

Advertising types cross-network effects on two sided platforms

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Abstract

Broadcast TV is a well-known example of a two-sided platform where cross network effects on the viewer and advertising sides interact. Like many platforms, it is advertiser-financed. While the literature shows that viewers dislike advertising, we explore a unique data set and distinguish between paid and non-paid (informative) ads. Cross-network effects' estimates show that the latter carry a positive network effect on viewership. We also explore a significant change in public interest for more information in TV content in Russia in 2022 to estimate structural changes to cross-network effects. The results indicate that negative paid ads' cross-network effects on viewership demand become stronger while positive non-paid (information) ads cross-network effects become weaker, even conditional on TV programing changes. Symmetrically, on the other side of the platform, advertisers value viewership less after the preference change.

Keywords: broadcast TV, advertising, cross-network effects, two-sided platforms, demand estimation.

JEL classification: C23, L22, L82, M37.

1. Introduction

A central part of the business model of the largest corporations in the world, digital platforms, exploits cross-network effects. While the importance of such effects cannot be understated today, it has been explored in different industries for more than a century, by newspapers, radio and broadcast or free-to-air television. Television is a mass medium characterized by accessibility, low selectivity and high impact on the general public. In 2023, the number of TV viewers worldwide

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is estimated at more than 5.2 bln.¹ and is expected to grow in coming years.² Despite the growing popularity of digital media, boosted by the COVID pandemic (UNCTAD, 2020), television is still an important source of news and entertainment for a majority of the population and an important way for advertisers to reach an audience. Lambrecht et al. (2024) show that TV ads boost the engagement on online platforms, being an important part of effective online platform marketing strategies.

Broadcast or free-to-air TV is a well-known example of a two-sided platform, where cross-network effects influence commercial decisions and industry organization (Evans and Schmalensee, 2016; Pontual Ribeiro and Golovanova, 2020). The cross-network effects, which characterize non-trivial interrelation between the size of the audience and the amount of advertising, allow broadcast TV to be economically viable using paid advertising, on the one side of the platform, and free content access, on the other. Nevertheless, the audience may dislike increasing advertisement duration in the programs. If advertising results in viewers switching to other programs, this reduces the attractiveness of the TV channel for advertisers and its revenue from airtime sales. Learning about the size of network effects and this trade-off is important to TV executives, advertisers and regulators, as often there are limits to the total amount of advertising on programs.

Assessment of the cross-network effects requires estimation of the viewers' demand for TV content and advertisers' demand for airtime. Most of the empirical papers on the topic follow the demand model with network effects adopted by Berry and Waldfogel (1999). In the literature, the positive effect of TV viewership on advertisers' demand and the negative impact of ads on TV viewership are confirmed in Wilbur (2008) for the U.S., Ivaldi and Zhang (2022) and Zhang (2025) for France and Ferrer and Richter (2025) for Spain.

On the other hand, advertising may not put viewers off. The first positive estimate is from Rysman (2004), on “Yellow Pages” catalogues in the U.S., suggesting that the readers of these catalogues are interested in such content. In the print media (magazine) markets Song (2021) on TV magazines in Germany found positive effects of advertising on readership (circulation). Ivaldi and Muller-Vibes (2018) explore the French magazine market and provide cross-magazine type evidence. The cross-network effects are positive only if the magazine is specialized. Specific type of advertising—previews—might be used to increase viewership of forthcoming TV programs (Bae and Kim, 2022). This may suggest that the attractiveness of advertising is due to viewers self-selecting and being exposed to different advertising, rather than the advertising itself generating different effects.

It remains to be seen if within a media cross-network effects related to advertising of different types may change due to some exogenous shock. Our paper fills this gap. We take advantage of Russian TV viewership (proprietary) data that segregates aired ads in two types, paid and non-paid advertising. The latter

¹ Number of TV viewers worldwide from 2020 to 2029. <https://www.statista.com/forecasts/1207931/tv-viewers-worldwide-number>

² Television market 2025–2029 report. <https://www.researchandmarkets.com/reports/5454784/global-television-market-2024-2028>

is often information to viewers such as network-led public announcements and coming attractions. The data provides a first opportunity to investigate cross-network effects on a common pool of viewers.

