Measuring the Welfare Effects of Public Television

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Abstract

Based on an explorative case study in the Netherlands, we develop a methodology to assess the welfare effects of public service broadcasting. This methodology consists of a combination of revealed and stated preferences, using readily available data for all programmes broadcast in the evening in 2011. The results cover both individual programmes and an aggregate level. Since the data used encompass both public and commercial programmes, the analysis allows for comparisons between these.

Keywords

Public service broadcasting, public broadcasting, PSB, television, welfare effects, impact

1. Introduction

Most countries around the globe have a system for public service broadcasting (PSB) next to commercial television.[2] Public broadcasters receive funding from specific taxes or licence fees, contributions, or directly from government budgets. In return for these subsidies governments typically require that PSB is freely available to the population without a subscription fee (free-to-air or free-to-view) and caters for a broad variety of interests (O'Hagan & Jennings, 2003). Also, governments demand that PSB provides high quality programmes, which inform and educate people (e.g. Brown, 1996b). Moreover, these programmes should be reliable and independent from government and vested interests. Governments require that these services be provided at the same quality to all. Is this public funding well spent?

The coexistence of PSB and commercial broadcasting raises the issue of unequal competition. In the Netherlands, for instance, public broadcasters have been competing with commercial broadcasters ever since the first commercial broadcaster entered the market in 1989. Likewise, PSB and commercial television in many other countries compete both for audience and for advertising revenues, yet they are not always easily distinguishable in terms of programming. Based on Hotelling's law, the presumption is

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[2] Brown (1996a) notes that non-commercial broadcasting is referred to as *public broadcasting* in North America and *Public Service Broadcasting* (PSB) in Europe and Australia.

that fierce competition between (public and commercial) broadcasters may lead to excessive sameness. It is not yet clear whether this law holds true in practice. Nevertheless, PSB receives government funding, while commercial broadcasters are taxed and may even have to pay license fees for the use of radio spectrum. From an economic perspective, government funding is only efficient if it solves market failures. The question then is whether PSB corrects market failure or cannibalizes commercial broadcasters.

In most papers, it is merely assumed that market failures exist (Brown, 1996b; Picard & Siciliani, 2013; Van der Wurff & Van Cuilenburg, 2001) or the concept of market failure is rejected (Tjernström & Tjernström, 2008). Coase concluded, as far back as 1966, that the assumption that market failures do indeed persist in broadcasting needs thorough academic analysis. Anderson & Coate (2005) took up the gauntlet and analysed under which circumstances market provision of socially valuable programming is possible using an advertisement model. Their models show that market provision is not impossible a priori.

Armstrong (2005) gives a broader analysis of market failures. He concludes that subscription television overcomes many market failures. For instance, broadcasting is no longer a public good because it is no longer non-excludable. Setting piracy aside, it is possible to exclude people who do not pay so that there is no free riding. Armstrong also rationalizes the external effect argument that is put forward by many authors (e.g. Meijer, 2005). According to Amstrong, externalities and 'citizenship-enhancing' effects can exist. Such effects will be positive when television educates people or makes them more community-oriented, more tolerant or better-informed voters. Also, think of people talking or tweeting about a programme which revealed a political, environmental or medical scandal. On the other hand, Armstrong explains that these externalities are hampered because people have an increasing ability to avoid unappealing, but perhaps socially desirable content. Moreover, externalities can also be negative, for instance, if watching violence on TV induces violent behaviour.[3] Also, watching too much TV may in itself negatively affect people's health and social contacts, which may in turn have a negative spill-over effect on the rest of society. Nevertheless, in line with most of the literature, it is assumed here that insofar as they occur, external effects will be predominantly positive. Note that this does not automatically imply that government subsidies are justified from an economic perspective.

Yet another issue relates to shrinking government budgets. In times of austerity, governments may be urged to rethink their role in broadcasting in line with the discussion on market failures above: What public interests do they safeguard by supplying PSB? How does the continued digitalization and growth of commercial broadcasting affect the need for PSB? What market failures justify public provision of broadcasting and do its social and economic benefits outweigh the costs? The need to ask these questions goes beyond austerity. Although public provision of broadcasting is bound by state aid regulations in Europe[4], one may well wonder what the rules of engagement should be from an economic perspective when public entities compete with commercial suppliers in a market.

This paper presents the results of a case study on the Netherlands, which explores the welfare effects of PSB both at a programme level and at an aggregate level, and makes comparisons between public and commercial television. Its background is linked to the specifics of the Dutch PSB system, which consists

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3 This may be a cause for regulation of programme content, particularly for the protection of minors.

4 Official Journal C 257 of 27.10.2009.

of three public TV channels (NPO 1, 2 & 3) that compete with seven commercial channels provided by RTL Nederland Holding (viz. RTL4, 5, 7 & 8) and SBS Broadcasting (viz. Net5, SBS6 & Veronica). Although there are differences in the social groups targeted by the various channels, these groups overlap significantly and all are generalist channels. Averaging over all programmes in the sample used for this paper, PSB programmes have somewhat higher viewing figures: 9.4% of those watching television at the moment a programme is broadcast, versus 6.5% for an average programme on commercial television. All ten national channels are included in the most basic offer of any access technology (cable, DSL, fibre, DTT and satellite) which implies nearly full penetration for each channel.[5] Hence, no useful variation in price and subscription rate exists that would allow for estimating channel specific valuations (as in Crawford and Yurukoglu, 2012).

The three public channels are programmed by eight PSB 'associations', which are state funded but operate independently of the government and aim to serve the specific interests of their own members in their programming.[6] Next to these, there are two public broadcasters without members (NOS and NTR) that are mainly charged with providing programmes on news, sport, and culture. Traditionally, funding and airtime are divided amongst these associations based on the number of members each PSB association has. When these associations were established some 90 years ago, Dutch society was strictly divided into religious and political groups. Each association represented one of the groups. Nowadays, the strict boundaries between these groups have disappeared and people are less prone to becoming and remaining members. Consequently, membership numbers have declined and differences in programming have probably become less pronounced. After a peak in 1992, when 62% of Dutch households were members of a broadcasting association, in 2014 only 46% hold a membership.[7]

1.1 A précis of the plot: policy question and outline

With membership numbers decreasing, this measure has gradually become outdated. The Dutch Scientific Council for Government Policy and the Council for Culture, both important advisors to the government, recognize this fact. In 2012, the Minister for Culture decided to no longer allocate budget based on membership numbers[8] and instead base the allocation on quality and originality. Until now there has been no new allocation methodology. This paper fills that gap.

The policy question addressed in this paper is to what extent the social impact of programmes on public television can be objectively assessed and whether a measure to this end can be developed. In an explorative analysis, this paper aims to do so on the basis of data that are currently collected for television programmes in the Netherlands. It outlines the theoretical foundation for such an analysis (section 2), and presents its outcomes (section 3). Since most of the data used are measured for both public and

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5 The PSB channels are also freely available through DTT, but less than 1% of households use only this offer. Analogue ether TV was switched off in 2006.

