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The Digital Future of Terrestrial Advertiser-supported Television[1]

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ABSTRACT *The digital transmission of signals greatly increases the channel carrying capacity of the broadcast spectrum and provides scope for a substantial increase in the number of television channels transmitted terrestrially in each broadcasting market. A simple model of a hypothetical advertiser-supported television market shows that with increased channel numbers the average audience size for programmes and channels will decline, advertising revenue per channel will decline, programme costs per audience member will increase, and average profit per channel will decline. In practice, with digital terrestrial television the number of new channels licensed will continue to be subject to government regulatory decisions. But even with liberalisation of licensing policy, the economics of advertiser-supported television broadcasting will impose severe limitations on the number of new channels that any market can support. Digital interactive television services offer commercial broadcasters the prospect of a new source of revenue. The financial viability of these services, however, is not yet proven. Another unknown factor is the impact that personal video recorders will have on television advertising revenues. The transition from analogue to digital terrestrial transmission will have wide-ranging effects on commercial television viewing, but probably not on the structure and ownership of the television broadcasting industry.*

Keywords: digital, television, advertising, audiences, multiplexing, interactive.

Introduction

Digital transmission of television signals has substantial technical advantages over the analogue system. Digital is much less susceptible to distortion and atmospheric interference. Broadcasters can transmit 'enhanced' programming, that is, additional content relating to a broadcast programme—for example, information concerning a player or choice of camera angles during a sports telecast. Substantially less power is required for digital transmissions, so the energy consumption for each programme service is much lower than for analogue. Digital facilitates subscriber-supported television (pay-TV) by the encryption of television signals. There is far more scope with digital than analogue for on-screen display of

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programming information (electronic programme guide), and for 'interactivity' between viewers and broadcasters thus allowing the provision of a range of 'interactive' services.[2]

From an industry structure viewpoint, however, the most important feature of digital transmission is that it is much more economical than analogue in the use of the broadcast spectrum. It is possible to have between four and six digital television channels within the same amount of spectrum that is required for one analogue channel.[3] This is possible because the digital signal is compressed, and because the spectrum currently used for 'buffer' channels between analogue signals and for 'shadow infill' in areas of hilly terrain is either not required or is greatly reduced.[4] Ongoing developments in compression technology are likely to result in further spectrum capacity gains. Moreover, with 'multiplexing' digital allows the transmission of more than one stream of programming over a single television carrier.

Digital transmission thus greatly increases the channel carrying capacity of the spectrum and provides scope for a substantial increase in the number of broadcasting signals transmitted terrestrially in each market area. With spectrum scarcity banished, the number of channels could be determined simply by the financial capacity of the market. This increased scope has provoked some writers to suggest that digitisation will bring about a large increase in the number of channels and broadcasters. Jones, for example, claims that '. . . digitisation would allow numerous [commercial] free-to-air networks'.[5] Negroponte goes further and argues that 'the monolithic empires of mass media are dissolving into an array of cottage industries [and the] media barons of today will be grasping to hold on to their centralized empires tomorrow'.[6] This contention requires some examination.

There are three methods for financing the provision of television programming. Commercial broadcasting can be funded either by advertising revenues or direct subscriptions from viewers.[7] Public service and community broadcasters can be funded either directly by government, by viewers licence fees, by voluntary contributions and/or by advertising. This paper examines the future of commercial terrestrial advertiser-supported television. Historically, this sector has dominated the television medium both financially and in terms of audience share in many countries, including the United States, Canada, Australia and New Zealand. During the 1990s there was a substantial increase in the number of terrestrial analogue advertiser-supported channels in the European Union countries where they quickly acquired sizeable audience shares and profitability. Digital terrestrial television broadcasts began in the United States and United Kingdom in November 1998. Then followed Sweden (April 1999), Spain (May 2000), Australia (January 2001) and Finland (August 2001). Most developed countries plan to commence digital terrestrial television transmissions by 2010, many by 2005.

While digital television allows scope for greatly increased provision of channels, there is a limit to the number of such advertiser-supported channels. If the size of the viewing audience remains constant, other things being equal, the average revenue per channel will fall the more channels are available to that fixed audience. This paper will look at the implications this has for commercial broadcasters, examining how channel proliferation might occur and the conditions that could allow or prevent proliferation.

In particular, it considers the potential effects of the transition from analogue to digital transmission on the regulation, ownership and operation of commercial advertiser-supported television channels. The paper begins with a model of

advertiser-supported television in a hypothetical market with digital transmission and no regulatory restrictions on the number of channels. The results of the model and their sensitivity to the model's assumptions are examined. The role of government in the introduction and operation of digital terrestrial television is discussed. The paper then considers new prospects in the form of digital interactive services, and the risks for advertiser-supported television inherent in digital personal video recorders.