The Russian case is interesting for other reasons. First, broadcast TV is an important media outlet. In 2021, 97% of the Russian population watched TV at least once a month, and 64% of the population watched TV daily, according to Mediascope.³

Second, using the 2021–2022 data on the Russian TV market, we can explore the effect of changes in audience interest in TV content, viewership and advertising. Broadcasters cater to audience preferences. However, it is hard to identify interest changes in the absence of significant external shocks. The Ukrainian conflict as a treatment for these preference changes is a unique “natural experiment” that makes it possible to estimate changes in the demand model structural parameters’ cross-network effects. With the conflict, the interest of viewers in information may have significantly shifted, making them less tolerant to ad breaks, but more interested in non-paid ads, even with programing changes.

The structure of the paper is as follows. In Section 1, we characterize the structure of the television market and the specifics of TV advertising in Russia. Section 2 provides information on the data used and the empirical approach. The key results of the empirical analysis are presented in Section 3. The last section concludes.

2. Literature review

Broadcast TV is a well-known two-sided platform, with viewers on one side and advertisers on the other. Advertisers find the channel more attractive as viewership rises. Yet for viewers, more advertising may have positive or negative effects on the attractiveness of a channel. Some users may find advertising informative and are not put off by more or longer commercial breaks, while others may find ad breaks a nuisance and switch channels if there is more advertising.

The actual estimation of these cross-network effects has been a topic of interest in the economic literature. The literature is scarce, given the difficulties in accessing relevant data for the platform. Most of the studies concentrate on traditional media such as newspapers, radio, magazines or television.

A positive advertising effect on viewership or readership has been estimated for “Yellow Pages” catalogues (Rysman, 2004), specialized magazines (Song, 2021) and print media (Ivaldi and Muller-Vibes, 2018). Argentesi and Filistrucchi (2007) and Fan (2013) could not estimate precisely advertising effects on newspapers readers. In the case of TV broadcast channels viewership, Wilbur (2008), Zhang (2025) and Ivaldi and Zhang (2022) found negative effects of advertising time on program viewership.

Following Berry and Waldfogel (1999), the literature uses a (nested) logit demand functional form to model viewer preferences. The demand model differs from the usual demand function as there is no explicit price for broadcast TV

³ Mediascope has been the authorized media audience meter in Russia since 2016.

viewers. The model is flexible to include cross-network effects in the utility function, with the inclusion of the amount of advertising, namely:

$$\ln(s_{jt}) - \ln(s_{0t}) = \alpha^V q_{jt} + \beta^V x_{jt} + \varepsilon_{jt}, \quad (1)$$

where (on the TV market example) s_{jt} is the market share of the channel j in time period t ; s_{0t} is the market share of “outside good” (calculated as $1 - \sum_j s_{jt}$); x_{jt} is the vector of observed characteristics of the TV program (type, time of day, day of the week, length) on TV channel j during time period t ; q_{jt} —the amount of advertising on channel j during time period t (α^V is the indirect network effect of advertising); ε_{jt} —an error term. The market share for viewership is calculated as a fraction of the total population that could be watching a program at the time.

There are several approaches to estimating the advertisers’ demand. It should be immediate to maintain symmetry across sides and assume the same functional logit form for advertiser demand. For example, as in Argentesi and Filistrucchi (2007) the advertisers’ demand function perceived by a TV channel would follow:

$$\ln(s_{it}^A) - \ln(s_{0t}^A) = \beta^A x_{it}^A + \alpha^A p_{it}^A + \mu_i^A + \rho y_{it}^V + \xi_{jt}, \quad (2)$$

where s_{it}^A is the share of paid advertising minutes of channel i at time t relative to the total potential market size; $s_{0t}^A = 1 - \sum_i s_{it}^A$ is the market share of “outside good”; x_{it}^A collect channel i programing observed characteristics; p_{it}^A is the advertising price; μ_i^A represent unobserved, fixed, channel i characteristics; y_{it}^V is the channel viewership; and ξ_{jt} —an error term.

