations, up until the BARB measurement changes in 2002. We therefore assumed that it would have remained stable if it was not for the measurement changes.

Use of natural logarithms - We wished to estimate price elasticities for the TV advertising market, and therefore we used the natural logarithms of the traditional channel and multi-channel real advertising price and quantity variables that were employed. We did not, however, use natural logarithms for some of our key drivers, such as multi-channel and BBC viewing, as we believed that these variables were best expressed as percentages of total TV viewing (i.e. shares of viewing) to estimate their impact on traditional channel TV advertising.

Possible existence of structural breaks - We were concerned that a structural break may have occurred in the relationships between TV NAR and its drivers during the 2001-3 period, following the end of the Internet boom. We believed that we alleviated this issue substantially by including variables to capture the impact of audience fragmentation, as we suspect that this was one of the main drivers of falling revenues during the 2001-3 period (in addition to a more temporary post-bubble cyclical decline). We also adopted the 'pooled' forecasting procedures described in Hendry & Clements (2004) in order to mitigate the risk of structural change affecting the forecasts. Averaging across forecasts provides an 'insurance' against the worst performing forecast models – a small loss of efficiency is incurred in order to reduce the impact of large errors in any single forecast methodology. Averaging forecasts may also provide more reliable forecasts if the different models are mis-specified in different ways, so their combination provides more information than any individual model. Academic research has found, for instance, that pooled forecasts for macroeconomic indicators (known as 'consensus forecasts') have been more reliable than the individual forecasts that make up the average.[14]

[14] For instance, see McNees (1987).

Impact of price on volume - As discussed in Section 3 above, we made the assertion that the price of traditional TV advertising will not affect the quantity of TV advertising in the current time period (hence weak exogeneity). The quantity of advertising is determined by viewer numbers, as the minutes of advertising per hour is controlled by regulation (regulation determines the minimum, maximum and average number of advertising slots per hour). The price of TV advertising may affect viewer numbers in the long run, as advertising revenue funds expenditure on programmes, but will not have a short run effect as programme expenditure budgets are decided more than one quarter in advance.

Annex 5 sets out additional areas of analysis that were considered but were not included in the final analysis (as set out in this report).

Econometric modelling approach

4.4 Econometric approach

We estimated a 'structural model' that was our best econometric representation of past relationships in the TV advertising market. Our structural model was estimated as a three equation vector equilibrium correction model (VEqCM).[15] This comprised a set of short run and long run equations for the three forecast variables: traditional channel real price, traditional channel volume and the price of multi-channel advertising relative to the price of traditional channel advertising. We did not estimate a similar forecast equation for multi-channel impacts. Instead we chose to use PwC/Ofcom forecasts for multi-channel viewing and a simple equation to translate those forecasts into forecasts for multi-channel impacts.[16]

[15] See Annex 1 for further details.

[16] We found that since 1993, the relationship between satellite/digital viewing and impacts had remained broadly constant, with seasonal adjustments.

The VEqCM approach seeks to capture the long run relationships between the three variables and their exogenous drivers in the three estimated long run equations. The difference between the actual level of the variables and the levels suggested by the long run equations form error correction terms which are fed into the short run equations. The short run equations identify the drivers of changes in the variables, including the error correction terms, and are therefore focused on short term fluctuations. All three short run equations are estimated simultaneously using a procedure called Full Information Maximum Likelihood (FIML), which seeks to take account of the inter-relationships between the three variables.

The exogenous drivers in the econometric regression were:

- Real corporate profits;
- Year-on-year growth rate of real consumer spending;
- Colour TV penetration;
- A dummy for the 1979 strike;
- Multi-channel TV viewing;
- BBC TV viewing (including all BBC channels);
- A dummy for the first quarter of 2002, due to the BARB measurement change;

To estimate the model, we used an econometrics package developed by Professor David Hendry, called PcGets.[17]

[17] PcGets stands for PC general-to-specific, referring to the econometric approach that it employs for model selection. The software was produced by David Hendry and Hans-Martin Krolzig, and published and distributed by Timberlake Consultants Ltd in 2001. Pre-release version 2.0 was used under the guidance of David Hendry.

4.5 Forecasting in an uncertain world

Our approach to forecasting was determined by the nature of the industry we were trying to forecast. We were very aware that the TV advertising market in the UK may well have been subject to recent structural change, as well as possible future structural change, that could change past relationships with key drivers. Clearly, many changes that may occur over the next ten years are not possible to forecast at present, as we do not yet know about those changes. But we did need to try to take account of changes that we do already expect to occur in the future, and we should take action to fully incorporate any changes that have already occurred in the recent past (in this context, 2001-3).

We therefore chose an approach – pooled forecasting - which has been developed to make forecasts more 'robust' and hence reduce the risk that recent structural change will affect the reliability of the pooled forecast – see Section 4.3 above for full details. The pooled forecasting approach employed is described in full in Hendry & Clements (2004). Our adapted form of this approach involved developing three separate forecasting models, and then calculating a simple average of these forecasts to produce our main forecast. The three forecasting models were based on the following econometric models:

Econometric modelling approach

- *A 'structural model' -* a three equation VEqCM as described above, modelling the real price and volume of traditional channel advertising and the relative price of multi-channel advertising;
- *A 'differenced model' -* which was the same VEqCM model, but employing the first differences of all of the same inputs as the above model; and
- *A 'long run trend model' -* which was a simple trend analysis, in which the real NAR growth rate of the past ten years was adjusted according to expected changes in the trend growth rates of the identified drivers.

Structural change close to the forecast origin could have a large impact on the forecasts produced by a structural model, like that explained above. The model assumes a long run relationship between the variables. If this relationship has just recently changed, this may not be reflected in the model and consequently the forecasts produced by the structural model could fail to reflect the change and hence show persistent errors. So while the structural model has the lowest standard errors of our three models, it may also be the most exposed to the threat of structural change close to the forecast origin. For this reason, the pooled forecasting approach also employs the forecasts of two alternative models which may be less at risk of structural change.

The 'Differenced' model is based on the full VEqCM of the structural model, but employs first differences of all of the same inputs into the model, with the same coefficients as before. As mentioned above, the purpose of this first difference version of the VEqCM was to reduce the risk posed by structural change close to the forecast origin.

If there was a large shift in the advertising variables close to the forecast origin, which was not explained by the estimated model, the full VEqCM model would essentially treat the shift as temporary (or cyclical) and the resultant forecasts would assume that the variables return to their long run trends. This would be sensible if the shift was cyclical/temporary, but not if it was due to a permanent structural change.

By using the first difference of all of the inputs into the VEqCM, we effectively remove the long term relationship from the model. Hence, in the situation described above, the first differenced version of the model would not produce forecasts that return the variables to a long run trend level. Instead, they follow a trend from the new level at the forecast origin.

The third forecasting model was based on relatively simple long run trend analysis. A forecast for average TV NAR (real) growth over the next ten years was calculated by taking the growth rate over the past ten years and adjusting it according to any expected changes in the trend growth rates of the key drivers. Coefficients linking the drivers to TV NAR were calculated using the long term reduced form equation for TV NAR derived from the full VEqCM model. Section 6.3 describes this approach further.

The three models were averaged using equal one-third weights (i.e. a simple average), which reflects uncertainty about which would be the optimal model given the high likelihood of structural change in this industry.

In Section 7, we also consider a broader range of uncertainties surrounding the forecasts, including analysis of the potential impact of PVRs and expected analogue switch-off during the 2008-12 period.

5 Results of the model

5.1 Introduction

In this section we review the structural model that was estimated by our econometric analysis, and how this model was translated into the three forecasting models we have used. We review the estimates of price elasticities produced by this model and discuss the implications for our understanding of the dynamics of the TV advertising market, in terms of the economic theory discussed in Section 3 above.

5.2 The dataset

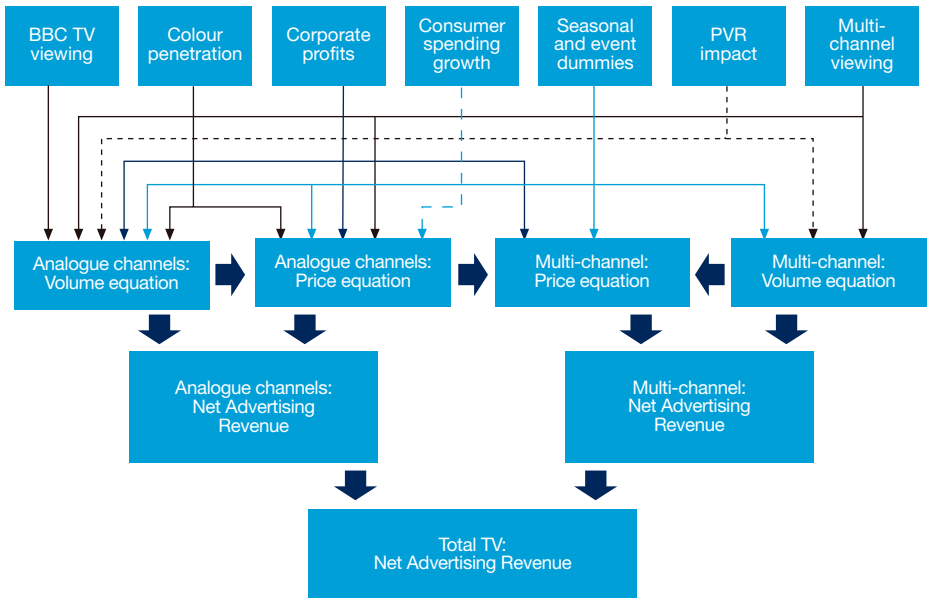
The PwC model of the TV advertising market was estimated based on a dataset that, with assistance from Ofcom, we collated from industry and macroeconomic data for the period 1975 to 2003. Full details of the contents of this dataset are provided in Annex 3.

5.3 The econometric model

As discussed in Section 4, the structural model comprised of three estimated equations for traditional channel impacts, traditional channel real price and the price of multi-channel advertising relative to traditional channel price. The model also included a simple equation for multi-channel impacts, based on external forecasts for multi-channel viewing (see Section 6.2 for further details).