6 The government incorporates most of the advertising revenues that are generated on Dutch public television in the state funding they receive.

7 This is a slight increase in comparison to the last count, which results from active campaigns by PSB associations to increase their membership for this count. This percentage is an overestimation, since often one household holds more than one membership, to support several associations in their effort to be admitted to the public system and to acquire budget.

8 Members are of importance to obtain access to public broadcasting, but not to cover the funding base.

commercial television programmes, these outcomes allow for comparisons between the two. Subsequently, it discusses how this approach can be elaborated and calibrated (section 4).

1.2 Contribution to the literature

This paper also aims to fill a gap in the literature. In 1996, the Journal of Media Economics published a special issue on PSB. It was introduced by Allan Brown (1996a) who noted that throughout its first eight years of publication (1988-1995), only two articles on PSB have appeared. Since then the number of papers on PSB in the Journal of Media Economics and in other journals has increased slightly (e.g., Lin et al. (2013), Rothbauer & Sieg (2013), Solberg(2007), Solberg (2007, 2008), Tjernström & Tjernström (2008)), but academic papers that assess welfare effects of PSB are still rare.

Lin et al. (2013) use a willingness to pay (WTP) study to measure welfare effects of PSB in Taiwan. Based on a sample of 376 respondents, the authors estimate that household average WTP per year for PSB is approximately US$30, which is equal to 0.18% of GDP per capita in 2007. Since this amount is much higher than the current government subsidy per household for the public broadcaster PTS, Lin et al. conclude that respondents have a high appreciation of PSB as well as its potential benefits for families.

The authors also cite a WTP study for the BBC among a nationally representative panel of 2,257 people. Respondents valued the BBC at between £18 and £24 per month. Four out of five people support the licence fee of £121 per year. However, in case a subscription-funded model would be introduced for the BBC that would cost £13 per month, only 60% of the British households said they would subscribe.

The contingent valuation method (CVM) that these studies use to measure WTP has several drawbacks. A questionnaire is used to elicit people's preferences for a public good by finding out what they are willing to pay for specified improvements of these goods. For instance, in the case of the Taiwanese broadcasting study, respondents are implicitly asked to choose between a situation with and without PSB. Households are asked this question: "Considering the benefits that the PTS brought to your household, are you willing to pay [amount] every year to maintain the operation of the PTS?" Depending on the amount depicted in the question, 22 to 62.5% of respondents were willing to pay this amount.

This kind of questioning may entail overestimation (Baarsma, 2000), what Lin et al. acknowledge. First, because of the direct way of posing the WTP question, strategic bias may occur if respondents overstate their WTP in an effort to raise the mean and thereby ensure provision. Second, hypothetical bias occurs because it is unclear whether a respondent's declared intentions (stated WTP) can be taken as meaningful guides to his or her actual behaviour (true value). Hypothetical bias might occur if the very fact that respondents are asked for valuations in a hypothetical market makes their responses differ systematically from real cash ('true') values. This is the case for all stated preference methods. After all, stated preference methods are based on preference data that are not observable in the market and that have to be drawn from people's stated responses to questions in surveys, whereas revealed preference methods are based on preference data that are observable in the market and that can be revealed from observations of real-world choices.

Crawford & Yurukoglu (2012) estimate the welfare effects of bundling television channels outside the context of PSB. They combine revealed preferences concerning subscription to various bundles of channels at different prices with viewing figures per channel and socio-demographic data, to estimate the willingness to pay per channel and the effects of bundling. The time spent by households watching a

channel is assumed to be a proxy for their willingness to pay for access to that channel. To use this methodology for estimating the welfare effects of PSB, variation in the price and subscription rate of bundles containing different combinations of PSB channels is required. Such information is not available for the Netherlands or for any country with free-to-air PSB.

The present paper adds to the literature by exploring an alternative approach which takes the opportunity costs of time as a conceptual starting point. By doing so, it ties in with the methodology proposed by Goolsbee & Klenow (2006) to estimate the total welfare which consumers derive from the leisure time they spend online, from the opportunity cost of time based on hourly wages. Another merit of the present paper's approach is that is can be used both at a programme level, and at the level of PSB associations, channels and PSB at large. It uses a combination of revealed and stated preferences. Viewing data is measured directly in households and thus presents revealed preferences. Insofar as stated preferences are used, these do not directly refer to willingness to pay, but only to ex post quality scores of programmes, which are used in combination with other revealed preference indicators to refine the rudimentary hypothesis in Crawford & Yurukoglu (2012) that viewing time is a proxy for valuation. As far as the authors are aware, the methodology developed in this paper is the first to assess the social impact of programmes on public television using revealed preferences, that is, actual viewing behaviour.

2. Theoretical framework

This paper operationalizes the social impact of television programmes in terms of their contribution to social welfare. Despite the common critique that PSB should not focus on viewing figures in the way commercial broadcasting does, they are a natural starting point for this: all other things being equal, a programme that attracts more viewers will entertain, educate or influence more people. A larger audience also implies that more people can talk about it at the water cooler at work or tweet about it to others, and by doing so, they create more spill-over effects for non-viewers.

Let w_i^p be the net welfare effect of watching programme *p* for viewer *i*, which is assumed to include any positive (or negative) spill-over effects which her viewing has on others. This would imply that for the aggregate net welfare effect of programme *p*:

$$W^p = \sum_i w_i^p \qquad (1)$$

This then equals the total number of viewers V^p of programme *p*, multiplied by $\bar{w}^p$, the average welfare effect per viewer of programme *p* inclusive of any spill-overs:

$$W^p = \sum_i w_i^p = V^p \cdot \frac{\sum_i w_i^p}{V^p} = V^p \cdot \bar{w}^p \qquad (2)$$

To evaluate this, one would need to determine $\bar{w}^p$. As was discussed in the previous section, free-to-air television has no price to go by other than the time people invest to watch it, and hence the opportunity costs of time is used as a conceptual starting point. Assuming that viewers behave rationally, watching a television programme can be considered the optimum use of that particular time span for them, given their preferences at the time. In welfare economic terms, this implies that the net individual utility u_i^p which viewer *i* derives from watching programme *p* is greater than or equal to the utility $u_i^{A_j}$ she derives

from any alternative activity A_j at that moment, which may be watching another programme, reading a book, mowing the lawn, etc.:

$$\forall_j \, (u_i^p \geq u_i^{A_j}) \qquad (3)$$

Both u_i^p and $u_i^{A_j}$ are defined as the net individual utility here, exclusive of any spill-over effects. They are net of marginal costs incurred by activity *p* and A_j. In case of watching a television programme, these costs are primarily the opportunity costs of spare time. In welfare economic analysis, the marginal opportunity costs of an hour of spare time are generally set equal to a person's marginal net hourly income I_i.[9]