Demand model estimates may have endogeneity issues that require the use of instrumental variables for identification, as market data are the outcome of interaction between supply and demand. Common in the literature is the use of BLP-type instruments, i.e. product characteristics of competing firms (Berry et al., 1995; Argentesi and Filistrucchi, 2007; Wilbur, 2008; Ivaldi and Zhang, 2022; Zhang 2025) or the use of Hausman type instruments, i.e., prices or product characteristics in alternative geographical areas (Zhang, 2025). These instruments are valid under timing restrictions based on the institutional setting of the industry, i.e., program characteristics are set before prices and quantities, but influence prices and quantities themselves.

Table 1 provides a brief overview of studies that estimate cross-network effects on both sides of the platform, namely, the advertising effect on audience demand and the audience effect on advertising demand equations.

In the identification of a demand equation in a system, there may be endogenous variables. This problem may be minimized with the use of controls and high-frequency data. On the one hand, TV advertising industry institutional information indicates that prices are set in advance and change only monthly. Prices can be seen as predetermined within the month. In addition, ratings in the advertising demand equation and advertising in the demand equation may be endogenous from the system of equations specification as the TV channel observes both sides’ demand. Again, the institutional setting of the industry across the world suggests that this endogeneity effect may be small. In France, Zhang (2025) argues that advertising is contracted in advance for a time slot

Table 1

Generalization of the results of the considered empirical studies.

Paper	Market in question	Advertising effect	Audience effect
Rysman (2004)	Directories Yellow Pages	Positive	Positive
Argentesi and Filistrucchi (2007)	Newspapers	Not estimated	Positive
Wilbur (2008)	TV	Negative	Positive
Jeziorski (2010)	Radio	Negative	Positive
Fan (2013)	Newspapers	Not estimated	Positive
Song (2021)	Magazines	Positive	Positive
Ivaldi and Muller-Vibes (2018)	Newspapers, magazines	Positive	Positive
Ivaldi, Zhang (2022)	TV	Negative	Positive
Ferrer and Richter (2025)	TV	Negative	Positive
Khlyupina (2024)	TV	Negative	Positive
Zhang (2025)	TV	Negative	Positive

Source: Conducted by the authors.

based on expected cost and viewership. Over time, the advertising amount may change, but not in the time frame of our data, namely hour-channel-day. In addition, market information sources point that ratings are not known to the TV channel until after the end of the program, if not the following day.⁴ In both cases, advertising amount and viewership as explanatory variables may be considered pre-determined with respect to current unobserved shocks to viewership and ad quantity when using high-frequency, hourly data.

3. The overview of the Russian television market

3.1. TV channels and their audience

In 2019, the transition from analog to digital broadcasting took place in Russia. A distinctive feature of digital TV over analog TV is that digital signal compression makes it possible to broadcast multiple TV channels at once on a single frequency. This digital package is called a *multiplex*. At the moment, there are two multiplexes on Russian TV; both of them contain 10 TV channels. The channels included in the multiplexes are publicly available throughout the country and are mandatory for free broadcast on digital broadcasting networks.⁵

In this study, we focus on the mandatory national segment of the Russian TV market (the channels included in the 1st and 2nd multiplexes). There are three leading channels, Rossiya 1, NTV and Pervyj, with the highest ratings⁶ both in 2021 and 2022. Across the leading TV channels, Pervyj channel's rating decreased in 2022, while the other two leading channels' ratings increased. This might be explained by the difference in the content provided (Pervyj is more focused on broadcasting news). Most channels with smaller ratings are characterized by the relative stability of the value of the indicator. Fig. 1 presents channels' ratings.

⁴ Preliminary ratings are counted by Mediascope the next day after the program; final ratings are ready on the 2nd–3rd day. TV Index project description: Mediascope, 2024. p. 34.

⁵ Law of the Russian Federation No. 2124-1 “On Mass Media” of 27 December 1991.

⁶ It is calculated as the number of people who watched the TV channel in an average minute, expressed as a percentage of the population (within the target audience—the population over 4 years old).