Full technical details of the model specification are provided separately in Annex 6, but Figure 5.1 below provides an overview of the structure of the model. At the top of the diagram, the seven identified input variables are defined. For each of the input variables, arrows below link them to the four 'endogenous' variables (price and quantity for traditional and multi-channel advertising) which they influence. The four endogenous variables also influence each other, as indicated by the horizontal arrows between them. From the four endogenous variables we are able to calculate net advertising revenues for both traditional and multi-channel TV.

Figure 5.1 Overview of the Structural Model



Source: PricewaterhouseCoopers

Results of the model

Below we provide an intuitive explanation of the various relationships estimated in the model, for each of the four endogenous variables.

Traditional channel impacts[18] (quantity) were related to their past growth rate, multi-channel viewing, BBC viewing, the 1979 strike, seasonal dummies, colour TV penetration, real corporate profits and some dummy variables for particular observations. We can interpret the results intuitively through a series of examples.

[18] See Annex 1 - Definitions

- If multi-channel channels were to capture an extra 1% of total TV viewing, then viewing of the traditional commercial channels would fall by about 0.6% of total TV viewing in the long term. Hence approximately 60% of new multi-channel viewing is taken from the commercial traditional channels (and the remainder is taken from the BBC channels).

- Similarly, if BBC channels (BBC1, BBC2 and other multi-channel BBC channels, such as BBC3, BBC4 and BBC News 24) were to capture an extra 1% of total TV viewing, then commercial traditional channel viewing would fall by about 0.7% of total TV viewing in the long term. Hence roughly 70% of new BBC viewing is taken from the commercial traditional channels (and the remainder is taken from multi-channel channels).

- A rise of colour TV penetration by 1% of households would result in traditional impacts rising by 0.75% in the long term. This presumably reflects the increased level of TV viewing.

- A rise in real corporate profits by 1% would result in a 0.1% rise in impacts in the long term. This small effect may reflect a long term relationship between higher corporate profits leading to higher advertising revenues, increasing expenditure on programming which should eventually lead to higher audiences. There might also be some (limited) room available to commercial channels to increase the rate of advertising per hour.

- Notably, we did not find that the real price of traditional channel advertising was a driver of impacts. There may be a long term relationship, reflecting the increased level of expenditure on programming due to higher revenues, but if there is this has been captured by the long term corporate profits relationship described above.

- Unsurprisingly, the 1979 ITV strike led to a sharp temporary fall in TV advertising impacts, but no lasting impact in the long term.

- We included dummies for outlying data points for the following dates: 3rd quarter 1976; 3rd quarter 1982; and 1st quarter 2002. These dummies were included to remove the influence of outlier observations from the data on traditional channel impacts, and therefore improve the congruence of the model. The 2002 dummy was expected due to issues arising from the BARB measurement change at that time. The dummy for 1982 relates to launch of Channel 4 in a model containing lagged variables. The 1976 dummy may also relate to measurement error or to a specific event, but the precise cause of this outlier has not been ascertained.

Results of the model

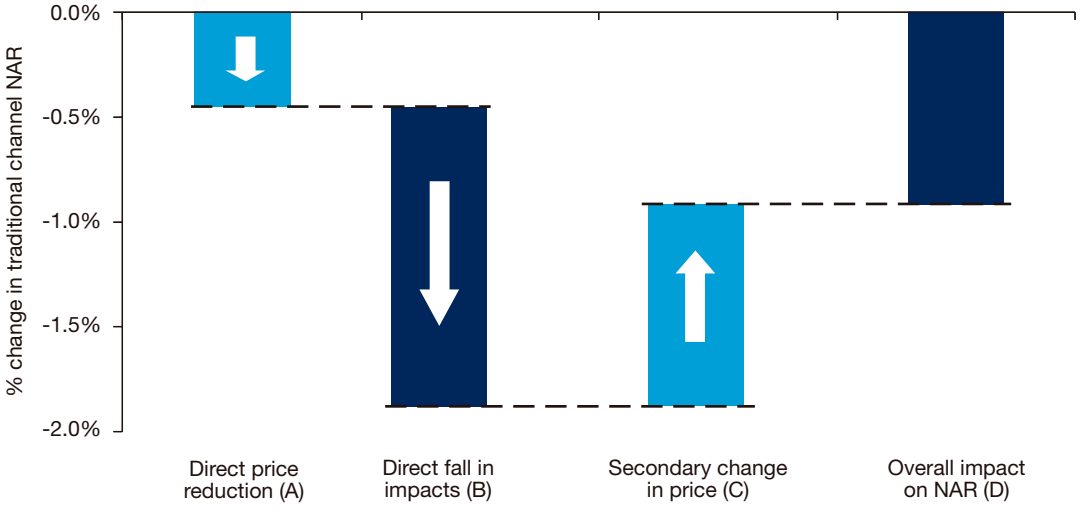
Real traditional channel advertising price (average cost per thousand impacts) was related to its past growth rates, the quantity of traditional channel advertising (impacts), the 1979 strike, seasonal dummies, consumer spending growth, multi-channel TV viewing, colour TV penetration and real corporate profits. Again, we can interpret these results intuitively through a series of examples.

- If traditional channel impacts (and hence traditional channel viewing) were to rise by 1%, then in the long run the real price of traditional channel advertising would fall by 0.69%. This equates to a price elasticity of demand equal to -1.44.[19] Hence, a rise in viewing leads to a rise in real NAR, but by proportionally less than the rise in viewing. In the short term, the elasticity is closer to one, being equal to -1.18 after one quarter. These results match our prior expectations set out in Section 3, that the elasticity is likely to be close to -1 in the short term (as advertising budgets are relatively fixed in the short term), but more elastic in the longer term (as advertising budgets can be varied in the longer term).

- If multi-channel viewing were to increase by an extra one percentage point of total TV viewing, then the real price of traditional channel advertising (with all other things being equal) would fall by 0.45% in the long term. We suspect this negative impact reflects the larger competitive pressure that higher multi-channel viewing puts onto the TV advertising market. However, the rise in multi-channel viewing would also lead to a fall in traditional channel viewing, and therefore an estimated -1.48% reduction in the supply of traditional channel impacts, which would itself push up the real price of traditional channel advertising (by 1.02%). Therefore the overall effect of a rise in multi-channel viewing by one percentage point of total TV viewing, including the consequent fall in traditional channel impacts, is a 0.57% rise in the real price of traditional channel advertising in the long term. Overall, real traditional channel NAR would fall by 0.92%, as the reduction in the supply of impacts would outweigh the rise in real price. This result matches the theoretical relationship that we expected to find, as detailed in Section 3 above. Figure 5.2 summarises the overall impact in traditional channel NAR.

[19] The elasticity is calculated as -1 / 0.69 = -1.44.
See Annex 1 – Definitions for further details of price elasticities.

Figure 5.2 Impact of multi-channel viewing on traditional channel NAR



Source: PricewaterhouseCoopers analysis

- If the consumer spending growth rate were to rise by one percentage point, then the real traditional channel price would rise by 1.44% in the long term. But this is only a short term effect, as consumer spending does not affect price in the long run equation. The rise would therefore have no long run effect on real prices.[20]

[20] David Hendry has noted the short run equation suggests that a permanent increase in the growth rate of consumer spending should have a long term impact on real traditional channel price, which would require an additional adjustment to the long run equation. This may be an area for future research.

Results of the model

- In contrast, we did find that real corporate profits featured in the long run equation, although rather weakly for traditional channel advertising. A 1% rise in real corporate profits results in a 0.14% rise in the real traditional channel price in the long term.[21] In addition to the small rise in impacts that the model also predicts, traditional channel NAR would rise by 0.24%.

- A 1% rise in the number of households with colour TVs would lead to an increase in the real traditional channel price by 0.68% in the long term. Overall, including the consequent rise in impacts, traditional channel NAR would rise by 1.43%.

- The 1979 ITV strike also affected the real price of TV advertising (negatively), but there was a quick recovery in real prices shortly after the strike. In the long term, the strike had no lasting impact on real prices, as we would expect.

The price of advertising on multi-channel channels, relative to the price for traditional channels was related to changes in past values of itself, growth of multi-channel advertising impacts, real corporate profits and seasonal adjustments. Again, we can interpret these results intuitively through a series of examples.

- If multi-channel viewing were to increase by 1%, then the real price of multi-channel advertising would fall, relative to the traditional channel real price, by 0.26% in the long term. All other things being equal, this would suggest a long term price elasticity of demand for multi-channel TV of -3.8 (see Annex 1 for definitions of elasticities).

- However, it is likely that any increase in multi-channel viewing would in part be at the expense of viewing of commercial traditional channels, which would affect the real price of commercial traditional channels and hence the relative price of multi-channel advertising. Assuming that total TV viewing remains constant, a 1% increase in multi-channel viewing would currently represent an increase of 0.25% of total TV viewing, as multi-channel currently commands about 25% of total TV viewing. As we explain below, we have estimated that a 1% increase in multi-channel viewing will translate into a 1% increase in multi-channel impacts. Therefore, following the calculations set out above, this would lead to an increase in the real price of traditional channel advertising by 0.25 * 0.57% = 0.14%.[22] Therefore, taking into account the predicted fall in the *relative* price of multi-channel advertising (of 0.26%), overall the price of multi-channel advertising would fall by 0.26% - 0.14% = 0.12%. Therefore due to competition between the channels, the long term price elasticity of multi-channel could be as high as -8.[23]

- We found that real corporate profits have a strong positive impact on real multi-channel advertising prices. A 1% increase in real corporate profits increases the real price of multi-channel advertising by 1.57% in the long term. This strong income responsiveness (see Annex 1 – Definitions) reflects the strength of the multi-channel advertising price during the late 1990s boom (and subsequent decline). We suspect that the late 1990s boom drove increased interest in multi-channel advertising and hence an increase in price that unravelled once the boom came to an end.

[21] The long term impact on price is less than that indicated by the equation expressed in Table 5.3, as rising corporate profits would also push up impacts, and hence reduce price. We have taken account of this offsetting effect here.