It is an empirical question by how much the utility of watching programme *p* exceeds these opportunity costs.[10] While this is expected to differ substantially between programmes, for any programme *p* the hourly welfare effect for person *i* is assumed to be proportional to the duration of the programme d^p and the viewer's net hourly income I_i:

$$w_i^p = \alpha_i^p \cdot d^p \cdot I_i \qquad (4)$$

Here α_i^p is the individual surplus factor of programme *p* for viewer *i*. Define $\bar{\alpha}^p$ as the average of α_i^p over all viewers and $\bar{\alpha}$ as the average over all programmes and viewers. One could potentially use the methodology developed by Goolsbee & Klenow (2006) to assess $\bar{\alpha}$. The present paper does not address this empirical question, but *assumes* that, on average, the consumer surplus for leisure activities – including any spill-over effects – equals 25% of the costs incurred. However, viewer *i* would also derive utility from many of the alternative activities A_j, which should be subtracted to arrive at the net welfare effect w_i^p of watching programme *p* for viewer *i*.[11] Given the fairly dense landscape of ten national Dutch television channels and the many alternative uses of time that are possible, it is assumed here that on average the utility of watching a programme on television exceeds the utility of the best alternative by no more than 10%. In the Netherlands, the average marginal net income $\bar{I}$ is approximately €12[12], which implies for the assumed net welfare effect of an average programme $\bar{p}$ with a duration of $d^{\bar{p}}$:

$$\bar{w}^{\bar{p}} = \bar{\alpha} \cdot d^{\bar{p}} \cdot \bar{I} = 25\% \times 10\% \times € 12 \cdot d^{\bar{p}} = € 0.30 \cdot d^{\bar{p}} \qquad (5)$$

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9 This is based on the assumption that people rationally optimize their working hours which implies that the marginal value of spare time equals the marginal income derived from working. See Becker (1965) and De Serpa (1971) for theoretical foundations.

10 Note that the opportunity costs of spare time are used as proxy and lower bound for the utility u_i^p, not as a cost in a demand function. No information on costs for consumers is available at a programme level, other than the duration which is not only a cost but also a proxy for utility. To illustrate this, average viewing figures *increase* with duration. Hence, it is not possible to derive a demand function.

11 From a different angle, this same argument could be made by pointing out that net utility derived from the best alternative is part of the opportunity costs of watching programme *p*.

12 The average gross hourly wage in 2012 was € 21.16 (Statistics Netherlands/ Statline, accessed 9-9-2014). Given the most common marginal tax rate of 42%, the marginal net hourly wage is on average € 12.27.

Thus $\bar{\alpha}$, the *average* welfare effect of watching television relative to net income is set as equal to 2.5% in this paper and the hourly welfare addition of an average programme for an average viewer as €0.30.

Ultimately this value should be determined empirically. For the purpose of this paper, only rough comparisons with earlier literature are made. Goolsbee & Klenow (2006) find a welfare effect of time spent online which corresponds to a surplus between $6.20 to $9.40 per hour. This translates to a considerably higher surplus over the opportunity cost: 28% to 42%. Pantea & Martens (2014) use the same methodology for five countries in the EU and find welfare effects corresponding to a similar relative surplus. However, Goolsbee & Klenow point out that their estimates may be too high, given the fact that their model assumes only two spare time activities for people: using the Internet and the rest. In reality, leisure activities such as watching TV or reading the news are likely to be a close substitute to being online and accounting for this would significantly lower their estimates.

An alternative comparison can be made based on Crawford & Yurukoglu (2012). They find in their baseline calculation a mean consumer surplus derived from television subscription bundles of $45.82 per household per month (in 2000 dollars), while reporting 'an average of more than seven hours of television per day' per household (table 8 resp. p. 643). This translates to a surplus of approximately $0.21 per hour, which would be $0.27 in 2011 dollars and € 0.20 in 2011 euros. Given the fact that monthly television expenses per household are substantially higher in the US than in the Netherlands while the number of channels available is also substantially higher in the US, this somewhat lower surplus per hour corroborates the assumptions made in the present paper.[13]

As previously stated, viewing figures and the average surplus over time are a natural starting point, but not the whole story. Some programmes may entertain or inspire viewers immensely or may have large spill-over effects. People might stay home to watch them or invite friends over. They may record such programmes on hard disk recorders or watch them through catch-up TV. Other programmes may have almost been forgotten before they end. People may watch certain programmes to help them to fall asleep, or zap away during the next commercial break. Where a specific programme lies on this continuum is highly personal, but the average impact a programme has on its viewers will not necessarily be reflected in viewing figures. In fact, it could be uncorrelated or even negatively correlated. A programme with a modest number of viewers may have a lot of value for a select group. Some would even claim that this is the *raison d'être* of PSB: while viewing figures – eyeballs – have a rather linear relationship with advertising revenues, the total welfare effect could be more elusive. A second reason why the welfare effect of a programme may diverge from viewing figures is that to some extent television programmes are *experience goods*. A viewer can better assess the value that a programme has for him or her after watching it.

Thus, more important than the average net welfare effect $\bar{w}^{\bar{p}}$ of an average programme, are the deviations of specific programmes from this average. Such deviations arise when a programme attracts viewers with a higher average value of time, and when a programme creates a higher hourly surplus than the average ($\bar{\alpha}^{p} > \bar{\alpha}$).

Currently, a permanent panel representative for the Dutch population is in use at SKO to collect information for individual programmes (see Section 3.1 for more details). Apart from average income and

[13] After all, when people watch more television the average surplus per hour of watching decreases.

viewing figures, four variables are identified from the available information which can be a proxy for such deviations:

1. The average quality score of a programme: The higher the score, the larger the welfare effect of a programme is likely to be.
2. The percentage viewing a programme 'postponed' from a recording device (e.g. a hard disk recorder, video recorder or catch-up service from a TV set top box): it is argued that people who record a programme watch it more consciously and deliberately than those who watch it on linear TV.
3. The percentage viewing a programme via Internet based catch-up services: this will correlate with (2) above, but may also be a proxy for spill-over effects, as people will be inclined to use such a service after hearing or reading about a programme.
4. Website visits, as a proxy for the wider interests a programme creates.

Using ordinary least squares (OLS) models, the latter three variables have been corrected for a number of exogenous programme characteristics that turn out to have some effect on the scores on these variables, which is unrelated to any welfare effects. For instance, programmes that are scheduled late in the evening are watched from a recording device or via catch-up TV more frequently than programmes scheduled during prime time. However, this will stem from the fact that people think the programme is broadcast too late and want to go to bed, which implies that the effect of the starting time distorts this variable as a measure for the welfare effects. Similarly, genre has a distorting effect on 'postponed' viewing which requires correcting for: sports and news for instance are watched from a recording device and catch-up TV less frequently for obvious reasons which have nothing to do with their welfare effect. The according models are discussed in Section 3.2. For these variables, the scores have been substituted with the residuals from the OLS models.