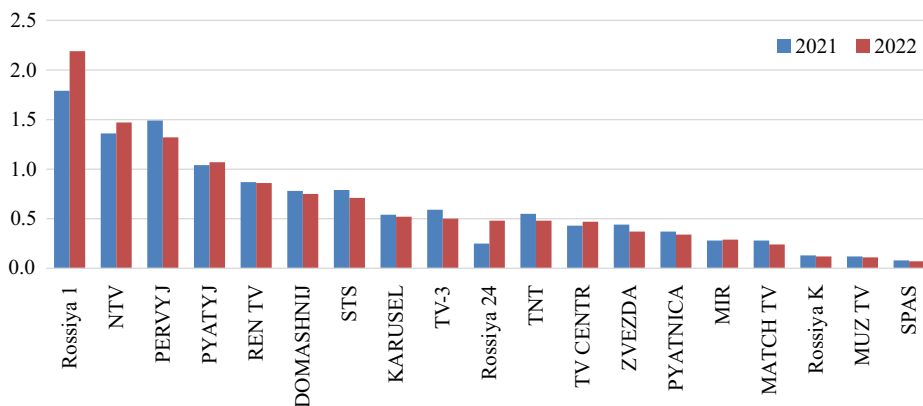


Fig. 1. Rating of Russian TV channels, 2021 and 2022.

Source: Mediascope, conducted by the authors.

There are three profiles of ad breaks on TV based on the content: commercial advertising, sponsored advertising and previews of the channel's forthcoming programs. Sometimes a fourth profile appears—a political advertising break (before important political events, for example, elections). Commercial, sponsored and political ads are the main source of TV channels' revenue. Previews of the TV channel's own content are non-commercial. They do not generate revenue directly. Indirectly, they are aimed to attract more audiences in the future. One of the channels included in the 1st multiplex (Rossiya K) does not broadcast paid advertising. It actively announces cultural events during advertising breaks and only for free. The channel operates at the expense of budgetary funds.

The Russian Federal Law “On Advertising” sets limits on the duration of advertising: no more than 20% (12 minutes) of airtime per hour and no more than 15% per day (216 minutes). These restrictions do not apply to non-commercial advertising.⁷ Fig. 2 reflects that, on average, the channels meet the requirements.

Advertising on national television channels is sold on the basis of the Cost Per Point (CPP), which is the price of one rating point.⁸ CPP is set for each TV channel. The final cost of advertising is calculated based on GRP'20—the rating normalized to a 20-second video, i.e., $CPP \times \text{Video duration coefficient} \times \text{GRP}'20$, where GRP'20 (Gross Rating Point) is the Customer's output rating $\text{GRP}'20 = T/20 \times \text{TVR}$; T is the timing of the video in seconds; TVR is the rating of the ad block, calculated as the percentage of the target audience that watched the particular program during which the ad was displayed. Video duration coefficients are established by the National Advertising Alliance (NAA), which is a centralized entity to intermediate ads in the TV advertising market.

When concluding contracts, advertisers are guided by the predicted rating of the program, which may differ from the actual ones. The ratings are known to the advertisers only after the program is shown. In case the actual audience reached by the ad differs much from the prepaid one, the correcting payment

⁷ Federal Law “On Advertising” dated 13.03.2006 No. 38-FZ.

⁸ For more details, see https://www.brandmedia.ru/serv_idP1_1267_idP2_2426.html#:~:text=Схема%20расчёта%20рекламы%20по%20рейтингам,сплит%20каналов%20и%20др (in Russian).

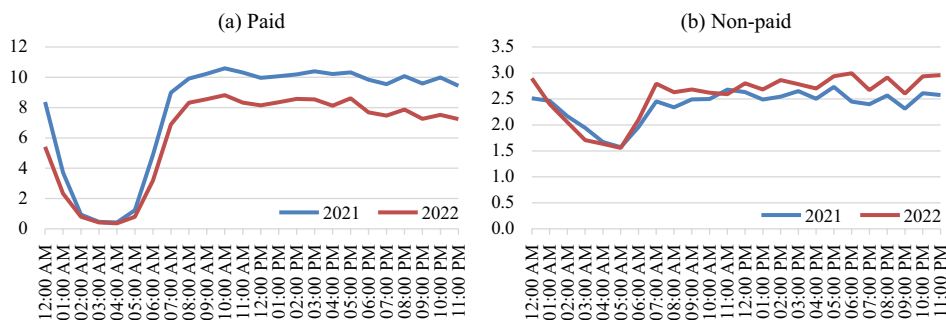


Fig. 2. Mean advertisement duration, minutes.