[22] The estimated impact on the real price of traditional channel advertising of a rise in multi-channel viewing of one percent of total TV viewing is a 0.57% increase in the real price of traditional channel advertising. Therefore the impact of a rise in multi-channel viewing of a one quarter of one percent of total TV viewing is 0.57% multiplied by one quarter, which equals 0.14%.

[23] As the price of multi-channel advertising would fall 0.12% in response to a 1% rise in multi-channel impacts (quantity), therefore the reverse calculation is for multi-channel impacts to fall 8% (= 1/0.12%) in response to a 1% rise in multi-channel advertising price. See Annex 1 for further details about calculating elasticities.

Results of the model

We also required an equation for *multi-channel advertising impacts*. We employed forecasts for multi-channel viewing for the traditional channel impact and real price equations, and so we formulated an equation that translated forecasts for viewing levels into forecasts for multi-channel impacts. We found that since 1993 there has been a stable relationship between multi-channel viewing levels and multi-channel impacts, so we estimated that a 1% increase in multi-channel viewing would increase multi-channel impacts by 1% as well.

For this report, we did not produce an independent forecast model for multi-channel viewing. Instead we employed PwC/Ofcom forecasts for multi-channel viewing, which took account of the announcement of analogue switch-off and possible trends in TV channel viewing behaviour by household type. See Section 6.2 for further details.

This *system of four equations* produced a model for the real price and quantity of advertising on traditional and multi-channel channels. The inputs were multi-channel and BBC TV viewing shares, colour TV penetration, real consumer spending growth, real corporate profits and seasonal and specific event dummies. The outputs were the real price and quantity of traditional channel advertising, the quantity of multi-channel advertising and the real price of multi-channel advertising relative to the real traditional channel price. These four outputs allowed us to estimate total TV NAR, split between traditional and multi-channel channels.

Statistical properties of the model

The estimated VEqCM passed the relevant standard statistical tests. We consider that the results of the statistical tests support the choice of model specification that we used in this analysis.

In summary:

- The average error of the model for traditional channel impacts was 2.5% of the actual impacts level.[24] The average error for real traditional channel prices was 5.0% of the actual recorded real price level. The average error for the relative price of satellite advertising was 7.4%. Therefore our estimated equations were more successful at explaining historical trends in traditional channel impacts and less successful at explaining the relative price of multi-channel advertising.

- Our central estimate of the traditional channel price elasticity of demand (-1.44) lies within a 95% confidence interval of -0.9 and -3.8.[25] This relatively broad margin of error is not atypical when estimating elasticities in a rapidly changing market such as TV advertising (see Hendry (1992)). We are 92% confident that the long term price elasticity is greater than unity.

- We did not find clear evidence of structural breaks having occurred during the period under analysis. After taking account of the 2002 BARB measurement change and the impact of audience fragmentation (through the inclusion of multi-channel viewing as a driver of the real price of traditional TV advertising), we were unable to reject the hypothesis of no structural change during the 2001-3 period. This result remains uncertain, however, due to the lack of data following this recent period.

- We did not find evidence of substantial unexplained auto-correlation – in other words we do not appear to have missed important relationships between past and current values of the variables.

[24] To calculate these errors, the model is used to estimate the past levels of variables based on their drivers, and these 'modelled' estimates are compared to the actual historic data. The margin (or error) between the two numbers was, on average, equal to 2.5% of the value of the actual historic data. This indicates the performance of the model on historic data.

[25] This confidence interval has been estimated using the standard statistical measure of standard errors, which may not be reliable in this instance. This range should therefore be treated with some caution.

5.4 Dynamics of the TV advertising market

Our structural model of the TV advertising market, based on econometric analysis of historical data, produced results that matched the economic relationships that we expected – as described in Section 3. In this section we summarise the results in terms of the dynamics of the TV advertising markets.

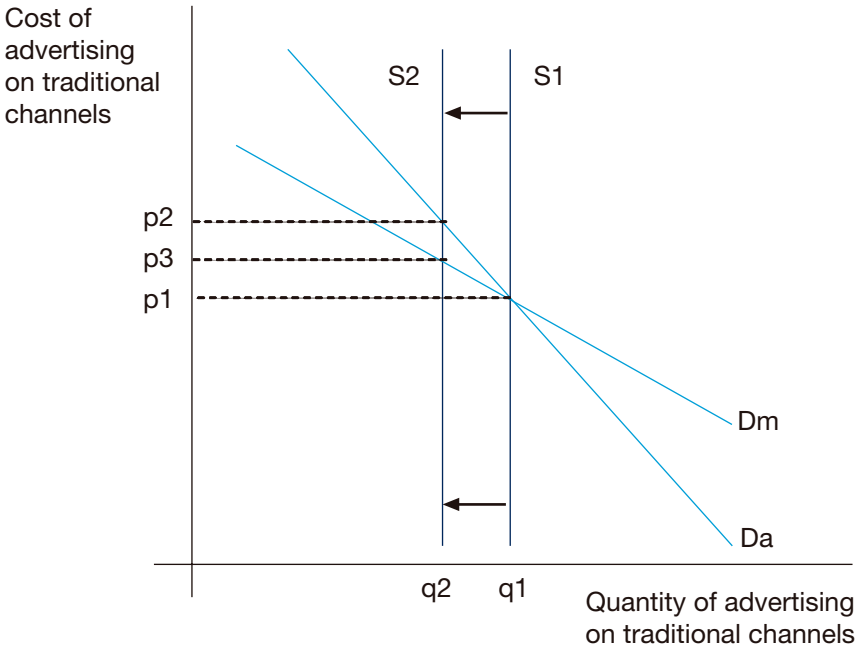
1 Both multi-channel and BBC audiences can draw audiences away from traditional commercial channels. We found that multi-channel draws about 60% of its new audiences from the traditional commercial channels. The BBC has, in the past, drawn about 70% of its new audiences from the traditional commercial channels, although we expect that relationship to change in the future, as multi-channel grows.

2 In the short term, changes in the supply of TV advertising impacts have little effect on TV NAR, as the price elasticity is close to unity (equal to -1.18 in the short term for traditional commercial channels). Effectively, the same amount of money continues to chase a smaller/larger number of advertising opportunities.

3 In the longer term, changes in the supply of TV advertising impacts have a more substantial effect on TV NAR. The long term price elasticity for traditional channels is -1.44, so a 1% fall in impacts results in a 0.31% fall in traditional channel NAR (the fall in NAR is partially offset by a rise in price).

4 Multi-channel advertising price is less responsive to changes in impacts than for traditional channels (i.e. the price elasticity for multi-channel TV is greater). Consequently, any change in impacts has a proportionally greater impact on NAR for multi-channel TV, than it would do for the traditional channels. Diagrammatically, we can represent this as multi-channel TV having a flatter demand curve than the traditional channels. In Figure 5.3 below, a loss of impacts (q1 to q2) would result in a larger price rise for the traditional channels (p1 to p2) than it would for multi-channel TV (p1 to p3). Therefore multi-channel NAR would fall by more than traditional channel NAR, for the same loss of impacts.

Figure 5.3 Illustrative demand curves for traditional channels and multi-channel TV



Source: PricewaterhouseCoopers

Results of the model

5 While there are asymmetries between advertising on traditional channels and multi-channel TV (as indicated by differing estimates of price elasticities), there is evidence of competition between the two types of advertising, suggesting that they are both part of a single advertising market. Increases in multi-channel viewing result in reductions in traditional channel advertising price, which reflects the increased competitive pressure from multi-channel as it grows. When the traditional channels lose audience to multi-channel TV, this increases the supply of multi-channel advertising impacts, which creates competitive pressure for the traditional channels and so pushes prices downwards.

6 Overall, a shift of audience from traditional channels to multi-channel TV results in a small increase in total TV NAR. Result (4) above suggests that multi-channel NAR would rise by more than the fall in traditional channel NAR, although this is partially offset by the increased competitive pressure, as shown in result (5).

7 Increased BBC audiences do not create additional competitive pressure in the TV advertising market, as these audiences do not provide TV advertising impacts. They do, however, draw audience away from commercial channels, and this would have a proportionally more adverse impact on multi-channel NAR than it would on traditional channel NAR.

6 Econometric forecasts

6.1 Introduction

We employed our structural model to build the three forecasting models described in Section 4 above. Employing reasonable input forecasts, we then used these three models to produce three sets of forecasts for TV NAR, split between traditional channels and multi-channel TV. The weighted-average of these three forecasts produced 'pooled' forecasts for TV NAR, based on our economic model of the TV advertising market.

In this section, we describe this process and present forecasting results for two illustrative scenarios for the TV advertising market, to highlight the potential implications of key uncertainties for the TV advertising market. These scenario forecasts are inherently tied to the historic relationships on which the economic model is based, and so in Section 7 of this report, we discuss other future drivers of change that are likely to affect TV NAR beyond the trends captured by the economic model.

6.2 Input forecasts and scenarios for the model

In order to use the estimated model as a forecasting tool, we required forecasts for the identified drivers of TV advertising out to 2014, the forecast horizon. Table 6.1 below describes the forecast data that was employed.

Table 6.1 Forecast data employed in the analysis

Identified driver	Forecast data employed	Long term extrapolation
Consumer spending growth	Consensus Economics, June 2004. Quarterly data for 2004 to 2005. Annual data for 2006-2014. Average forecast for period = 2.0%	None required
Real corporate profits	GDP growth forecasts are used to forecast real corporate profits. Source: Consensus Economics, June 2004. Quarterly data for 2004 to 2005. Annual data for 2006-2014. Average forecast for period = 2.2%	None required
Retail price inflation	Consensus Economics, June 2004. Used average annual growth rate, 2004-2014. Average forecast for period = 2.4%	None required
Colour TV penetration	None	Extrapolation of past rate of reduction of B+W only households
TV audiences (BBC and Multi-channel)	PwC forecasts to 2014, explained further below	None required
PVR impact assumptions	Illustrative scenario data provided by Ofcom	Extrapolation to 2014 based on growth rate 2010-12

Note: As annual macroeconomic forecasts are relatively stable from 2006, we used annual forecasts as forecasts for year-on-year growth rates for 2006-2014.