Just like the value of $\bar{\alpha}$ in equation (5), the relative effects of differences in quality score, viewing from recording devices, catch-up TV, and website visits on the welfare effect of a programme ultimately need to be determined empirically: what is the trade-off between a higher quality score and a smaller share of viewers from recording devices? The spread of these variables differs substantially (see Table 2), which is why for lack of empirical testing, all four variables X_n^p(with n = 1,…4) have been given equal weight by standardizing and transforming them in the following way into correction factors for the estimated welfare effect:

$$X_n^{p\prime} = \exp\left[\frac{X_n^p - \bar{X}_n}{\max(X_n^p) - \min(X_n^p)}\right] \qquad (6)$$

It is readily seen that the argument has an average of 0 and that the spread is equal to 1. This implies a correction factor of e^0=1 on average. A positive value for the argument implies an above average score on this variable, which would entail a higher than average welfare effect and thus $X_n^{p\prime} > 1$. A below average score entails a lower than average welfare effect and $X_n^{p\prime} < 1$. Inserting these correction factors for specific programmes in equation (4) after averaging over all viewers and substituting the result in equation (2) yields for the welfare effect of programme p:

$$W^p = V^p \cdot \bar{w}^p = V^p \cdot \bar{\alpha}^p \cdot \bar{I}^p \cdot d^p = 0.025\, \bar{I}^p \cdot V^p \cdot d^p \cdot \prod_n X_n^{p\prime} \qquad (7)$$

That is, the welfare effect of programme p is the product of viewing figures, a surplus of 2.5% over the average net income $\bar{I}^p$ of its viewers, its duration and the four correction factors $X_n^{p\prime}$. In the next section, the empirical implications of this framework are explored.

3. Data analysis

3.1 Data sources and key statistics

For this study, a dataset is used of all programmes broadcast on all ten Dutch public and commercial channels between 1 January and 30 September 2011, with a starting time between 6.00 and 11.55 p.m. This data set is compiled from data obtained from Stichting Kijkonderzoek (SKO) and Kijk- en Luisteronderzoek (KLO).[14] In total, this dataset contains 24.221 programmes or episodes for which programme characteristics and outcome variables are available, such as title, airdate, starting time, duration, viewing figures, quality score and genre.

Table 1 Genre classification, number of programmes or series in data set and viewing figures

First level	Viewing figures*	Second level	Viewing figures*	Third level	Viewing figures*
Fiction (1426)	230	Foreign fiction (1356)	169	Foreign films (1224)	113
				Foreign series (132)	331
		Dutch fiction (70)	400	Dutch films(35)	267
				Dutch series (35)	506
Children (0 - 12 yrs) (53)	295	Fiction for children (36)	275	Children films (26)	246
				Children series (10)	315
		Children: amusement (5)	255	Children: entertainment (5)	254
		Children: music (6)	242	Children: music (6)	246
		Children: non-fiction (6)	151	Children: non-fiction (6)	200
Music & dance (70)	379	Pop music & dance (38)	314	Pop music: live registration (15)	303
				Pop music: programme (11)	262
				Pop music: miscellaneous (12)	347
		Other music & dance (32)	386	Other music: live registration (7)	710
				Other muisic: programme (13)	240
				Other music: miscellaneous (12)	362
Non-fiction (677)	397	News & current affairs (59)	415	Current affairs (29)	487
				News (26)	444
				Weather report (4)	787
		Other non-fiction (618)	358	Other non-fiction (618)	369
Entertainment (264)	494	Cabaret & satire (57)	356	Cabaret & variety (39)	292
				Satiric programme (18)	475
		Games & quizzes (61)	516	Games & quizzes (61)	533
		Talent show & audition programme (31)	869	Talent show & audition programme (31)	873
		Other entertainment (115)	361	Other entertainment (115)	357
Sport (196)	658	Sports information (54)	529	Current sports information (44)	618
				Other sports information (10)	261
		Sport report (142)	661	Soccer report (92)	864
				Other sport report (50)	271
Other / unknown (4)		Other / unknown (4)		Other/unknown (1)	
				RTV programme information/promo (1)	
				Text information (2)	

14 SKO provides television audience figures (and background variables) for the Netherlands based on a continuous panel representative for the Dutch population. KLO is part of the Dutch public broadcasting coordinator NPO and provides appreciation/quality scores for programmes with a sufficiently large audience. For more information see: https://kijkonderzoek.nl/research and http://www.publiekeomroep.nl/oud-organisatie/klo/waarderingscijfers.

* Average viewing figures (×1000) for all programmes in genre after correcting for other programme characteristics. For instance, the first level genre 'fiction' contains 1426 programmes with an average viewing figure of 230,000 after correcting for other programme characteristics.

Episodes or recurrences of the same programme broadcast by the same broadcasting association or on the same commercial channel (e.g. episodes of the daily evening news, a recurring game show or a series) have been aggregated by using average values for programme characteristics. For each programme or series, genre is available on three nested levels of detail as defined by SKO. After removing four programmes in genre-category 'other/unknown' for the sake of the robustness of the analysis, this yielded a set of 2686 unique programmes or series. Table 1 describes these genres and the corresponding number of programmes or series (in parenthesis) for each level. The bars in this table represent relative average viewing figures per genre after correcting for programme characteristics (see Section 3.2.1).

Table 2 Variables for all programmes/series on Dutch television between 1-1-2011 and 30-9-2011

Variable	Observations
Programme characteristics	
Title	2686
Broadcasting association	2686
Channel	2686
Dummy commercial or public	2686
SKO1-genre	2686
SKO2-genre	2686
SKO3-genre	2686
Number of episodes, of which	2686
- % first broadcast	2686
- % rerun within 7 days	2686
- % rerun after more than 7 days	2686
Starting time*	2686
Net duration* (net of commercials)	2686
Gross duration* (incl. commercial breaks)	2686
Outcome variables	
Viewing figure* (≥6 years of age)	2686
Percentage postponed viewers within 7 days* (on hard disk	2686
recorder, etc) Average income of viewers*	2686
Average quality score*	1247
Number of Internet views at *Web-TV**	1128
Website visits*	261

* means variable is defined as average over episodes/recurrences

Table 2 gives an overview of the variables that were available for this set and distinguishes programme characteristics from outcome variables. In this aggregation, the number of episodes was added while the

airdate was dropped. Table 2 also gives the number of observations for each variable. Programme characteristics are available for the full dataset, but the number of observations drops for some of the outcome variables. Quality scores are only available for programmes with a sufficient number of viewers, and not all programmes are available through the Internet based streaming service *Web-TV*.[15] Moreover, information on website visits was not available for any programmes from commercial channels, which implies it cannot be used to asses differences between public and commercial television.[16]

Table 3 provides basis statistics for the outcome variables, as well as correlation coefficients with p values in parentheses. There is large variation within most variables except for average income and quality scores. Many of the correlations are highly significant. The number of viewers has a rather strong positive correlation with the use of *Web-TV* and website visits, which also correlate strongly amongst themselves. There is also a positive correlation between the quality score of a programme on the one hand and the percentage of postponed viewers and the average income on the other. However, there is *no* significant correlation between the quality score of programmes and the number of viewers, *Web-TV* streams and website visits. Finally, there is a *negative* correlation between the number of viewers and the percentage postponed viewing. This may stem from the fact that niche programmes are broadcast at less convenient time slots, or lose out in the household decision process which programme is watched live.