Source: Mediascope, conducted by the authors.

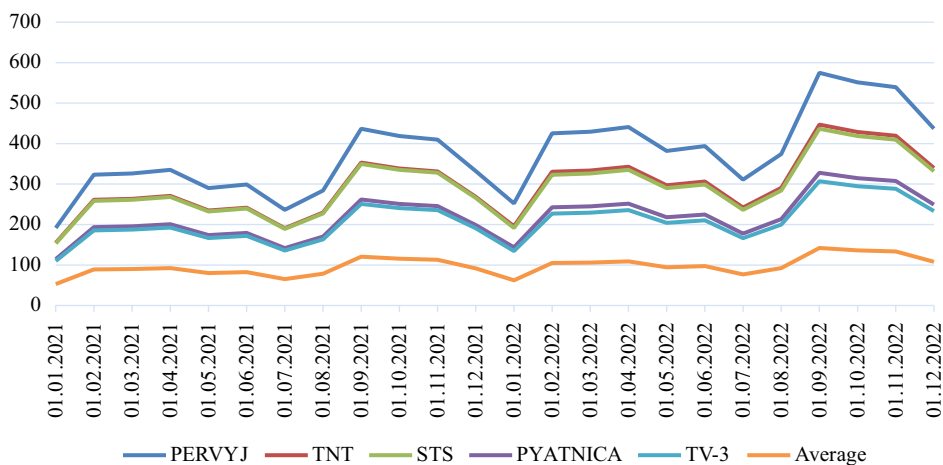


Fig. 3. The CPP dynamics for prime time hours by channels, thousand rubles.

Source: Mediascope, conducted by the authors.

between the channel and the advertiser is made. Small deviations from the contract price are not corrected; thus, the ex-post actual cost of a rating point might differ from the basic one.

The CPPs and the coefficients for each month are reviewed once a year and, thus, can be considered exogenous during a year. The institutional features reinforce the idea that prices are predetermined with respect to observed period ratings. Fig. 3 presents the dynamics of CPP for prime hours, respectively. It is shown that there is a seasonality in prices, with sharp breaks in January and summer months and growth in the autumn.

3.2. The 2022 shock

The Russian TV advertising market was affected by the 2022 Ukrainian conflict both on the demand and supply sides. First, the importance of news on the geopolitical and economic situation has increased for Russians. Thus, the content provided by the TV channels changed. Table 2 reflects that the total duration of programs of that type increases at the expense of others.

Table 2

Program type duration and advertising spaces.

Program type	Airtime distribution by program type, %		Average advertisement duration per hour (total) by program type, seconds	
	2021	2022	2021	2022
Entertainment	13.88	13.22	659.76	600.63
Socio-political	7.54	10.54	600.27	502.69
TV series	22.98	21.78	723.30	609.60
Documentaries	8.34	8.30	537.74	485.87
Movies	14.53	14.68	642.05	570.03
News	9.20	9.87	615.57	465.71
Children	0.59	0.56	304.11	215.75
Animation	6.48	6.50	434.44	364.52
Educational	5.83	4.01	610.28	532.40
Music	5.55	5.61	677.28	611.55
Sport	4.90	4.79	544.59	538.83
Other	0.17	0.17	219.11	132.48

Source: Mediascope, conducted by the authors.

Second, the demand for advertising was affected by the withdrawal of many foreign brands from the Russian market. Foremost, this affected the industries that have a historically high share of foreign advertisers, for example, pharmaceutical products. At the same time, Russian brands began to occupy the vacant advertising slots in the wake of the departure of foreign competitors. As a result, the share of domestic advertisers in the television advertising market has grown significantly, from 56% in 2021 to 77% in 2022.⁹ According to the Association of Communication Agencies of Russia, in the first half of the year, the total amount of national TV advertising decreased by 9%. The latter columns of Table 2 illustrate the effect by program types. As shown, the most affected are ads during news and programs for children. This might reflect either that companies became less interested in advertising during such programs (in the case of goods for children, it might be the result of the exit of corresponding brands from the Russian market) or that TV channels decided to minimize advertising during such programs. In the case of news, it might be due to the decreasing tolerance of viewers for such breaks.