Econometric forecasts

We used real GDP growth forecasts to forecast real corporate profits as corporate profit's share of GDP has remained broadly stable in the past. We judged that the current share of GDP is quite close to the long run trend level, which suggests that there is no clear reason to expect the share to change in the future. We therefore forecast real corporate profits to retain the same share of GDP, and hence grow in line with GDP growth forecasts.

The only use of retail price inflation forecasts in this analysis was to translate real NAR growth forecasts into nominal NAR growth forecasts. The retail price index has no other role to play in this study.

Our analysis included two sets of forecasts for multi-channel and BBC viewing shares as input forecasts into the model. These forecasts for TV viewing patterns reflect two different scenarios for the adoption of digital TV technology by households in the run-up to analogue switch-off (expected in 2008-2012). Our scenario forecasts for digital TV penetration by household for the UK as a whole are an aggregation of our digital penetration forecasts for each region of the UK (as defined by the Channel 3 regional licences). These regional forecasts are based on the following:

- Data for actual digital penetration by region up to the first quarter of 2004;
- Scenario assumptions (see below) for digital penetration two quarters before analogue switch-off occurs, by region;
- An assumption that 95% of households have digital TV following analogue switch-off; and
- An assumption that there is a very gradual rise in digital TV penetration towards 100% of households thereafter.

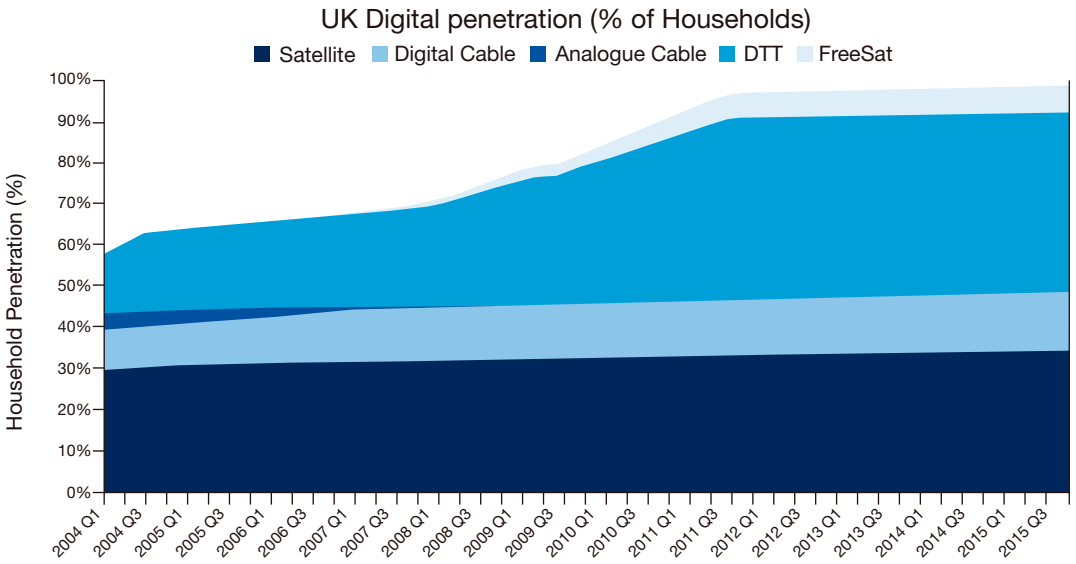
In the analysis below, we refer to these two scenarios to highlight the impact of digital switchover on the results of the model. The two TV viewing scenarios can be summarised as follows:

- Scenario A, where digital switchover progresses relatively slowly until analogue switch-off forces households to install the new technology; two quarters before analogue switch-off in each region, 75% of households are assumed to have digital TV; and
- Scenario B, where digital switchover occurs relatively rapidly over the next few years, before analogue switch-off; two quarters before analogue switch-off in each region, 90% of households are assumed to have digital TV.

Econometric forecasts

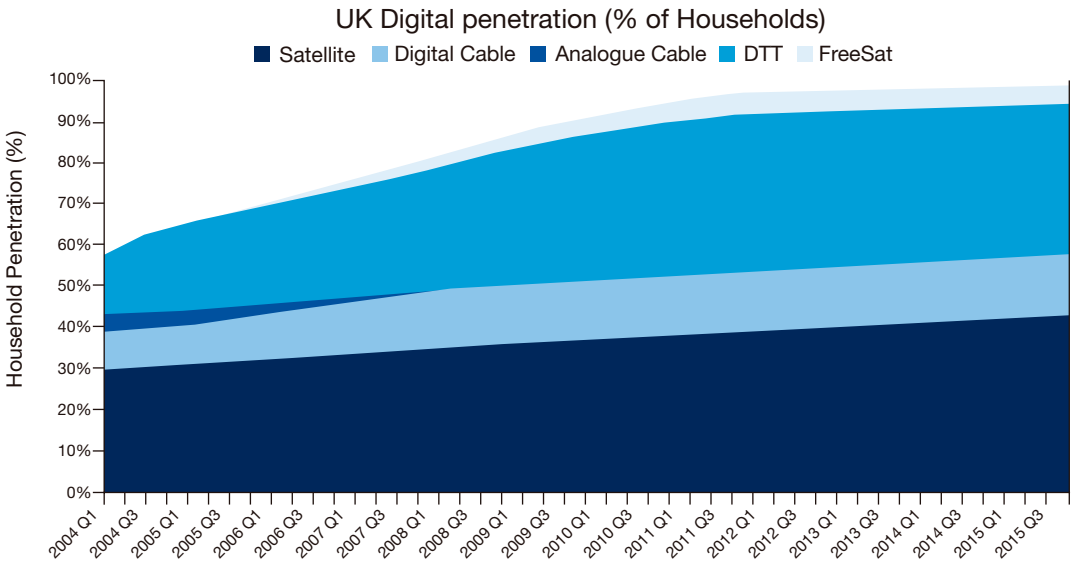
Figures 6.1 and 6.2 below provide our scenario forecasts for digital penetration for the UK as a whole. The forecasts are split between the main forms of TV broadcasting platform: satellite (e.g. Sky Digital); DTT (e.g. Freeview); FreeSat; digital cable; and analogue cable (which is included here as it provides multi-channel viewing). The remainder of TV households are those with only analogue terrestrial access.

Figure 6.1 Digital penetration by household, Scenario A



Source: PricewaterhouseCoopers

Figure 6.2 Digital penetration by household, Scenario B



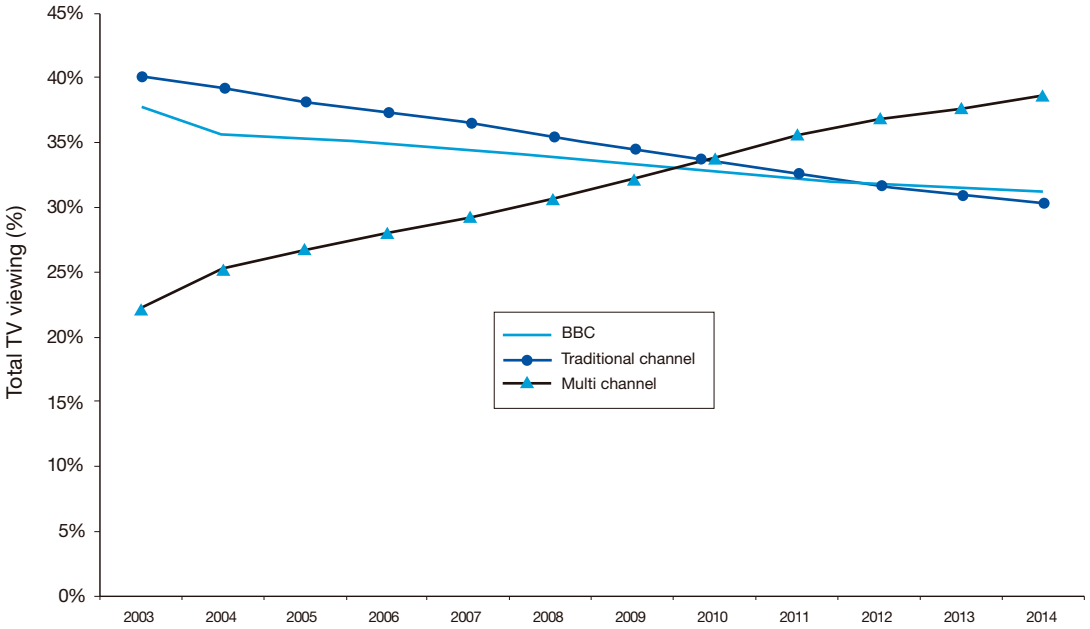
Source: PricewaterhouseCoopers

Econometric forecasts

We have modelled how these digital TV penetration forecasts could affect viewing shares by channel. Importantly, digital switchover will ultimately result in 100% of TV households having access to multi-channel TV, in some form, which is likely to affect viewing behaviour. We have produced forecasts for TV viewing by channel for different types of household.[26] Figures 6.3 and 6.4 below provide our forecasts for the viewing shares of the BBC, multi-channel and traditional channels (which sum to 100% of viewing, by definition), based on the two scenarios for digital penetration and, importantly, other scenarios for viewing behaviour. It should be emphasised that there are many other drivers of viewing shares and, in the analysis presented here, all of these other drivers are held constant (and therefore the range of potential scenarios for viewing shares is much broader than that suggested by the two scenarios presented here).