A Model of Commercial Advertiser-supported Television Broadcasting

The desirability of an increase in the number of television channels is supported by conventional economic theory as well as by the economic literature relating specifically to broadcasting. Economic analysis supports the proposition of removing artificial barriers to entry—such as government imposed restrictions on the number of licences issued—thus allowing the number of firms to be determined by market forces. Applying traditional criteria of welfare economics to television, economists have argued that television broadcasting generates viewer satisfactions that exceed its costs in resources, and that where channel numbers are restricted consumer welfare would be enhanced by additional channels.[8]

The theory of programme choice that originated with Steiner,[9] and the Spence–Owen model of monopolistic competition,[10] both suggest that economic welfare is improved when channel numbers are determined by market forces. Although these two economic theories of broadcasting differ in their analytical approach, they have identical policy implications. Referring, in 1975, to commercial television and radio broadcasting in the United States, Owen claimed that:

> The present structure of broadcasting, with artificially limited channels . . . is very nearly the worst structure that can be imagined. The solutions are clear, and they follow both from the Steiner analysis and from the analysis of monopolistic competition in product space: remove the artificial barriers to channel expansion . . .[11]

A common feature of highly concentrated industries is economies of scale. Largely because of the existence of scale economies a number of industries—supermarkets, newspapers, airlines, oil refining, and cigarette, pharmaceutical, chemical and motor vehicle production to name a few—generally have only a small number of competing firms even though there may be very low or no artificial barriers to entry. They are natural oligopolies. Television broadcasting is such an industry. While the creation and editing of television programmes is labour intensive with limited opportunities for economies of scale, there are substantial scale economies in the transmission of programmes. Once a programme is produced or purchased by a television channel the 'first copy costs' are unaffected by the size of the audience for that programme. The larger the audience the lower the first copy costs per audience member. As well, because free-to-air television signals are 'nonexcludable' (reception of signals is not denied to potential viewers) the marginal cost of transmission to an additional viewer is zero.[12] These features relating to the costs of television programmes imply that, for a given audience size, more channels means higher average programme cost per viewer.

Assumptions

Assume a hypothetical commercial terrestrial advertiser-supported television market. With analogue transmission of signals the number of channels is restricted by government allocation of scarce spectrum. Given the audience available for advertisers, each channel earns an economic rent ('excess' profit). With the introduction of digital transmission we suppose that the government decides to no longer restrict the number of television licences, but to allow the number of channels to be determined by market forces.

The simplifying assumptions regarding the increase in channel numbers are as follows:

1. the *size of the total viewing audience* remains constant with an increased number of channels;
2. the increase in channel numbers causes *fragmentation of the audience* over all channels;
3. the *advertising rate* per viewer is unchanged with an increased number of channels; and
4. per hour *programme costs* are also unchanged with an increased number of channels.

Implications

Reflecting the economics of advertiser-supported television broadcasting, the increase in channel numbers implies the following for our hypothetical market.

- The average audience per programme *declines* with an increase in the number of channels.
- Because of the decline in the average audience per programme, advertising revenue per channel per hour also *declines*.
- With per hour programme costs remaining constant and the average audience size for each channel declining, per hour programme cost per viewer *increases* as channel numbers increase.
- With constant revenues per viewer per programme hour and increasing per viewer programme costs, average channel profits are reduced.

In brief, as average audience numbers decline, programming cost per audience member increases. Without a corresponding increase in advertising revenues per audience member, the average per channel profit is reduced. The profit of channels is thus squeezed by the combined effect of declining advertising revenues and increasing per viewer programme costs. This is represented in Figure 1.

Discussion

How realistic is this model of advertiser-supported television broadcasting? This section addresses this question by examining the validity of each of the four assumptions on which the model is based.