4. Empirical approach and data

To estimate the cross-network effects by advertising type and the influence of the 2022 shock on the Russian TV advertising market, we follow the literature and estimate two demand models: one for the audience side (TV viewers demand for content) and another one for the advertisers' side (demand for airtime). In both equations, the unit of observation is hour-day-channel interval.

The institutional and technological setting of the industry, combined with the high frequency data show that the TV station cannot react contemporaneously (within the hour) to unobserved shocks to viewership and advertising demand estimated.

⁹ National Advertising Alliance Industrial Report 20221/2022 (in Russian).

In order to estimate the geopolitical shock of February 2022's impact on the indirect network effects, we provide a differences model within a structural model that predicts viewership and advertising demand for a channel, where we allow a break in the parameters from the start of the event.

4.1. Audience demand

Since the 19 TV channels considered in this paper are free, there is no price variable in the audience demand equation. In fact, the advertising duration acts as a 'cost' for the audience, as they pay attention to watching the advertisement in anticipation of the content they are interested in. Each viewer chooses to watch a TV channel or the "outside good," maximizing his or her utility. The "outside good" option means to watch a channel that is not included in our sample or not to watch TV at all.

The audience demand equation can be presented by the discrete choice model (Berry et al., 1995; Berry and Waldfogel, 1999). Therefore, assessing this demand, we follow the methodology commonly used by researchers to estimate the indirect network effects (Rysman, 2004; Argentesi and Filistrucchi, 2007; Wilbur, 2008; Zhang, 2017, 2024; Ferrer and Richter, 2025). The basic equation is:

$$\begin{aligned} \ln(s_{jt}) - \ln(s_{0t}) = & \alpha_1 \text{Paid_share}_{jt} + \alpha_2 \text{NonPaid_share}_{jt} + \omega_{\text{after}} + \\ & + \alpha_3 \text{after} \times \text{Paid_share}_{jt} + \alpha_4 \text{after} \times \text{NonPaid_share}_{jt} + \\ & + \beta_i x_{jt} + \varepsilon_{jt} \end{aligned} \quad (3)$$

where s_{jt} is the share of TV channel j at time t , measured as a ratio of the number of viewers of the TV program broadcasted by the TV channel j at time t to the total market size, which is taken equal to the total population of Russia (144 million); s_{0t} is the share of "outside good" at time t , $s_{0t} = 1 - \sum_i s_{jt}$; $\text{Paid_share}_{jt} = \text{Paid}_{jt}/3600$ is the share of paid advertising on the air on channel j at time t , measured as the ratio of the duration (in seconds) of paid advertising on channel j during the time t (Paid_{jt}) to the total number of seconds in an hour; $\text{NonPaid_share}_{jt} = \text{NonPaid}_{jt}/3600$ is the share of non-paid advertising (previews) on the air on channel j at time t , measured as the ratio of the duration (in seconds) of non-paid advertising on channel j during time t (NonPaid_{jt}) to the total number of seconds in an hour; x_{jt} presents programs' characteristics such as genre and duration; ε_{jt} is an error term. The coefficients α_1 and α_2 reflect the indirect network effects of paid and non-paid advertising, respectively.

We distinguish these two types of advertising, assuming that they have different effects on audience demand. If the corresponding coefficient is less than zero, the effect is negative and otherwise. We expect that $\alpha_1 < 0$ because paid advertising annoys the audience, and the $\alpha_2 > 0$ because non-paid advertising is the part of the searched content, informing viewers either about future programing or public interest announcements.

The fixed effects of TV channels, day of week, program genre, hour interval and year-month are included in the model as control variables (x_{jt}). Fig. 4 shows that there is seasonality within day and between months in viewership.