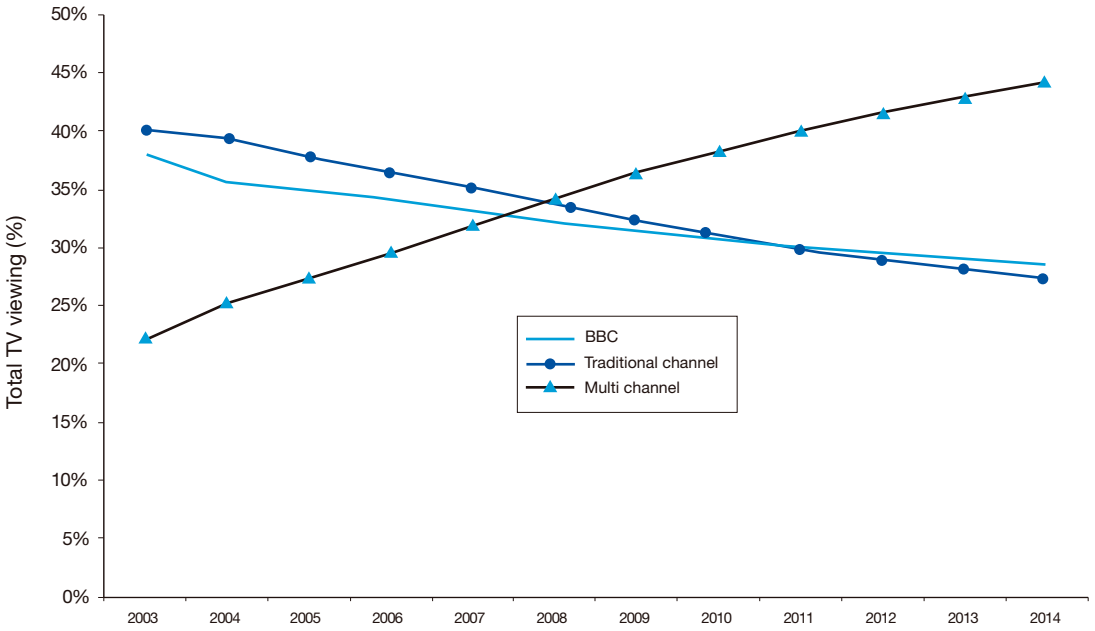
[26] Households are defined in this context according to the technology employed for their main TV set. We have also differentiated between early adopters of digital TV and late adopters (namely those who switch to digital terrestrial services shortly before or on the date of analogue switch-off).

Figure 6.3 TV viewing shares by channel type, Scenario A



Source: PricewaterhouseCoopers analysis

Figure 6.4 TV viewing shares by channel type, Scenario B



Source: PricewaterhouseCoopers analysis

6.3 Three sets of forecasts

In this section, we review the forecasts produced by the three forecasting models, based on the input forecasts described above and, in particular, Scenario A for TV viewing patterns.[27] To briefly recap, the three forecasting models were:

- a *'structural model'* based on the full VEqCM model;
- a *'differenced model'* employing first differences of the same inputs into the VEqCM model; and
- a *'long run trend model'* which adjusts past trend growth rates according to expected changes in future growth rates of identified drivers.

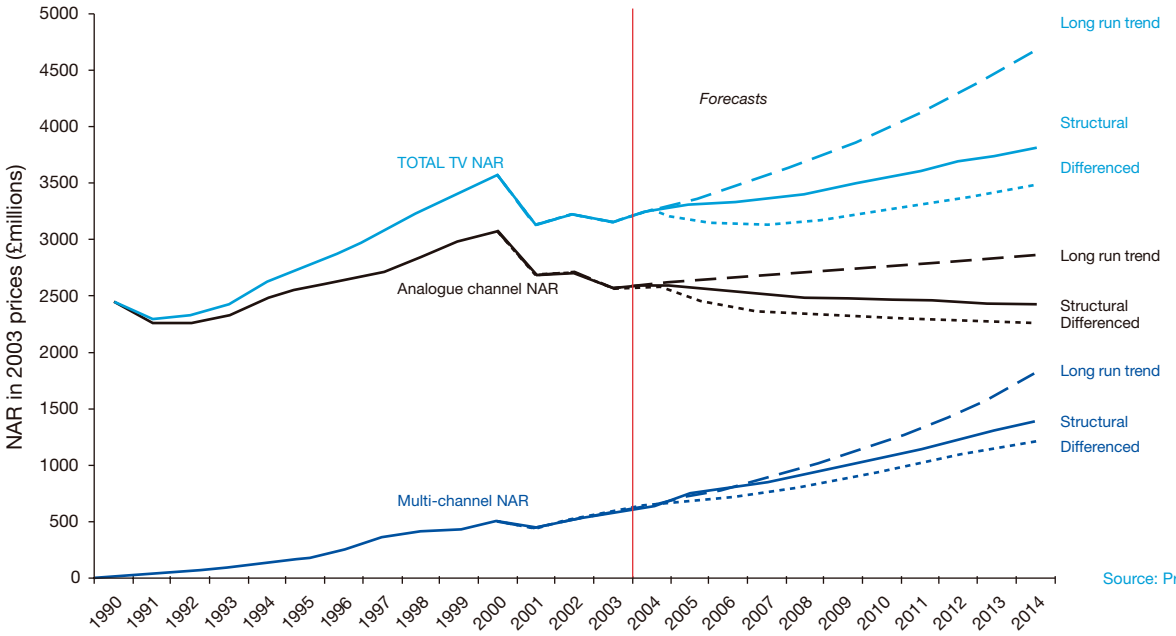
[27] Scenario A was chosen for no other reason that we need only present here the results of the three forecasting models for a single illustrative scenario.

The structural model and the differenced model produced quarterly forecasts for traditional channel quantity and real price, and the relative price of multi-channel advertising. By multiplying the forecasts for quantity with the forecasts for price, we were able to produce forecasts for TV NAR. In contrast, the simple long term trend analysis produced forecasts of TV NAR based directly on past trends, and so did not produce separate price and quantity forecasts.

Comparison of the results of the forecast models

Based on our econometric estimation of historic relationships in the TV advertising market, and the chosen input forecasts (including Scenario A for TV viewing patters), we employed the three developed forecasting models to produce a set of the forecasts for a single illustrative scenario, as presented in Figure 6.5 below. Here we compare these forecasts to present the key differences between the three forecast models, to highlight the potential implications of recent structural change in the TV advertising market.

Figure 6.5 Three sets of forecasts for illustrative Scenario A



Source: PricewaterhouseCoopers analysis

Econometric forecasts

The structural model produces more positive traditional channel NAR forecasts than the differenced model, and the gap grows over time. The gap is driven primarily by differences between the real price forecasts for 2004-5, which suggests that the difference reflects the role of the estimated long run equation. Essentially, the structural model is predicting a cyclical upswing in real prices over the first two forecast years, which suggests that the structural model treats part of the 2001-3 downturn as being only temporary. In contrast, the differenced model treats all of the 2001-3 downturn as being structural and hence permanent. This is the key difference between these two forecasting models, and it highlights the current uncertainty that surrounds future movements in the real price per advertising impacts following recent decline.

The forecasts for the relative multi-channel advertising price are generally less reliable than the forecasts for the price of advertising on traditional channels, as indicated by standard statistical measures of forecast reliability. Again we find that the structural model predicts a stronger cyclical upturn during 2005 than the differenced model. It would appear that part of the downturn in multi-channel prices during 2001-3 is not explained by the estimated long run equation, and hence is treated by the structural model as being partially cyclical in nature.

Notably, the structural model suggests that the price premium that is currently enjoyed by traditional channels will decline over the forecast period (to 2014), as multi-channel prices are forecast to rise relative to those of traditional channels. This forecast is based on past trends, so should be treated with caution given the possibility of significant changes in the attitudes and behaviour of advertisers in the future.

The long term trend model produces the strongest real NAR forecasts. Traditional channel NAR growth over the past ten years was relatively positive, at around 1% per annum in real terms. The average growth rates of the drivers of real traditional channel NAR are not likely to change that significantly over the next ten years, as compared to the past ten years. Consequently, the simple trend analysis suggests that traditional channel NAR will grow at a similar rate in real terms over the next ten years, as it did during the past ten years.

How should we interpret these differences? The differences reflect the possibility that structural change has occurred in the TV advertising market in the recent past. The three forecasting models highlight the uncertainties that need to be considered when developing forecasts based on an econometric representation of historic relationships.

6.4 The pooled forecasts for TV NAR to 2014

The pooled forecast was calculated as a weighted-average of the three forecasting models, and was the central forecast produced by our analysis for the illustrative scenarios discussed here. We used equal weights for all three models, as we cannot be sure which of the three models is likely to be superior in the future, given the likely occurrence of significant structural breaks, both in the recent past and in the future.

As discussed above, we present here two sets of pooled forecasts for two illustrative scenarios for TV viewing patterns, to indicate the implications of digital switchover on the results of the model. These forecasts are presented in Table 6.1 below.

Table 6.2 – Pooled forecasts for two illustrative scenarios

Illustrative TV NAR forecasts (in constant 2003 prices)		Traditional	Multi-channel	Total
Scenario A (weak digital penetration)	2003 2014 Annual growth rate	£2,570m £2,530m -0.2%	£590m £1,470m +8.6%	£3,160m £4,000m +2.1%
Scenario B (strong digital penetration)	2003 2014 Annual growth rate	£2,570m £2,430m -0.5%	£590m £1,620m +9.6%	£3,160m £4,050m +2.3%

Source: PricewaterhouseCoopers analysis

Source: PricewaterhouseCoopers analysis.
Note: These illustrative forecasts are based on two scenarios for the adoption of digital TV technology, which is a driver of both the mix of traditional and multi-channel viewing, and the total amount of commercial TV viewing. All of the other key drivers are assumed to be the same in these two illustrative scenarios (and therefore it is possible to construct a broader range of scenarios by introducing scenarios for the other key drivers as well). The scenarios exclude any impact of possible future drivers (such as PVRs), which are discussed in Section 7. All prices are in constant 2003 price levels.

These two illustrative scenarios suggest that that advertising revenues of traditional channels are not likely to grow significantly over the next decade – the two scenarios both forecast gradual declines in real revenues over time.

In contrast, multi-channel real NAR would, according to the economic model, rise quite rapidly over the next ten years in both of these scenarios, with stronger growth in Scenario B.