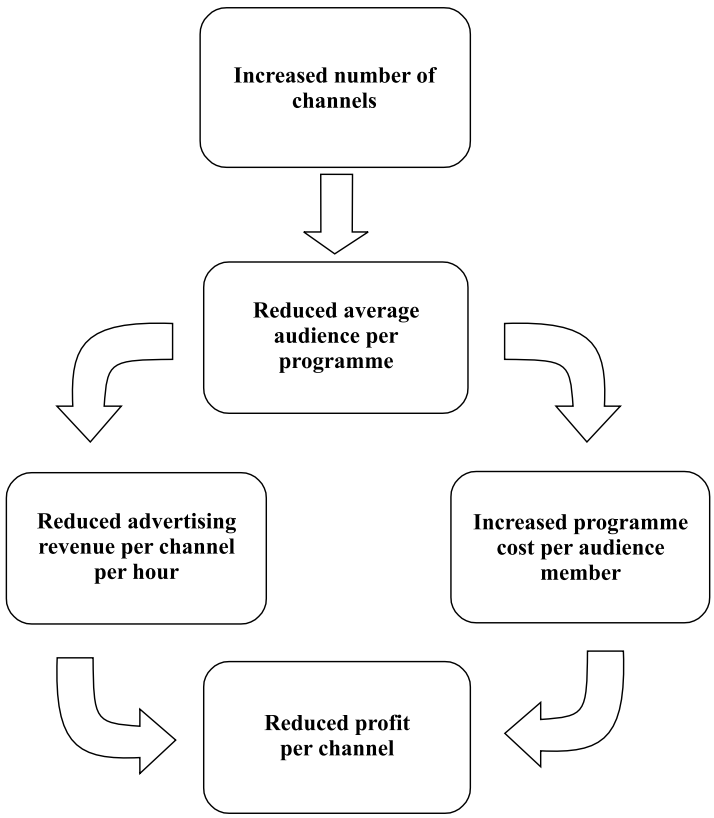

Figure 1. Increased channel numbers reduce per channel profit.

The Size of the Viewing Audience

The model assumes that the total viewing audience does not change with increased channel numbers (assumption 1). Unlike many other industries, increased 'supply' of programming from an increased number of television channels is unlikely to bring forth much by way of an increase in 'demand' for those programmes in terms of aggregate viewing time. This is due in part to relative stability in the overall population of most markets, at least in the medium term, and to natural limitations on individuals' viewing time.

Empirical evidence suggests that total viewing time increases only slightly with increased channel numbers. Picard reports that in the European Union countries between 1990 and 2000 the number of terrestrial channels rose by a substantial 44% (mainly from the licensing of new advertiser-supported channels), but that average daily viewing time rose by only 13.7%, a total of 22 minutes for each viewer over the decade (about 2 minutes a year). Picard concludes that:

> . . . when additional channels are added, it typically does not alter overall audience size and overall demand remains relatively constant. Additionally, time spent on television remains relatively constant in the short term, so providing more channels and hours of programming does not significantly increase consumption of television programming.[13]

As well, the Bureau of Transport and Communications Economics (BTCE), an Australian government research body, found in a 1998 study that the number of minutes that individual viewers spent watching commercial advertiser-supported television increased with the availability of new channels, but that the number of additional viewer minutes declined as the number of channels increased.[14]

Competing claims on viewers' discretionary time from the Internet, interactive services and prerecorded digital video disks may, in the future, further limit the time spent viewing advertiser-supported television programmes.

Nature of Audience Fragmentation

The viewing audience will fragment among all channels as their number increases (assumption 2). But what will be the nature of this fragmentation? This raises the issue of the number and types of new channels made possible by the liberalisation of the market for advertiser-supported television.

A distinction must be made here between television *networks* and independent television channels. Networks act as intermediaries between programme producers (who have programming content to sell), television channels (that seek programming to fill air time), and advertisers (who desire to expose their messages to viewing audiences). Networks have substantial economic advantages over television channels confined to single (or only a few) market areas. The financial advantages of networking include reduced transaction costs in the acquisition and scheduling of programmes, savings to advertisers in the distribution of advertising budgets and, because of simultaneous transmission of programmes to affiliated stations, efficiencies in transmission costs. National television networks are also likely to have a programming 'quality' advantage, as single-market channels will generally be unable to invest the same level of funds in programmes for local transmission as the networks can for programmes distributed nationally. Finally, viewers generally favour national (and international) programmes to local programming, especially for entertainment.[15]

For these reasons it is very difficult for independent single-market channels to set up in competition with networks or network-affiliated channels. They will be able to do so only in very large markets with one or more minority audience segments that are large enough to support the cost of providing their preferred programmes.

An alternative strategy is for new entrants in terrestrial television to try to establish new networks to take advantage of network economies. New networks will have the choice of competing head-to-head with incumbent networks by providing 'all-round' general interest programming, or directing their programming at special interest 'niche' audiences.

In recent years the dominant position of the large commercial advertiser-supported networks has been eroded, mainly by cable and satellite pay-TV. In the United States, for example, the aggregate audience share of the 'big four' networks of ABC, CBS, NBC and Fox during the prime-time evening hours has declined from around 70% in the late 1980s to around 54% in 2000.[16] A major reason for this dramatic shift is that various pay-TV networks now specialise in a number of programme types that were previously the preserve of the free-to-air networks, especially movies, sport and news.[17]

It is conceivable that new terrestrial advertiser-supported networks will be established. This would further reduce audiences for the incumbent networks. This

is similar to the fate of general interest magazines, which were replaced in the second half of the twentieth century by special interest, narrowly defined and demographically targeted magazines.[18] However, advertiser-supported networks will not necessarily go the same way as the general interest magazines. With a constant demand for programming content that is costly to produce, it is far more difficult to operate a specialist television channel than to publish a specialist magazine.