Table 3 Basic statistics for outcome variables and correlations

	Viewers (×1000)	Postponed viewers	Income	Quality score	Website visits	Streams *Web-TV*
Mean	396	2.8%	€ 40,698	7.51	15,062	14,794
Median	278	1.7%	€ 40,753	7.50	3,333	5,006
Maximum	4996	37.1%	€ 83,401	8.70	547,000	350,584
Minimum	6	0.0%	€ 23,618	6.00	48	0.1
Stand. Dev.	382	3.7%	€ 3,982	0.35	51,358	30,665
Observations	2686	2686	2686	1247	261	1128
Postponed viewers	-0.10 (0.00)					
Income	0.07 (0.00)	0.03 (0.11)				
Quality score	0.04 (0.13)	0.31 (0.00)	0.07 (0.07)			
Website visits	0.31 (0.00)	-0.03 (0.67)	0.08 (0.20)	0.06 (0.48)		
Streams *Web-TV*	0.43 (0.00)	0.18 (0.00)	0.16 (0.00)	0.05 (0.23)	0.33 (0.00)	

15 The number of observations for the more popular catch-up TV service *Uitzending Gemist* was even much smaller, as only the 500 most streamed programmes were available. Moreover, this service exclusively offers programmes from public television. Therefore, the Web-TV variable was preferred.

16 In addition to absolute viewing figures, viewing figures relative to total viewing at that time were available for each programme. These two variables correlate highly (correlation coefficient 95%) and as was argued in Section 2, absolute viewing figures are preferred in a welfare measure.

3.2 Models

As discussed in Section 2, OLS models have been used to correct the outcome variables for both public and commercial programmes for the effect of characteristics that turn out to have some effect which is unrelated to any welfare effects. For postponed viewing, the use of Internet based catch-up TV (*Web-TV*) and website visits, the models have been used to correct these variables in order to eliminate distorting effects on the welfare measure. For these variables, the scores have been substituted with the residuals from the OLS models presented below. The models are only used to correct the outcome variables for bias caused by these programme characteristics. Hence, their explanatory power is expected to be low.

OLS models for the number of viewers, the quality scores and the average income of viewers have also been estimated. Since these models are not used to correct the outcome variables for the welfare impact measure, they are not presented in this paper, but some key observations from these models are given.

3.2.1 Observations from models for viewing figure, quality score and income

As regards the absolute viewing figures, it will not surprise that genre and starting time are important drivers. The impact of genre is illustrated in the bars in Table 1: correcting for other programme characteristics, football reports are the most popular genre, closely followed by talent shows and weather reports. Interestingly, programmes that have a relatively high gross/net duration ratio due to commercial breaks have lower viewing figures. The independent public broadcaster NOS has significantly more viewers after correcting for all other factors. The PSB associations combined do not have a significantly smaller or larger audience than the commercial channels.

Quality scores are also significantly influenced by genre, with children's programmes receiving the highest scores and 'entertainment' receiving the lowest scores. Longer programmes and programmes with more episodes have higher scores while commercial breaks do not impact scores. Apparently, commercials provide disutility which causes the viewing figure to drop but not the quality ratings given by the actual viewers. Reruns receive higher scores than first broadcasts. An elitist explanation would be that the audience has to learn to appreciate a programme. A more profane explanation would be a selection effect on both the broadcasters' and the viewers' side. The most important observation for the purpose of this paper, however, is that public service broadcasters receive significantly higher quality scores, after correcting for other programme characteristics: they make better programmes in the eyes of the audience.

There is no robust evidence for a difference in income of viewers, between programmes from public and commercial broadcasters. However, the independent public broadcaster NOS attracts significantly higher income groups, also after correction for genre and other relevant factors.

3.2.2 Postponed viewers

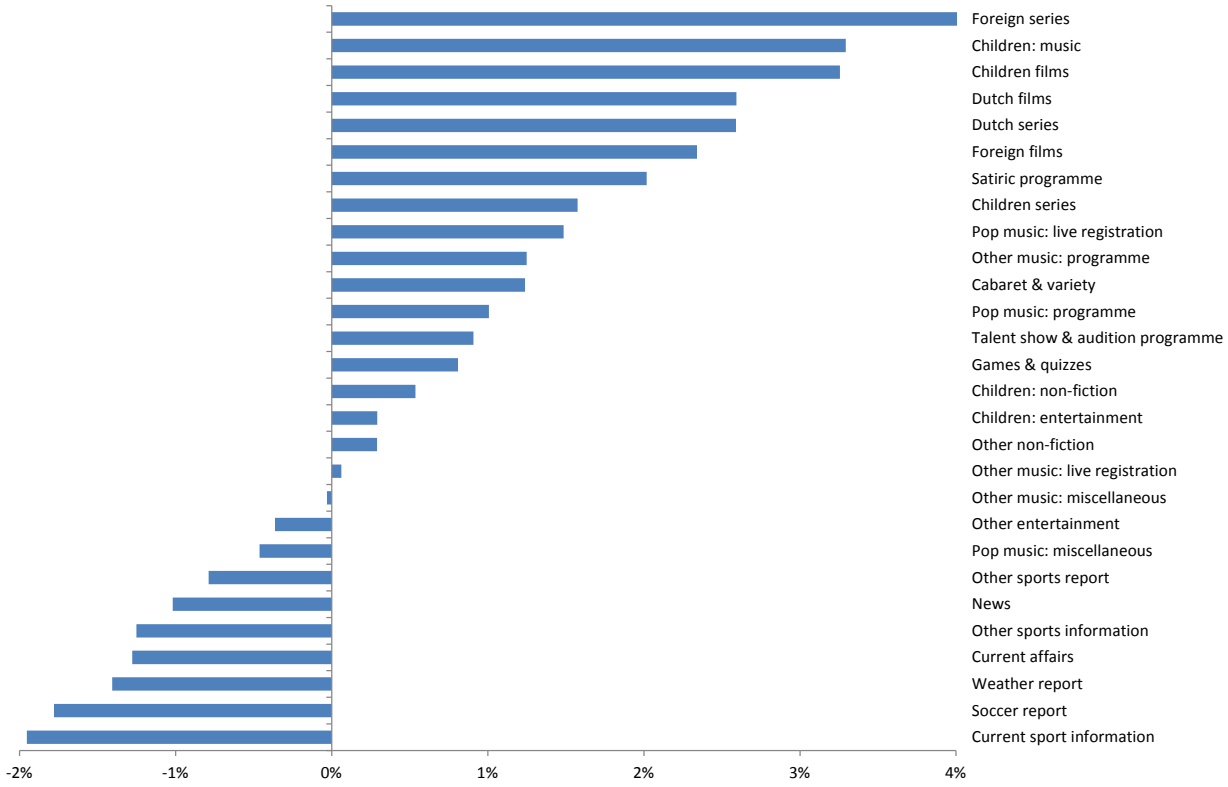
Table 4 presents the OLS model used for correcting the 'postponed viewers'-variable. Figure 1 presents the genre dummy values graphically. For variables other than the genre-dummies, a 95%-significance threshold (Prob.<0.05) was used for inclusion. DUM20H is a dummy variable for a programme starting between 8.00 and 8.59 p.m. etc. As was already mentioned in Section 2, postponed viewing is significantly driven by the starting time and genre of a programme: programmes starting after 8 p.m. are viewed from a recording device of catch-up TV relatively more frequently. As is seen from Figure 1,