The two forecasts for total TV NAR are more similar, as the differences between the two scenarios mainly reflects competition between the two types of commercial channels. The model points towards slightly higher total TV NAR growth in Scenario B, however, as the growth in audiences on multi-channel TV would have a relatively more positive impact on multi-channel NAR, as multi-channel advertising is relatively more price elastic.[28]

[28] See Section 5.4 for an explanation of this trend.

The forecasts for total TV NAR shown here are broadly in line with expected wider GDP growth for the UK economy, which suggests that total NAR will retain a similar share of the UK economy over time.

7 Future drivers of change and uncertainty

7.1 Introduction

A single set of pooled forecasts based on an econometric representation of historic relationships would hide the considerable uncertainty that surrounds the future of TV advertising, particularly for a relatively distant forecasting horizon of 2014. In order to develop reliable forecasts for the future we must also consider different possible scenarios for the TV advertising market and the potential future drivers that cannot be captured by studying past data. In Section 6 above, we presented two illustrative scenarios to indicate uncertainty created by possible TV viewing patterns. In this section, we review a broader range of uncertainties that need to be considered in developing forecasts for TV advertising revenues - including analysis of the potential impact of new technology (in particular PVRs) and uncertainty surrounding the prospects for the UK economy. We begin by considering the statistical uncertainty that arises from the econometric analysis.

7.2 Statistical forecast error from the model

The historical data for the TV advertising market cannot be entirely explained by the drivers we have considered in this analysis. We have attempted to explain as much of the variation and trends in the market as possible, but ultimately certain drivers could not be captured and some past fluctuations are, effectively, random in nature. The model does not, therefore, perfectly describe historical trends, even though we believe that it is our best econometric representation of historic trends.

The degree of statistical forecasting error is different for each of the three forecasting models described in this report. The structural model should produce the lowest statistical forecasting error, as it is our best econometric representation of past data. We estimate the quarterly traditional channel NAR *mean forecasting error* of the structural model to be 3.2%.[29] To this *statistical* error we would need to add the risk of error from possible future structural change, as discussed below. While the error for the pooled forecast is likely to be less than the error of the structural model (which is the reason that we employ the pooled forecast), it is clear that there is a potentially significant amount of error present.

As we note below, however, the forecasts for total TV NAR are likely to be more reliable than the separate forecasts for traditional and multi-channel NAR, as the advertising revenues of the two types of channel are negatively correlated.

[29] This is a rough estimate based on certain key assumptions – notably that the model errors are not correlated over time. We provide this figure here for reference.

7.3 Future uncertainty in the TV advertising market

In addition to the statistical error resulting from the econometric estimation, we also need to be aware of other forms of future uncertainty for the TV advertising market, which can be summarised to include:

- Potential new drivers of the TV advertising market, not yet witnessed in past data;
- Uncertainty surrounding the input forecasts used in the forecast models; and
- Potential structural changes in the relationships that determine the dynamics of the TV advertising market.

We review these potential uncertainties in turn below, providing quantitative estimates as guidance wherever possible.

Potential new drivers of the TV advertising market

Under guidance from Ofcom, we focused on two key potential new drivers of the TV advertising market: the impact of analogue switch-off; and the potential impact of Personal Video Recorders (PVRs).

Analogue switch-off is expected to occur across the regions of the United Kingdom over the period 2008-2012, as the part of the frequency spectrum currently dedicated to analogue television broadcasting is reallocated to other uses, such as mobile telephony. Analogue switch-off will require that all televisions are converted to digital reception, which will consequently result in all TV households having access to many new channels (the number of new channels accessible to each household will depend on their choice of digital platform, as satellite-broadcast Sky Digital is likely to provide a far wider range of channels than digital terrestrial FreeView). Access to new channels should boost multi-channel viewing, and hence impact on traditional channel viewing.

We employed two illustrative forecasts of TV viewing patterns, which were based on forecasts of household penetration rates for different types of TV viewing platform, as well as forecasts for TV viewing behaviour by household type.[30] It remains unclear how quickly households will convert to digital platforms now that Ofcom has announced the planned analogue switch-off for the 2008-12 period.

[30] See Section 6.2 for details. The forecasts are based on planned regional switch-over dates provided to us by Ofcom in October 2004.

Section 6 above provides further detail as to how these two scenarios for TV viewing patterns affect the forecasts produced by our forecasting model.

PVRs allow viewers to record TV programmes to view them later (including 'time-shifting', where viewing occurs only minutes after the time of broadcast), perhaps skipping the advertisements as they view. We employed an illustrative scenario for the potential impact of PVRs on the viewing of TV advertisements, based on data supplied by Ofcom. We treated these forecasts as a proportional reduction in the viewing of TV advertisements, and hence a downward adjustment to the forecast for advertising impacts (quantity). As PVRs are a new technology, we cannot base any relationship on past data (as none are available) and must instead use forecasts. These forecasts were based on two scenarios:

- PVRs reduce the number of impacts in line with the illustrative scenario that we employed; or
- PVRs have no impact on TV advertising at all.

Future drivers of change and uncertainty

We also determined a method for including an adjustment to the value of advertising, but we did not include such an adjustment due to the lack of reliable data. It is not clear at this stage whether PVRs will have a negative or a positive impact on the value of an individual advertising impact after adjusting for the reduction in the number of advertising impacts (due to advertisement skipping by viewers).

The illustrative scenario for PVRs used in this report indicates that they might reduce advertising impacts by about 10% by 2014. The impact of PVRs is limited as we do not include any effect on value here the effect is purely through the reduction in impacts, which tends to result in an offsetting increase in the price of TV advertising.

There may be other important technological drivers which we are currently unable to forecast. For instance, broadband internet connections are likely, at some point during the forecast period, to allow people to view channels across the internet. The potential popularity of such a broadcast platform remains highly uncertain, but in the long term it could well have important implications for TV advertising.

Uncertainty surrounding input forecasts

We use a number of input forecasts in the forecasting model, and uncertainty surrounding these forecasts can create uncertainty for our forecasts for TV NAR. These input forecasts were:

- Colour TV penetration, which is not uncertain at all as it is very close to 100%;
- Multi-channel and BBC viewing forecasts, which were provided by PwC/Ofcom and the uncertainty surrounding them is described above; and
- Macroeconomic forecasts, including real corporate profit growth and real consumer spending growth.

In our pooled forecasts described in Section 6 above, we assume that real corporate profits grow in line with current real GDP growth forecasts of around 2.3% per annum on average. If we were to increase the forecast real corporate profit growth to 3% per annum on average, then our forecast average real annual growth rates for total TV NAR would increase by around 0.2 percentage points per annum. The increase in the total real NAR growth rate is smaller than the increase in the real corporate profits growth rate, suggesting that TV advertising is income inelastic. Our model suggests that multi-channel NAR growth is much more sensitive to real corporate profit growth than traditional channel NAR.

Change in the attitudes and behaviour of advertisers

Perhaps the most difficult area of uncertainty to judge is the potential impact of changing attitudes and behaviour in the TV advertising market. The value that advertisers place on TV advertising, relative to other forms of marketing, can change over time, resulting in changes in the price of TV advertising. Our forecasting model is inherently bound to historical relationships, as quantified through our econometric analysis. If the market begins to act in a radically different way in the future, these relationships could be rendered obsolete.

We have taken steps to mitigate this risk. We have employed pooled forecasting technologies to reduce the risk of structural change close to the forecast origin. We have estimated relationships that have held over a relatively long period of time (1975-2003), which may suggest that they could hold in the future as well. And we have focused on the drivers of the advertising market that we expect to be key in the future.

There is, of course, no way that we can forecast the truly unpredictable. Instead, we noted that scenario analysis can be employed to improve our understanding of the uncertainties. So for instance, if we wished to understand the potential impact of a gradual shift in corporate marketing budgets away from TV advertising, we might adjust the corporate profit forecasts downwards to imitate downward pressure on marketing expenditure.

7.4 The degree of uncertainty around the forecasts

So how uncertain are the forecasts overall?

The greatest uncertainty surrounds the separate forecasts for traditional channel and multi-channel NAR, as crucially these depend on the competition between these two groups of channels for audiences. Any shift in audiences from traditional channels to multi-channel TV will tend to result in lower traditional channel NAR and higher multi-channel NAR, particularly in the longer term. The two sets of advertising revenue are therefore likely to be highly negatively correlated over time.

There is also uncertainty about the future path of the Channel 3 and Channel 4 advertising price premiums over other traditional channel and multi-channel advertising. Were this premium to fall substantially as a result of increasing multi-channel competition, we might expect some of the historical relationships outlined above to break down.

Total TV NAR is likely to be considerably more stable and predictable, as the total for the market is much less affected by competition within the market. Macroeconomic performance can vary, but most independent forecasts for trend UK GDP growth lie within a range of 2-3% per annum, which does not suggest huge variations in our TV NAR forecasts. New technology could significantly impact total TV NAR, however, particularly if it changes the (perceived) effectiveness of TV advertising, relative to other forms of advertising. Such structural change could change the way the whole market works, which remains a great uncertainty.

Any precise forecast for the TV advertising market would require quantification of the possible scenarios for future change discussed in this section, to include as adjustments to econometric forecasts such as those discussed in this report.

Annex 1 Definitions

1. Channels

'Traditional' commercial channels are defined to be ITV1, Channel 4 and Five (Channels 3, 4 & 5) - the three main commercial channels currently provided across the analogue spectrum. Estimates of traditional channel advertising revenues include all revenues received by the three channels, even if some of those revenues may be related to viewers watching the three channels on a digital/satellite platform. Naturally, BBC1 and BBC2 are excluded here as they do not supply advertising.

'Multi-channel' channels are defined to be all of the other commercial TV channels, including satellite/cable platform channels (including subscription and pay-as-you-go TV channels) and digital channels such as ITV2 and E4.

'BBC' channels are BBC1, BBC2 and all of the multi-channel BBC channels, including BBC3, BBC4 and BBC News 24.

'Analogue switch-off' refers to the situation where TV channels are no longer broadcast in analogue form, and only digital broadcasts are available. This is expected to occur during the latter end of the 2008-12 period [reference Ofcom document on digital switchover].