Although they have suffered audience decline, the major advertiser-supported networks continue to be the dominant force in television broadcasting in terms of audiences, advertising revenue and profitability. They have strong incumbency advantages over new entrants with programme acquisition experience, as well as established relationships with advertisers and viewers. Most of the existing networks also have a considerable degree of vertical integration in programme production, as well as in programme distribution with their 'owned and operated' channels. Referring to television broadcasting, Litman explains that '. . . vertical integration in combination with market power may be used to constrict the open portion of the market, create access problems, and thereby fortify existing positions of market power'.[19]

There is a tendency for individual viewers to focus most of their viewing on relatively few channels even when multiple channels are available. There is also a bias by viewers in favour of larger channels and against smaller channels: 'Smaller channels not only have fewer viewers but also attract less of these viewers' viewing time than the larger channels'.[20] There is still strong advertiser demand for the kind of broad appeal programming that only the incumbent advertiser-supported networks can efficiently provide: '. . . the more the market fragments, the greater the value to advertisers of any outlet that can offer such a mass audience'.[21]

This analysis suggests that the incumbent commercial networks should be able to retain a disproportionate share of the viewing audience after the commencement of new terrestrial channels. It is unlikely that most new entrants into advertiser-supported television will compete head-to-head with the existing commercial networks. Instead, they will seek to become niche players in the market by directing their programming towards relatively small, differentiated audience segments whose viewing preferences are not adequately catered for by the existing networks. The strategy of targeting niche audiences will tend to result in *unequal* audience shares between, on the one hand, the existing terrestrial networks with relatively large audiences and, on the other, new niche networks and independent channels with smaller audiences.

Advertising Rates and Revenues

The model assumes that the advertising rate per viewer remains constant with an increase in channel numbers (assumption 3). This assumption means that total hourly advertising revenue summed over all channels is constant. This is a crucial assumption, as the revenue available to the industry will limit the number of channels a market is able to support. If average advertising rates rise with an increase in channel numbers a market will support a greater number of channels, while, if average rates decline, fewer channels will be financially viable. For incumbent channels the rates charged for advertising per audience member will need to increase by the same percentage as the per audience programme costs for channel profitability to be maintained.

It is difficult *a priori* to predict accurately the level of advertising rates and aggregate television advertising revenues with increased channel numbers. Economic theory suggests that an increase in supply of advertising time will cause the price to fall. As well, audience fragmentation and higher transaction costs resulting from increased channel numbers may reduce the attractiveness of television as an advertising medium and tend to reduce demand for advertising time.[22]

Conversely, it may be that with new channels or networks providing special interest programming, advertisers may be prepared to pay premium advertising rates for better targeted, niche audiences. Indeed, there will be a tendency for new broadcasters to identify potential audience segments with above average disposable incomes and/or an interest in specific products that will enhance their value to advertisers. Even if new niche channels could command a higher per viewer rate from advertisers, however, it seems improbable that *average* advertising rates for all channels would rise at all, let alone significantly. Incumbent channels would face downward pressures on their aggregate advertising revenues because of their declining audience numbers.

It seems more likely, therefore, that increased channel numbers will cause aggregate advertising revenues to rise, but at a lower rate than the increase in channel numbers. This accords with the recent experience in the European Union countries. Picard found that over the 1990s aggregate advertising revenues rose with an increase in channel numbers, but at a lower rate than the rate of channel expansion. This was '. . . having the effect of reducing income per channel, thus putting significant financial pressures on channels'.[23]

Programming Costs

The final assumption of the model is that channels' per hour programme costs will be unchanged as channel numbers increase. This is a vital issue as programming is by far the largest cost component for television broadcasters, usually accounting for well over half of total costs. As with advertising, the effect of increased channel numbers on television programming costs is unclear, with contrary forces operating. The greater demand for programming material resulting from increased channels will tend to raise the cost of programming content. Incumbent channels may also endeavour to minimise their loss of audience share to new entrants by increasing their spending on 'higher quality' programming. At the same time, as average per channel audiences fall the level of programming expenditure that channels can support will also fall.

Programme investment strategies may involve channels endeavouring to maximise audiences during the most profitable 'peak' viewing hours (early evening) and minimise programming costs during off-peak periods. Programming costs can be reduced by an emphasis on lower-cost programme types such as 'talk', game shows and 'reality' programmes, and by increased repetition of programmes.[24]

Conclusions of the Model

The examination in this section of the various assumptions leaves the results of the model largely intact. With unrestricted entry and increased channel numbers the *direction* of change of the key financial variables in commercial advertiser-supported

television is likely to be as indicated in the model presented, although in practice the extent of the changes will differ from one market to another.