sports, weather and news programmes are the least frequently watched from a recording device. Films, series and children's programmes have the highest percentage of postponed viewers. On top of that, first broadcasts are recorded significantly more often. Other programme characteristics turn out to have no significant effect.

Table 4 OLS model for share of viewers via recording devices and catch-up TV (N = 2686)

	Coefficient	Std. Error	Prob.
DUM20H	0.01	0.00	0.00
DUM21H	0.01	0.00	0.00
DUM22H	0.02	0.00	0.00
DUM23H	0.01	0.00	0.00
% First broadcast	0.01	0.00	0.00
Current sports information	-0.02	0.01	0.00
Soccer report	-0.02	0.00	0.00
Weather report	-0.01	0.02	0.41
Current affairs	-0.01	0.01	0.06
Other sports information	-0.01	0.01	0.26
News	-0.01	0.01	0.14
Other sports report	-0.01	0.01	0.13
Pop music: miscellaneous	0.00	0.01	0.65
Other entertainment	0.00	0.00	0.31
Other music: miscellaneous	0.00	0.01	0.98
Other music: live registration	0.00	0.01	0.96
Other non-fiction	0.00	0.00	0.21
Children: entertainment	0.00	0.02	0.85
Children: non-fiction	0.01	0.01	0.70
Games & quizzes	0.01	0.00	0.10
Talent show & audition programme	0.01	0.01	0.16
Pop music: programme	0.01	0.01	0.34
Cabaret & variety	0.01	0.01	0.03
Other music: programme	0.01	0.01	0.20
Pop music: live registration	0.01	0.01	0.10
Children series	0.02	0.01	0.15
Satiric programme	0.02	0.01	0.02
Foreign films	0.02	0.00	0.00
Dutch series	0.03	0.01	0.00
Dutch films	0.03	0.01	0.00
Children films	0.03	0.01	0.00
Children: music	0.03	0.01	0.02
Foreign series	0.04	0.00	0.00
Adjusted R-squared	0.14		

Figure 1 - Genre dummy values in OLS model for share of viewers via recording devices and catch-up TV



3.2.3 Catching up via *Web-TV*

From Table 2, it can be seen that the use of the Internet based catch-up TV service *Web-TV* is only known for less than half of the dataset (1128 observations). Hence, using this variable in the current dataset could create a bias. Nonetheless, Table 5 present the OLS model for streams at *Web-TV*, while Figure 2 presents the genre dummy values graphically. The number of streams per episode is larger for programmes with a starting time between 8 and 11 p.m., most specifically between 8 and 9 p.m. This is the most popular time for watching TV and the most successful programmes are planned in this slot. Apart from this, first broadcasts are more frequently viewed via *Web-TV* than reruns.

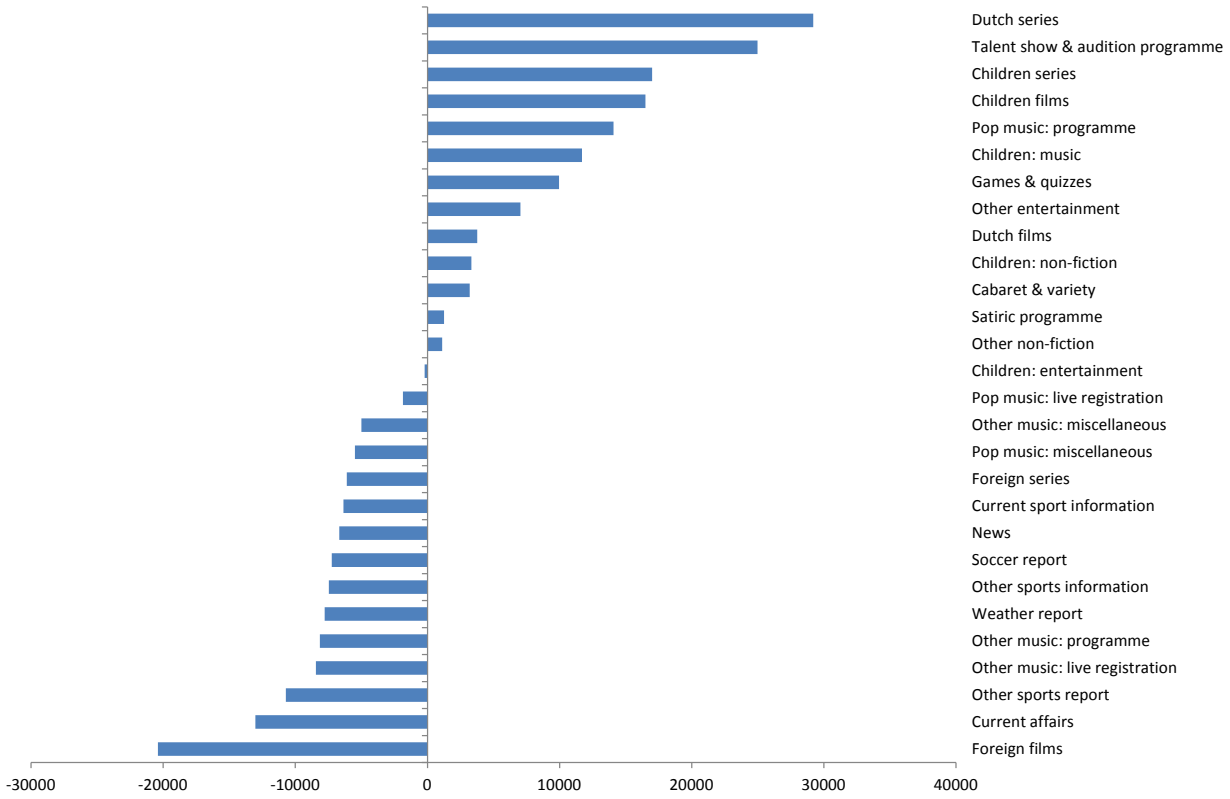
Figure 2 illustrates that Dutch series, talent shows and children's programs are the most popular on web-TV. Foreign films are the least popular which is likely due to the fact that most foreign films, in particular the more popular and recent ones, are not available via Web-TV for copyright reasons. Just like the correlation of postponed viewing and Web-TV streams in Table 3, the correlation between the dummy values in Figure 1 and 2 is far from perfect, which underlines that these variables measure different things.