2. Advertising revenue

'NAR' (Net Advertising Revenue) is defined as advertising revenue received by broadcasters, and therefore excludes agency fees and commission.

'Impacts' are the measure of the quantity of advertising, defined to be a single individual watching a single 30 second advert (or equivalent). For example, if one million individuals watch a one hour programme containing eight minutes of advertising, this would produce 16 million impacts.

'Price' of TV advertising is defined to be the average revenue received for a thousand impacts. We have used real price in our econometric analysis, which was calculated as equal to NAR divided by the retail price index and divided by the number of impacts (in thousands).

3. Econometric modelling terms

'First differenced' variables are the change in the original variable compared to the previous quarter. So the first difference of variable x in time t is equal to x(t) – x(t-1).

A variable is *'weakly exogenous'* of another variable if the current value of the other variable does not influence the current value of the weakly exogenous variable.

'Endogenous' variables are the variables that we need to forecast, as their future values are determined by the external drivers we have identified.

Annex 1: Definitions

Also, the prices of advertising on Channel 3 and Channel 4 can be said to be *'endogenous'* (rather than weakly exogenous) as both prices affect each other in the current time period. The loss of the weak exogeneity assumption makes the results of any econometric modelling more difficult to interpret, as discussed in more detail in Hendry (1992).

'VEqCM' stands for Vector Equilibrium Correction Model which is the econometric approach we adopted to estimate our structural model. For technical details of the VEqCM econometric approach, see (for instance) James Hamilton, "Time Series Analysis", especially chapters 10, 11, 19 and 20.

'Structural model' is the forecasting model based on the VEqCM model that we estimated. This is our best econometric representation of historical relationships in the TV advertising market.

'Differenced model' is the forecasting model that employs first differences of the same inputs into the same VEqCM model of the 'Structural model'. The use of first differences of inputs into the same model removes the long term relationship incorporated in the 'structural model'.

'Long run trend model' is the forecasting model which adjusts past trend growth rates according to expected changes in future growth rates of identified drivers. The model takes the average growth rate of real NAR over the past ten years and adjusts it according to expected changes in the trend growth rates of drivers.

'Pooled forecast' is our central forecast, which is equal to a simple average of the forecasts of the structural, differenced and long run trend models.

4. Elasticities

'Price elasticity of demand' is defined to be the percentage change in quantity demanded that results from a one percentage point change in price. If a change in price leads to a proportionally greater change in quantity demanded, the product is said to be 'price elastic'.

'Cross price elasticity' of product A compared to product B is defined to be the percentage change in the quantity demanded of product A that results from a one percentage point change in the price of product B. This measures the competitive pressure that exists between products A and B.

'Income responsiveness' is defined in this report as the percentage change in the real price of advertising that results from a one percentage change in real corporate profits (the 'income' available for expenditure on advertising). We relate the income effect to price, rather than quantity (which would be an 'income elasticity'), as quantity is fixed by viewing habits in the short term.

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Annex 3 The dataset

The table below describes the data that was collected for the analysis described in this report.

	Data Description	Period available Annual	Quarterly	Source	Units
	TV Advertising				
1	Terrestrial NAR	1955-2002	1975Q1-2003Q3	ASY	£m
2	Terrestrial NAR by channel (C3, C4, C5)	1975-2003	1975Q1-2003Q3	Ofcom	£m
3	Multichannel NAR	1991-2002	NA	ASY	£m
4	Terrestrial impacts	1961-2002	1973Q1-2002Q4	ASY	bn
5	Multichannel impacts	1961-2002	1994Q1-2002Q4	ASY	billions
6	Comm terr TV viewing (hours) per home, per week	1973-2003	1973Q1-2003Q4	ASY	hours
7	BBC TV viewing (hours) per home, per week	1985-2003	1985Q1-2003Q4	Ofcom	hours
8	Satellite TV viewing (hours) per home, per week	1985-2003	1985Q1-2003Q4	Ofcom	hours
9	Colour TV penetration	1968-2003	NA (but estimatable)	ONS	percent
10	Digital TV penetration	1998-2003	1998Q3-2003Q3	Ofcom	percent
11	Cable/satellite penetration	1985-2003	1992Q3-2003Q3	ASY	percent
	Alternative media data				
12	Commercial radio NAR	1990-2003	1990Q1-2003Q4	RAB	£m
13	Commercial radio audiences	1993-2003	1992Q4-2003Q4	RAB	hours
14	Printed press rates (plus TV rates)	1965-2002	NA	ASY	index
15	Specific press rates	1991-2002	NA	ASY	index
	Macroeconomic drivers				
16	Consumer spending (real, nominal, SA, NSA)	1955-2003	1955-2003	ONS	£bn
17	GDP	1955-2003	1955-2003	ONS	£bn
18	RPI (all items)	1955-2003	1955-2003	ONS	index
19	Company profits	1959-2003	1959-2003	ONS	£bn
20	FTSE all shares	1963-2003	1963-2003	ONS	index

Note on sources:

- ASY is the Advertising Statistics Yearbook, produced by the World Advertising Research Centre for the Advertising Association
- ONS is the Office for National Statistics
- RAB is the Radio Advertising Bureau
- BARB is the Broadcasters' Audience Research Board Ltd.

Annex 4 Overview of academic literature survey

Research Paper Title	Author	Year Published	Elasticities Results	Summary
An Econometric Analysis of TV advertising Expenditure in the United Kingdom	David Hendry	1992	Dependent variables: Change in price of advertising, average viewers per hour and minutes of advertising Short run price elasticity -4.3 Long run price elasticity -2.4	A dynamic econometric model explaining the real price of TV advertising, average audiences and the number of commercial home minutes broadcast, based on quarterly observations covering the period 1973-1986. The paper claims that previous studies include problematic exogeneity assumptions that result from the use of annual, rather than quarterly data.
An empirical analysis of the demand for commercial television advertising	Rumi Masih	1999	Dependent Variable: Change in impacts Short run price elasticity -0.352 Short run cross-price radio elasticity 0.2701 Long run price elasticity -0.8998 Long run cross-price radio elasticity 0.1089 Income elasticity 0.2151	An empirical analysis of the demand for commercial television advertising in the Sydney metropolitan market as a case study using unpublished quarterly data (1986q4 – 1994q2). Based on an oligopolistic framework, the paper employs co-integration (VEqCM) methods. Findings: Price elasticity of demand is robust in terms of theoretical expectation in sign and statistical significance, but substantially less than unity in the short run, and neighbouring unity in the long-run.
Are Local TV Markets Separate Markets?	Robert Ekelund, JR., George S. Ford, & John Jackson	2000	Dependent Variable: Log TV ad price Price elasticity -4.264 Cross-price radio elasticity 1.0474 Cross-price newspaper elasticity 0.2351 Income elasticity 3.6176	Employing data from 101 separate local TV markets, they estimate the own-price and income elasticities of demand for TV advertising, cross-price elasticities between TV and newspapers and radio stations. Econometrics method: Instrumental Variables and reduced form – 1995 cross sectional data.
Intermedia Substitutability and Market Demand by National Advertisers	Alvin J. Silk Lisa R. Klein Ernst R. Berndt	2001	Network TV advertising Price elasticity -0.69 Cross-price magazine elasticity 0.55 Cross-price network radio elasticity 0.02 Newspaper elasticity -0.05 Direct mail elasticity 0.58	An assessment of substitutable and complementary relationships among eight national advertising media classes, as well as the magnitude of their own-price elasticities. Econometrics: Used a 'translog' demand model, whose parameters estimated by three-stage least squares, based on 1960-94 annual U.S. data. Findings: Aggregate demand by national advertisers for each of the 8 media is own-price inelastic, and that cross-price elasticities suggest slightly more substitute than complementary relationships.
Determinants of advertising expenditure: aggregate and cross-meda evidence	Brendan O'Donovan, David Rae, Arthur Grimes	2000	Long run elasticity of TV advertising circulation to share of consumption in: TV -0.84 Press 0.27 Magazine 2.02	The paper models the advertising industry in New Zealand and addresses advertising in different media using a structural systems approach.
On the Substitutability of Local Newspaper, Radio, and Television Advertising in Local Business Sales	C. Anthony Bush FCC	2002	TV advertising Own price elasticity -0.79601 Cross price newspaper elasticity -0.0044 Radio elasticity -0.12399	Develops a model of local business behaviour in purchasing advertising for use in sales activities to obtain estimates of elasticities of substitution, ordinary own- and cross-price elasticities for a representative local business establishment. The results suggest weak substitutability between local media. Demands for both local radio and local television advertisings are inelastic. Due to limitations in the underlying data, the results of this study, although consistent with economic theory, cannot be considered conclusive.

Annex 5 Analysis considered but not included in final results

During the work conducted for this study, we considered many possible options for modelling and forecasting TV NAR which were not included in the report above, as they were excluded, for various reasons, from the central analysis. In this Annex to the main report, we explain the analysis that was considered in this study, but was not included in the final results reported above. This includes:

- Potential drivers of TV NAR that were excluded from the main analysis;
- Possible modelling specifications and econometric modelling approaches that were considered but not used in the main analysis; and
- Possible forecasting techniques that were considered but not included above.

We provide brief explanations for why we chose to exclude these options from the analysis.