In summary, the analysis of the model suggests that with increased channel numbers the average audience size for programmes and channels will decline; advertising revenue per channel will decline; programme costs per audience member will increase; aggregate advertising revenues will increase, but by a smaller proportion than the rate of increase in channel numbers; and average profit per channel will decline.

The digital transmission of signals and entry and exit into the industry unimpeded by government regulation would allow the number of commercial advertiser-supported television channels in any broadcast area to be determined by market forces. Some channels may incur losses and exit the market, while declining channel profits will tend to deter further entry. The number of channels that can be supported by any given market will depend upon various factors. The most important of these is population size. In common with most industries, an advertiser-supported television market with a larger population will generally support more outlets than a smaller market.

The number of channels in any television market will also depend upon the nature of the population in that market. It was argued above that new channels will tend not to compete directly with established channels, but will seek out profitable audience segments whose programming preferences are not already catered for. By this analysis there will be niche channels for as many audience segments that are large enough to support the cost of providing their preferred programmes: 'Competitors under unlimited channels will always satisfy economically viable preferred choices'.[25] This indicates that markets with a number of sizeable special interest minority groups will support a greater number of channels than a similarly sized market with a more homogeneous population.

The Role of Government

From the examination of a model of increasing channel numbers in a hypothetical market, the paper now turns to consider the role of government in the introduction and operation of digital terrestrial television. In industrialised countries advertiser-supported television broadcasting is one of the most heavily regulated of all industries. This situation will continue with the transition to digital. Government decision making will be crucial for the introduction of digital terrestrial transmissions. Governments will need to determine, among other things, the timing of the switch to digital, the means to ensure that viewers can receive terrestrial free-to-air programming with existing analogue receivers, and arrangements for the eventual 'switch-off' of the analogue transmission system. Most importantly for the purposes of this paper, while digital transmission makes it technically possible to expand greatly the number of terrestrial television channels, the actual number of channels and the number of competing broadcasters will continue to be determined by government.

Multiplexing

A common strategy for digital conversion is for the national government to make additional spectrum available to existing analogue broadcasters and require them to 'simulcast' their programming in both analogue and digital during an interim

period until such time as the analogue system can be switched off. The analogue spectrum would then be returned to the government.

It is possible for a government to decide on digital conversion for existing analogue channels only, with no increase in the number of advertiser-supported channels. Indeed, this is the approach adopted in Australia where the digital legislation stipulates that no new commercial television licences (advertiser-supported or pay-TV) will be granted before 2007.[26] However, if a government does decide to increase the number of commercial television channels with the conversion to digital, it will do so by means of multiplexing (or 'multichannelling'). Multiplexing is a technical device that allows the broadcast of multiple programmes simultaneously on a single transmission. Different streams of programming are funnelled into a single data stream for transmission, and at the reception end the stream is split back into the original multiple programme streams. Significantly, the various programming streams can be originated by *different broadcasters*.

Governments are faced with a wide range of policy options regarding multiplexing for terrestrial commercial television. Considering, firstly, the licensing of advertiser-supported channels (only), a government can decide:

1. to licence one or more new advertiser-supported channels to *existing* broadcasters only;
2. to licence one or more new advertiser-supported channels to *new* broadcasters only; or
3. to licence new advertiser-supported channels to both *existing and new* broadcasters.

Option 1 would impose additional programming costs on incumbent broadcasters who would be likely to set up new niche channels in addition to their established mass audience channels. This would result in some fragmentation of the advertiser-supported audience, but total television advertising revenues would continue to be shared among the existing broadcasters. There would be no increased competition from new players. Programming diversity to audiences would be increased, while diversity of broadcast ownership would be unchanged.

Option 2 would represent a greater threat to incumbent broadcasters by allowing for the introduction of new advertiser-supported players and increased competition. New channels would result in a diversion of audiences and advertising revenues from the existing broadcasters. With this option both programming diversity and ownership diversity would be increased.

Option 3 is similar to option 2, but also provides for existing broadcasters to be licensed with new channels. For the same number of new channels, this would likely result in a smaller diversion of audience and advertising revenues from the incumbents than option 2.

As mentioned in the Introduction, it is also possible with digital transmission for terrestrial broadcasters to operate pay-TV services whereby viewers are charged for access to programming on one or more pay channels and/or on a per-programme basis ('pay-per-view'). A major reason for the significant take-up of cable and satellite pay-TV multichannel services during the 1980s and 1990s was the restriction on the number of terrestrial channels. This difference in channel numbers between the three 'platforms' is narrowed by digital transmission, although cable and satellite systems will continue to have greater channel capacities than terrestrial.