Table 5 OLS model for Web-TV streams per episode (N = 1128)

	Coefficient	Std. Error	Prob.
DUM20H	16879	2429	0.00
DUM21H	9575	2529	0.00
DUM22H	7289	2532	0.00

% First broadcast	6575	2290	0.00
Average duration	108340	54103	0.05
Foreign films	-20401	4377	0.00
Current affairs	-13025	6495	0.05
Other sports report	-10726	7802	0.17
Other music: live registration	-8442	11396	0.46
Other music: programme	-8143	8430	0.33
Weather report	-7785	16495	0.64
Other sports information	-7468	10377	0.47
Soccer report	-7239	6478	0.26
News	-6678	6521	0.31
Current sports information	-6362	8087	0.43
Foreign series	-6102	6856	0.37
Pop music: miscellaneous	-5487	9413	0.56
Other music: miscellaneous	-5005	8960	0.58
Pop music: live registration	-1860	9265	0.84
Children: entertainment	-212	12835	0.99
Other non-fiction	1103	2735	0.69
Satiric programme	1252	7635	0.87
Cabaret & variety	3191	7513	0.67
Children: non-fiction	3327	11677	0.78
Dutch films	3767	6163	0.54
Other entertainment	7031	4829	0.15
Games & quizzes	9962	4739	0.04
Children: music	11697	12914	0.37
Pop music: programme	14074	11946	0.24
Children films	16488	9558	0.08
Children series	16992	10868	0.12
Talent show & audition programme	24969	6406	0.00
Dutch series	29193	5485	0.00
Adjusted R-squared	0.14	30665	

Figure 2 - Genre dummy values in OLS model for Web-TV streams



3.2.4 Website visits

The number of observations for website visits is much smaller again. Moreover, this variable is only available for programmes from PSB associations. Table 6 gives the OLS model for this variable, which has a very limited explanatory power. Only the percentage of first broadcasts and the average duration of the programme are significant.

4 Table 6 OLS model for website visits (N = 261)

	Coefficient	Std. Error	Prob.
C	-17971	9378	0.06
% First broadcast	17736	9029	0.05
Duration	719027	207573	0.00
Adjusted R-squared	0.05	51358	

4.1 Results

The models presented in Section 3.2 are used to correct the outcome variables for postponed viewers, web-TV streams and website visits. Combined with the uncorrected variables for the number of viewers,

programme duration, deviation in the average income of viewers from the overall average[17] and the quality score, these are used to estimate the welfare effect using equation (7) in Section 2.

Note that the cumulative use of the variables for quality scores (N = 1247), Web-TV (N = 1128) and website visits (N = 261) entails a cumulative reduction of the total dataset. Given that disclaimer, Table 7 presents the top 15 of the programmes with the highest estimated welfare effect per episode. Dutch programme titles have been translated and described for convenience. Programmes broadcast on public television are marked with an asterisk (*).

Table 7 Top 15 of programmes with highest estimated welfare effect per episode

Viewing figure, income, quality score and postponed viewing (N = 1247)	+ Web-TV (N = 556)	+ website visits (N = 130 only available for public TV)
Farmer wants a wife (reality dating show)*	Farmer wants a wife*	Farmer wants a wife*
CL final Barcelona-Man United (football)*	Voice of Holland	Who is the mole*
Voice of Holland (talent show)	Who is the mole*	Flikken maastricht'*
Who is the mole (celebrity reality series)*	'Flikken maastricht'*	National IQ test 2011 (quiz)*
Voice of Holland - The results (talent show)	Voice of Holland - The results	'Spaanse schaep'*
EC qualification NL- Hungary (football)	'Spaanse schaep'*	Untraceable *
'Spaanse schaep' (Dutch drama series)*	Expedition Robinson (celebrity reality series)	Radar (consumer rights non-fiction)*
'Flikken Maastricht' (Dutch police series)*	Untraceable (relational reality show)*	Adultery (Dutch drama series)*
CL Arsenal-Barcelona (football)*	National memorial of WWII victims*	Reunion (relational reality show)*
CL Barcelona-Arsenal (football)*	Máxima, portrait of a princess (non-fiction)*	DNA unknown (relational reality show)*
CL semi-final Real Madrid-Barcelona (football)*	I love Holland (game show)	Memories (relational reality show)*
CL semi-final Barcelona-Real Madrid (football)*	Voice of Holland - The sing off (talent show)	Andre Rieu at the Vrijthof (classical concert)*
National memorial of WWII victims*	EC qualification Finland-NL (football)	Sam the Goofbye (documentary)*
EC qualification NL-San Marino (football)	Adultery (Dutch drama series)*	Hello goodbye (relational reality show)*
X factor the final (talent show)	The boys against the girls (game show)	Rembrandt and I (documentary)*

* Programme broadcast on public television

As can be seen, programmes with massive viewing figures such as important football matches and 'The Voice' feature prominently, but there are some programmes with much lower viewing figures, such as the *National memorial of WWII victims*, which derive their top position from the other factors. This top

[17] More precisely, to obtain $\bar{I}^p$ in equation (7), the average income for programme p is divided by the average over all programmes in the dataset and multiplied by the average net marginal income of € 12.

contains programmes from both commercial and public television, with PSB having a slight majority, also after taking football out of the equation.

Based on the measure in the leftmost column of Table 7 (i.e. excluding Web-TV and website visits because of lower data availability), Table 8 gives the top 15 of programmes with the highest aggregate estimated welfare effect over all episodes in the first three quarters of 2011. Seven of these are broadcast on public television.