Excluded possible drivers of TV NAR

There were a number of possible drivers of TV NAR that were not included in our analysis. Some of these possible drivers were excluded due to lack of available data, including data on:

- *Alternative advertising/marketing media;* apart from some data collected on press and radio advertising rates (see below), we were unable to collect sufficient quarterly time-series data on other forms of marketing to test whether there were historic relationships with TV advertising; notably, very little data on sales promotions is available;[31] given uncertainty about the degree to which other forms of marketing affect TV advertising, we therefore excluded this area from the analysis (the expert panel advised us that substitution between TV and other forms of advertising media remains limited in extent);

- *Total marketing budgets of both the public and private sectors;* traditional forms of advertising (including TV advertising) may be declining as a share of total marketing budgets; we were not able to obtain data on total marketing budgets, although we hoped that there should be a close relationship between these budgets and our macroeconomic drivers (e.g. corporate profits, consumer spending); such a close relationship would make the exclusion of the former data less detrimental to the analysis (as the macroeconomic data would act as a proxy for marketing budget data);

- *Industry awareness of TV advertising media;* the rise in TV NAR during the 1970s and early 1980s may have been driven by the increasing number of sectors using TV advertising,[32] rather than colour TV penetration; notably, high cost items (such as cars) were increasingly advertised on TV, raising the demand (and hence the price) for TV advertising; we were unable to collect information on the former, so instead we used the latter as a proxy for the former; as colour TV penetration followed a similar trend in the past, and is set to follow a similar trend in the future (i.e. not to rise any more), we believed this was a sensible proxy; in fact, the increased attractiveness of TV advertising to new advertisers, such as car producers, was perhaps due to colour TV penetration, suggesting that the latter was a strong proxy for the former;

[31] See "Marketing Pocket Book 2004", page 137 for details of data problems in this area

[32] See "Long term issues for TV advertising", Patrick Barwise, as detailed in Annex 2

Annex 5: Analysis considered but not included in final results

- *Production expenditure and other drivers of TV quality;* within the scope of this project, we did not have available sufficient quarterly time series data on production expenditure or other indicators of TV quality, which may have helped explain past trends in audiences; and

- *Sponsorship of TV programming;* while sponsorship of TV programming was currently a relatively small proportion of broadcaster revenue, this could change in the future; we did not have appropriate time series data to include sponsorship in our analysis; we hoped that sponsorship of TV programming was just another form of TV advertising, so would follow the same trends; if TV sponsorship follows the same trends as TV advertising in the future, then the combination of TV advertising and TV sponsorship should follow the same trend as our forecasts based on past TV advertising alone.

We also excluded some possible drivers of TV NAR as we were unable to estimate statistically significant relationships, including:

- *Advertising prices for radio and press;* we did have some data on these alternative advertising media, but were unable to identify clear relationships vis-à-vis TV advertising this confirmed the views of the expert panel regarding the low level of substitution;

- *Digital/satellite penetration;* we did not use this data, as we found that multi-channel viewing was a better explanatory variable for our purposes;

- *Launch of Channels 4 and 5;* in some model specifications, a dummy was required for the launch of Channel 4, but the impact was only limited and in our final specification a dummy was not required; we did not find any statistical requirement for a Channel 5 dummy;

- *Other specific events;* we tested whether Diana's funeral in 1997 might have created the need for a dummy variable for that period due to the surge in TV viewing, but we did not find this to be statistically necessary; and

- *Other macroeconomic drivers;* we did not employ real GDP numbers, as instead we used real consumer spending and corporate profits; we did not employ FTSE share price data as we found that the relationship was weak except for the 1998-2003 period, which might be a one-off correlation linked with the Internet bubble.

Annex 5: Analysis considered but not included in final results

Excluded possible econometric approaches

There were a number of possible econometric approaches to modelling the TV advertising market that were not employed in the main analysis, including:

- *Use of annual data:* we did not estimate models based on annual data as we wished to estimate elasticities and therefore wished to maintain the weak exogeneity assumption for quantity (i.e. quantity is not driven by contemporaneous price); we also wished to exploit the larger number of observations of quarterly data;

- *Single equation analysis of TV NAR;* we did not undertake single equation analysis of TV NAR as this analysis was covered by our previous January 2003 report; in this study, we wished to identify elasticities, which would not be possible with a single equation model;

- *Three equation analysis of TV NAR;* Hendry (1992) split TV NAR into three components – price, average audiences and minutes of advertising – where average audiences multiplied by minutes gives impacts, which is the measure of supply that we have used; we did not split impacts into audience and minutes as we found that minutes had been stable over time and so the split was not necessary;

- *Individual traditional channel analysis;* we investigated modelling traditional TV NAR split between the three commercial channels – Channels 3, 4 and 5; we judged that this was not the most reliable way of forecasting TV NAR, and that it would be better, in any later project, to estimate a model based on shares of NAR for the three channels; and

- *Total TV advertising market analysis;* we did not include econometric analysis of the aggregate total TV advertising market as we believed, following discussions with the expert panel, that the traditional channel advertising market has followed different trends to the multi-channel advertising market; we therefore modelled these two markets separately.

Excluded forecast approaches

The approach to forecasting adopted in this study includes three different types of forecasting model, but in addition it might also have included the:

- *Multi-step forecasting procedure;* this involves forecasting each time period in the future directly from the forecast origin, using a separately estimated forecasting model for each forecast period; we judged that this approach was outside of the scope and timeframe of this project.

While we did include an adjustment to our forecasting model for the potential future effect of PVRs on total viewing of advertising (and hence impacts), we did not include any adjustment to the value of an individual impact. It is possible that the value of an individual impact might decline due to PVRs as it could lead to advertisers coming to the opinion that viewer attentiveness is declining and hence the effectiveness of TV advertising is declining. Alternatively, PVRs could raise viewer appreciation of TV, and hence could raise the value of an individual impact. Our research indicated that more reliable evidence on the potential impact of PVRs will not be available for another year or so, so it was decided that these effects should be left out of the analysis until data are available

Annex 6 Econometric modelling results

Table 6a and 6b below provide details for the specification of the estimated long run and short run equations for traditional channel advertising impacts.

Table 6a – Estimated long run equation for log of traditional channel impacts

Variable name	Description	Coefficient	Std Error
C	Constant	11.19	0.920
SATTV	Multi-channel viewing as % of total TV viewing	-1.48	0.370
BBCTV	BBC viewing as % of total TV viewing	-1.85	0.652
COL_4	Colour TV penetration (% of TV households), lagged four quarters	0.0075	0.006
LCPR	Log of corporate profits (real)	0.1	0.144

Table 6b - Estimated short run equation for change in log of traditional channel impacts

Variable name	Description	Coefficient	Std Error
C	Constant	-0.016	0.004
D2LTIM_2	Change in log of traditional channel impacts over past two quarters, lagged by two quarters	-1.48	0.041
CSeasonal	Seasonal adjustment for first quarter	-0.032	0.014
CSeasonal_1	Seasonal adjustment for second quarter	-0.086	0.016
CSeasonal_2	Seasonal adjustment for third quarter	-0.079	0.014
DSATTV	Change in multi-channel viewing, as % of total TV viewing	-1.156	0.372
DBBCTV	Change in BBC viewing, as % of total TV viewing	-1.589	0.274
D79	1979 strike dummy	-1.666	0.044
D79_1	1979 strike dummy, lagged one quarter	0.463	0.128
D79_2	1979 strike dummy, lagged two quarters	-0.502	0.086
D79_4	1979 strike dummy, lagged four quarters	0.271	0.078
DCOL_4	Change in colour TV penetration as % of TV households	0.068	0.007
ECM	Error correction term from long run equation	-0.771	0.071
I763	Dummy for third quarter, 1976	-0.110	0.027
D4I823	Dummy for third quarter, 1982	-0.079	0.018
I021	Dummy for first quarter, 2002	-0.109	0.026

Annex 6: Econometric modelling results

Table 6c and 6d below provide details for the specification of the estimated long run and short run equations for traditional channel advertising price per impact (in real terms).

Table 6c - Estimated long run equation for log of real traditional channel price

Variable name	Description	Coefficient	Std Error
C	Constant	0.015	0.017
LTIM	Log of traditional channel impacts	-0.693	0.221
SATTV	Multi-channel viewing as % of total TV viewing	-0.454	0.443
COL_4	Colour TV penetration (% of households), lagged four quarters	0.012	0.005
LCPR	Log of corporate profits (real)	0.21	0.049

Table 6d – Estimated short run equation for change in log of real traditional channel price

Variable name	Description	Coefficient	Std Error
DLTIM	Change in log of traditional channel impacts	-0.490	0.073
DLTIM_1	Change in log of traditional channel impacts, lagged one quarter	-0.610	0.118
D2LTIM_2	Change in log of traditional channel impacts over past two quarters, lagged by two quarters	-0.199	0.050
D3LTCPTR_1	Change in log of real traditional channel price over three quarters, lagged by one quarter	-0.358	0.057
CSeasonal	Seasonal adjustment for first quarter	-0.095	0.030
CSeasonal_2	Seasonal adjustment for third quarter	-0.158	0.024
D79	1979 strike dummy	-0.754	0.153
D79_1	1979 strike dummy, lagged one quarter	-0.553	0.193
D79_2	1979 strike dummy, lagged two quarters	0.815	0.197
D4LCSR	Change in log of real consumer spending over four quarters	1.443	0.176
ECM	Error correction term from long run equation	-0.373	0.055

Annex 6: Econometric modelling results

Table 6e and 6f below provide details for the specification of the estimated long run and short run equations for the relative price (per impact) of multi-channel advertising.

Table 6e - Estimated long run equation for the log of the real multi-channel price divided by the real traditional channel price

Variable name	Description	Coefficient	Std Error
C	Constant	6.162	1.057
LSIM	Log of multi-channel impacts	-0.265	0.052
LCPR	Log of corporate profits (real)	1.569	0.239

Table 6f – Estimated short run equation for the change in the log of the real multi-channel price divided by the real traditional channel price

Variable name	Description	Coefficient	Std Error
DLSPR_2	Change in log of real multi-channel price divided by real traditional channel price, lagged two quarters	0.281	0.092
DLSIM	Change in log of multi-channel impacts	-1.090	0.129
DLSIM_1	Change in log of multi-channel impacts, lagged one quarter	-0.519	0.194
DLCPR	Change in the log of real corporate profits	-1.041	0.374
DLCPR	Change in the log of real corporate profits, lagged one quarter	-0.714	0.340
Cseasonal	Seasonal adjustment for first quarter	-0.225	0.052
CSeasonal_1	Seasonal adjustment for second quarter	-0.287	0.044
CSeasonal_2	Seasonal adjustment for third quarter	-0.197	0.041
ECM	Error correction term from long run equation	-0.808	0.112

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