Unlike advertiser-supported television, with pay-TV viewers can express the intensity of their viewing preferences by 'voting with their dollars'. This has the potential to generate the production and supply of programming that caters to the tastes of audience groups whose size is sufficiently small that such programming would not be provided under advertiser support (even with unlimited channels). Pay-TV also has the potential to 'siphon' highly popular programming material—with relatively inelastic demand by audiences—from advertiser-supported television.

The licensing of terrestrial pay-TV channels would provide competition to cable and satellite multichannel services. Pay-TV gives a government a further set of policy options in relation to the licensing of new commercial digital channels. It can decide:

4. to licence one or more pay-TV channels to *existing* broadcasters only;
5. to licence one or more pay-TV channels to *new* broadcasters only; or
6. to licence pay-TV channels to both *existing and new* broadcasters.

Option 4 would be a means to increase the number of commercial channels in a market with minimum impact on the advertiser-supported television industry and existing broadcasters. This is because terrestrial pay channels can be expected to result in less diversion of audiences and revenues from existing free-to-air channels than additional advertiser-supported channels. Incumbent commercial broadcasters may also welcome the opportunity to have access to the additional source of revenue provided by pay-TV.[27] Option 5 would introduce new players into commercial broadcasting, but would reserve advertiser-supported television for the incumbents. Option 6 incorporates options 4 and 5.

Finally, governments could decide to issue new digital terrestrial licences for both advertiser-supported *and* pay-TV services. This would give them a further set of options:

7. to licence advertiser-supported and pay-TV channels to *existing* broadcasters only;
8. to licence advertiser-supported and pay-TV channels to *new* broadcasters only; or
9. to licence advertiser-supported and pay-TV channels to both *existing and new* broadcasters.

With option 7, new digital terrestrial television licences would be issued only to existing commercial broadcasters, but viewers would have access to new digital free-to-air and pay channels. Programming diversity would be increased, but diversity of broadcast ownership would be unchanged. Options 8 and 9 represent the most liberal licensing options for digital television. They would increase both diversity of programming and diversity of broadcasting ownership.

The nine options available to governments for the licensing of new digital terrestrial television channels are summarised in Table 1.

The above discussion of the policy options available to governments presupposes that new digital licences will be issued in the same way as traditionally employed for analogue licences, that is, on a channel-by-channel basis. However, with digital it is possible for governments to licence *multiplexes* rather than channels, and for multiplex licensees to operate all channels transmitted on their

Table 1. Government policy options for new commercial digital terrestrial television channels

Advertiser-supported channels only	Pay-TV channels only	Advertiser-supported and pay-TV channels
(1) To existing broadcasters only	(4) To existing broadcasters only	(7) To existing broadcasters only
(2) To new broadcasters only	(5) To new broadcasters only	(8) To new broadcasters only
(3) To both existing and new broadcasters	(6) To both existing and new broadcasters	(9) To both existing and new broadcasters

respective multiplexes. In practice, both methods have been adopted: digital terrestrial licences have been granted on a channel-by-channel basis in Sweden and Finland; in the United Kingdom licences for multiplexes have been granted; and in Spain both schemes have been implemented—one multiplex licence plus a number of licences for individual channels.[28]

Proliferation or Concentration?

It can be seen that the transition from analogue to digital terrestrial transmission provides governments with the potential to alter radically the structure and level of competition in advertiser-supported television (and pay-TV) by licensing new channels and/or new players. Governments, however, may prove reluctant to liberalise commercial terrestrial television. It was mentioned earlier that in Australia the digital legislation explicitly prohibits the licensing of new television channels until at least 2007. The government made this policy decision following intense lobbying by the powerful commercial television networks.[29] The Australian example serves as a reminder that other governments may endeavour to maintain into the digital era the role that prominent commercial terrestrial broadcasters played in analogue television, by restricting the number of digital licences and/or by favouring incumbent broadcasters in their licensing decisions.

However, the examination of the economics of commercial television broadcasting in this paper suggests that the digitisation of transmission, even if accompanied by liberalisation of government licensing policy, may not result in a very great increase in the number of new channels, new networks or new broadcasters. As with most industries that experience significant scale economies, advertiser-supported television broadcasting is likely to be a natural oligopoly. The inherent competitive advantages of incumbent networks will make it hard for new entrants to become successfully established. This task will be all the more difficult if incumbent networks are licensed with additional advertiser-supported and/or pay channels under a multiplex regime. As Humphreys and Lang have commented:

> Digital technology may in theory present the opportunity to target new, smaller niche markets, thus leading to greater choice for the viewer. .. In practice, however, economic circumstances will ensure that it will mainly be the established commercial media players which will further consolidate their position in their respective national media markets.[30]

New Prospects and Risks

Two further matters have the potential to affect the future of television broadcasting in the digital era. They are interactive television and personal video recorders (PVRs).