Returning to the policy question outlined in the introduction, these welfare effects can be aggregated to PSB associations. Aggregating over all PSB associations plus the public broadcasters without members (NOS and NTR), but leaving out programmes on commercial television, yields a total welfare contribution of € 695 million. Extrapolating this linearly to a full year would give a welfare effect of € 927 million. This would be a lower bound, since it is based only on programs for which a quality score was available and which started between 6 and 11.55 p.m. Having said that, the annual welfare effect of € 927 million would translate to an annual effect of approximately € 125 per Dutch household, which lies between the estimates for Taiwan and the UK based on CVM mentioned in the introduction.

Table 8 Top 15 of programmes with highest aggregate estimated welfare effect (in € mln.)

Programme	Aggregate welfare effect in 2011 Q1-Q3
8 p.m. news*	€ 68
News hour (daily current affairs programme at 10 p.m.)*	€ 39
'De wereld draait door' (diner time talk show)*	€ 38
7.30 p.m. news	€ 35
Rtl boulevard (celebrity gossip talk show)	€ 32
Primary league (soccer competition summaries)*	€ 26
'Pauw & witteman' (late night talk show)*	€ 26
Good times, bad times (Dutch soap series)	€ 25
Heart of the Netherlands (national news show)	€ 23
X factor (talent show)	€ 17
Ncis (crime series)	€ 15
I love Holland (game show)	€ 15
Shownieuws (celebrity gossip talk show)	€ 14
Farmer wants a wife*	€ 14
6 p.m. news*	€ 14

* Programme broadcast on public television

4. Conclusions and discussion

This paper presents the results of an explorative case study in the Netherlands, to develop a methodology to assess the welfare effects of public service broadcasting (PSB). It does so both for individual programmes and at an aggregate level, based on a combination of revealed and stated preferences. To do so, a dataset is compiled of all programmes broadcast on all ten Dutch public and commercial channels in the evening in the first three quarters of 2011. This dataset contains various programme characteristics

such as starting time, duration and genre, as well as readily available outcome variables, such as viewing figures, quality ratings and viewing from recording devices and catch-up TV.

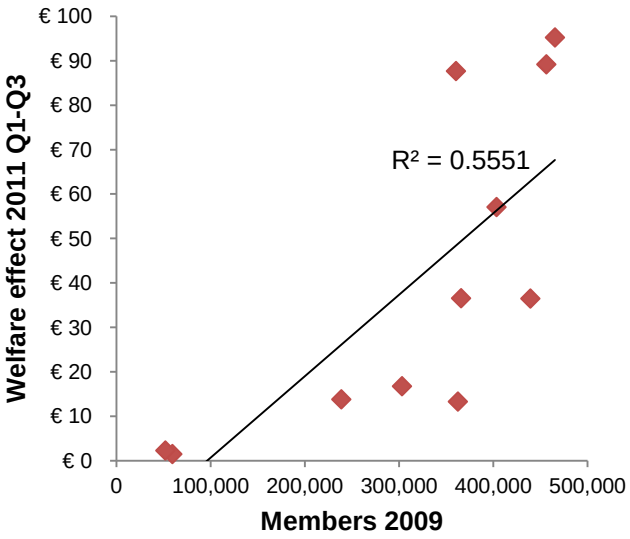
The underlying idea of the proposed methodology is that the time people spend to watch a programme is a lower bound for the utility they derive from watching this programme. If a person choses to watch a specific programme over other programmes or activities, this implies she experiences a surplus over this time spent which is larger than the surplus other programmes or activities would give her. How large this surplus is, will differ between programmes. Hence, the average value for this surplus is adjusted using the quality score a representative sample of viewers give a programme, the percentage of viewers watching from recording devices (as a proxy for consciously watching) and the number of people watching from web-based catch-up TV (as a proxy for both consciously watching and spill-over effects), website visits (as a proxy for the wider interests a programme creates), and the average income of the viewers of a programme.

This yields a measure for the welfare value of programmes, which can be aggregated to broadcasting associations, channels and the entire PSB system. As indicated in this paper, two basic steps in this methodology ultimately need empirical validation: one is the surplus that watching an average programme creates over time spent, which for the purpose of this paper is assumed to be 2.5%. At an average marginal net income of € 12, this implies an average welfare effect of € 0.30 per hour. A rudimentary validation of this value suggests that this is a conservative estimate, but further empirical testing is necessary. Note, however, that this value is only required for an *absolute* assessment of the welfare value of programmes or PSB organisations. For the purpose of comparing the relative welfare performance of programmes or organisations, calibration of this surplus is not necessary. The second step that requires further empirical testing is the relative weights of the various variables to adjust the average, which in this paper have been assumed equal. A conjoint analysis or discrete choice experiment could be performed to estimate these weights.

The background of this paper is linked to the specifics of the Dutch PSB system, which consists of three public TV channels programmed by eight state funded PSB ‘associations’. Traditionally, funding and airtime are divided amongst these associations based on the number of members they have, but membership numbers have declined since 1992, as a result of which this measure has gradually become outdated. Hence the question is to what extent the social impact of programmes on public television can be objectively assessed and whether an alternative measure to this end can be developed.

The methodology presented here aims to provide such an alternative. The results are promising, despite the fact this methodology may seem technocratic, that elements call for further empirical testing, and that taking the average income of the viewers into account may be considered by some to be controversial.

Figure 3 - Aggregate welfare effect per PSB association in first three quarters of 2011 vs. membership*



* Excluding PSB organisations without member and co-productions between different PSB associations

In general, the lists of programmes with the highest welfare value were recognizable for experts from the PSB associations. Moreover, aggregation of these values over PSB associations yields results that are correlated with – though not identical to – the current criteria for allocating funds. This is illustrated in Figure 3, by the fairly strong correlation between the aggregated welfare effect per PSB association as calculated for the first three quarters of 2011, and membership according to the last preceding count (2009). Provided that the overall budget for PSB would be determined democratically (rather than based on welfare analysis) this implies that the methodology presented here could serve as an alternative to the current system of membership numbers, even without validation of the average surplus factor $\bar{\alpha}$.

At the highest level of aggregation, this methodology also provides information about the total welfare value of PSB, which may be compared to the subsidies given. For the Netherlands, and based on the conservative assumptions made here, there seems to be a positive return on investment: in 2011, PSB organisations received € 798 million in subsidies, used not only for television but also for radio and internet activities (Tweede Kamer, 2011-2012). This is substantially less than the estimated minimum welfare value of at least € 927 million for television alone. From a welfare-economic perspective, however, this positive rate of return is a necessary but not a sufficient condition for public funding: without such funding, commercial channels create consumer surplus as well as profits. To give a satisfactory justification for public funding, the resolution of market failure by PSB needs to be shown convincingly. The observation that PSB programmes receive significantly higher quality scores after correcting for programme characteristics is a promising starting point for that. Further analysis of spill-over effects, for which catch-up TV and perhaps website visits are a proxy, is another.

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