Interactive Television

Interactivity between viewers and broadcasters with analogue television is largely confined to teletext, which allows viewers to access a number of pages of text and data relating mainly to news, sports and financial information. A significant feature of digital transmission is that it has the technical capability to expand greatly the number and sophistication of interactive television (ITV, also known as 'datacasting'). ITV is a manifestation of the convergence of broadcasting and computer technology. The concept of interactivity gives rise to the prospect of 'active' television viewing in contrast to traditional 'passive' viewing, and offers viewers '. . . the ability to make various interactive choices regarding programs, services, information and advertising, to obtain a large amount of control, or to experience various kinds of direct input or feedback'.[31]

The electronic programme guide (EPG) provides on-screen information relating to the current day's programmes as well as those scheduled for future days, arranged according to time of broadcast or programme type. 'Superteletext' is a HTML (hypertext markup language) based service that can handle both text and graphics interactively and so provide 'Web television'. The EPG and superteletext are not primarily commercial interactive applications, but advertising messages can be carried on either.

Among the main revenue generating applications for ITV are the following:[32]

- *interactive advertising*: an interactive advertisement allows the viewer to 'click through' from the broadcast programming stream to the interactive function. This provides further information on the advertised product and may allow the viewer to place an order or request a sales representative to make contact. In addition to the normal charge for advertising airtime, broadcasters may receive a commission for each order placed via the interactive advertisement;
- *premium rate telephony*: this can apply to home banking services, interaction with quiz programmes, televised text message discussion programmes ('interactive chat') and viewer polling on political and other public issues. Broadcasters enter into a revenue sharing arrangement with telephone companies in relation to the calls generated from viewers;
- *games*: viewers pay a monthly fee to access a number of interactive games provided by the broadcaster. The games may be rotated on a regular basis, say, weekly. The technology allows the games to be played by individual players, against other household members, or against members of other (unknown) households;
- *gambling*: this allows viewers to place wagers on a wide range of sporting and other events. Wagers are placed through licensed betting shops and broadcasters receive a small percentage of the amount waged;
- *t-commerce*: this is the application of computerised 'e-commerce' to television. It involves the sale of products via ITV, with payment usually by credit card. Broadcasters establish and manage a t-commerce channel and charge retailers

'rental' for space to operate a 'virtual shop'. They can also charge retailers a small share of revenues from t-commerce sales or a fee for each t-commerce transaction.

ITV is in its infancy with most commercial applications in operation by mid-2002 confined to the United Kingdom, France and Spain.[33] Commercial digital broadcasting licences usually include the right to provide ITV services (although the Australian government has legislated to grant separate 'datacasting' licences for ITV). Most ITV applications involve broadcasters in relatively high set-up and operating costs, but the marginal cost for individual transactions is virtually zero. The general business strategy of ITV operators therefore is to build up a large installed base of ITV customers and to maximise the number of ITV transactions.

The financial viability of the various ITV services is as yet largely unproven. ITV presents broadcasters with the opportunity to develop a new revenue source, and has the potential for high profits—and high losses—depending on consumer demand for the new services and the nature of ITV competition.

Personal Video Recorders

Videocassette recorders (VCRs), introduced in the early 1980s, allow viewers to 'time shift', that is, record programmes as they are broadcast and view them when and as often as desired. The personal video recorder (PVR) is the 'digital version of the VCR'. It stores television programmes as computer files on a hard disk in a set-top-box or integrated digital receiver, with no need for videotape. It records in a digital format, which allows for storage of television programmes without degradation of video or audio quality. In 2001 the recording capacity of a PVR was 60 hours.[34] Advances in digital compression technology, however, are expected to increase capacity further within a short time: 'The capacity of hard drives [for PVRs] is doubling every 10 months without costing the set-top builder any extra cash'.[35]

Greatly increased storage capacity is not the only advantage of PVRs over VCRs. PVR technology has been developed to *automatically* edit out advertisements.[36] As well, EPGs allow viewers quickly and easily to organise and access their stored programmes according to genre and/or title: 'In the longer term, PVRs will enable users to create personal channels of stored programmes and ignore the original source of the programme or segment they are watching'.[37]

In practice, VCRs have had only a minimal effect on viewing habits. In the United States, for example, viewers spend only 4% of television viewing time watching programmes they have recorded.[38] PVRs, however, have the potential to increase significantly time shifting by viewers, and to diminish the value to advertisers of television advertising. One research firm is of the opinion that PVRs will directly, and quickly, threaten broadcasters' traditional business models: 'Television will become more like publishing and the Internet with content "published" at a given point and then managed over a limited time window'.[39]

It is too early, however, to confidently predict the eventual effects of PVRs on advertiser-supported television. Much will depend on the price to viewers of digital recording and storage equipment, and the proportion of viewers prepared to spend the time and effort involved in recording, organising and accessing stored television programming. Many viewers will maintain a passive role in relation to

television viewing, and most will continue to view certain types of programming such as news, current affairs and sports in 'real time'.

Summary and Conclusion

Historically, with analogue terrestrial advertiser-supported television broadcasting the number of channels and broadcasters has been restricted by both a shortage of available broadcast spectrum and protective government licensing policy. A major feature of the transition to digital transmission is that it largely solves the problem of spectrum scarcity. A liberalisation of television licensing policy by governments would therefore allow the number of channels and broadcasters to be determined by market forces.

Some scholars have claimed that digital transmission will result in a proliferation in the number of channels and broadcasters, and a diminution in the role of the large commercial television networks. This paper has argued that neither of these outcomes is probable. The number of new channels licensed will continue to be subject to government regulatory decisions, and even with liberalisation of licensing policy, the economics of advertiser-supported television broadcasting will impose severe limitations on the number of new channels that any market can support.

For the foreseeable future advertiser-supported television will continue to be dominated by the existing large networks providing programming to mass audiences. Digital will allow the establishment of niche audience channels and networks, the number depending on the population size and characteristics of broadcast markets. If networks are permitted to multichannel they will be likely themselves to operate niche channels, thus narrowing the scope for entry by new competitors.

Digital technology facilitates the provision of pay-TV services by terrestrial television. This may divert some of the audience from advertiser-supported television as well as intensify competition among the various transmission platforms—terrestrial, cable and satellite. Digital also allows broadcasters to provide interactive television services. These potentially provide a new revenue source for commercial television broadcasters, but it is not yet clear if there will be sufficient consumer demand for these services to make them profitable. Another unknown factor is the impact that PVRs will have on television viewing habits and television advertising revenues.

The transition from analogue to digital transmission is the major development in broadcasting since the commencement of television half a century ago. It will have wide-ranging effects on commercial television *viewing*, but probably not on the structure and ownership of the commercial television broadcasting industry. The switch to digital will not alter the fundamental economic characteristics of advertiser-supported television broadcasting, which is likely to remain a natural oligopoly.

Notes and References

1. I am grateful to Jonathan Levy, Federal Communications Commission, Stuart McFadyen, University of Alberta, two anonymous referees and the editor of this journal for their helpful comments on an earlier version of this paper.

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17. Another reason for the decline of network audiences in the United States has been the lifting of a number of regulatory restrictions previously imposed to protect the free-to-air networks.
18. Barry Litman, 'The economics of television networks: new dimensions and new alliances', in Alison Alexander, James Owers and Rod Carveth (eds), *Media Economics: Theory and Practice*, 2nd edition, Lawrence Erlbaum, Mahwah, NJ, 1998, pp. 131–49.
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21. Sophie Pedder, 'Power in your hand', *The Economist*, 11 April 2002, on-line version, www.economist.com (accessed 1 May 2002).
22. BTCE, *op. cit.*, p. 8.
23. Picard, *op. cit.*, p. 14.
24. *Ibid*; Owen and Wildman, *op. cit.*, p. 149.
25. Owen and Wildman, *op. cit.*, p. 87.
26. Allan Brown, 'From analogue to digital television broadcasting: a case study of Australia and Australian firm experiences', in Robert G. Picard (ed.), *Media Firms: Structures, Operations, and Performance*, Lawrence Erlbaum, Mahwah, NJ, 2002, pp. 27–39.
27. Owen and Wildman (*op. cit.*, p. 204) suggest that some broadcasters may decide to transmit the *same* programming on pay-TV without advertisements, and on free-to-air with advertisements.
28. BIPE Consulting, *Digital Switchover in Broadcasting: Final Report*, 2002, p. 134, http://europa.eu.int/information_society/topics/telecoms/regulatory/studies/documents/final_report_120402.pdf (accessed 24 July 2002).
29. See Brown, *op. cit.*

30. Peter Humphreys and Matthias Lang, 'Digital television between the economy and pluralism', in Jeanette Steemers (ed.), *Changing Channels: The Prospects for Television in a Digital World*, Luton University Press, 1998, pp. 9–35 at p. 31.
31. Jens Jensen and Cathy Toscan, 'Introduction', in Jens Jensen and Cathy Toscan (eds), *Interactive Television: TV of the Future or the Future of TV?*, Aalborg University Press, 1999, pp. 11–23 at p. 16.
32. This outline of ITV services is largely drawn from Chapter 4 of Adam Thomas, Simon Dyson and Stuart O'Brien, *The Digital Broadcasting Revolution*, 4th edition, Informa Media Group, London, 2001.
33. Interactivity can be adapted to any of the digital platforms. The interactive experience of the United Kingdom, France and Spain relates mainly to cable and satellite systems.
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