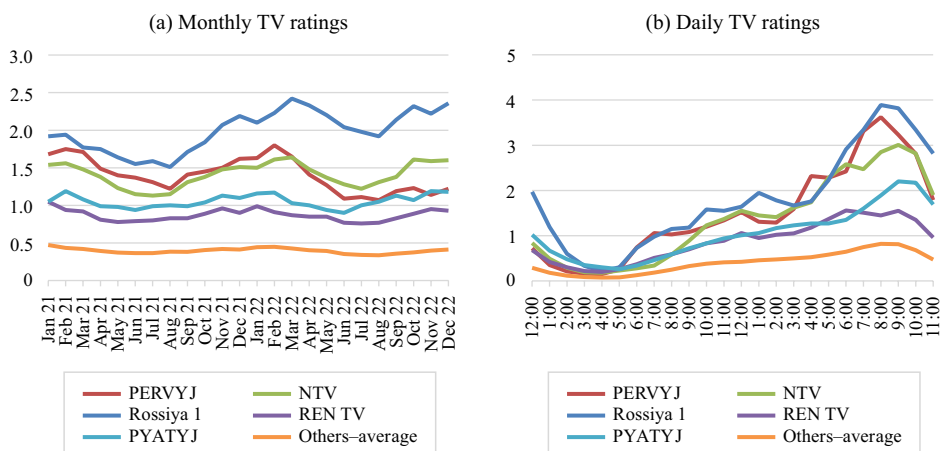


Fig. 4. The dynamics of TV channels' ratings by month (2021–2022) and day (2021).

Source: Mediascope, conducted by the authors.

We also include two program characteristics: (i) whether the TV program duration is more than an hour. Longer broadcasts (such as movies) are characterized by higher average ratings: their average rating is 0,84–8,86 compared to 0,52–0,55 for programs with a duration less than one hour;¹⁰ (ii) a prime time (from 7 PM to 11 PM on weekdays, from 8 AM to 11 PM on weekends and holidays) indicator. The audience demand for a TV program's content is measured by the rating of the particular TV program, in percentage of total potential viewership.¹¹ Ratings are collected at the level of the program that was on the air at the beginning of the hour interval. Appendix A provides a description of the variables and descriptive statistics.

To estimate the impact of the Ukrainian conflict, the variable “after” is included in the equation. This variable is equal to 1 for the dates starting from 24.02.2022. In addition, the variable is interacted with the advertising minutes so that we allow preferences themselves change with respect to advertising. The coefficients α_3 and α_4 reflect changes in the intensity of indirect network effect of paid and non-paid advertising, respectively. Their signs are also a point of interest in the study.

4.2. Advertisers' demand

Advertisers demand the audience's attention, as each viewer can be a potential consumer of the advertised product or service. Advertisers enter into contracts with advertising agencies that specify the number of ratings to be purchased, the price of one rating point, and various allowances and discounts.

A common approach for assessing the advertisers' demand equation is to estimate the inverse demand function with the price of advertising placement

¹⁰ Authors' estimates.

¹¹ Predicted ratings of TV programs are estimated by the channel's media seller based on the Mediascope data. <https://studizba.com/lectures/menedzhment-i-marketing/massovye-kommunikacii-i-mediaplanirovanie/14277-ponyatie-reyting.html> (in Russian).

as a dependent variable (Rysman, 2004; Wilbur, 2008; Zhang, 2017) and using a simpler, constant elasticity specification. Alternatively, we assume that the platform (the TV channel) understands the preferences of the two sides in parallel fashion, based on the same demand functional form (logit). The advantage is that the functional form is more flexible than the constant elasticity. The modelling choice reflects the facts that (i) advertisers are price takers, and they choose where to place an advertisement and the number of rating points to buy considering the channel's price; (ii), basic prices per rating point and correcting coefficients change very infrequently with respect to our data, which is per hour of the day. The basic equation is:

$$\ln(\text{Paid}_{jt}) - \ln(s_{0t}) = \gamma_1 \ln(\text{CPP}_{jt}) + \gamma_2 \ln(\text{tvr}_{jt}) + \delta_{\text{after}} + \gamma_3 \text{after} \times \ln(\text{CPP}_{jt}) + \gamma_4 \text{after} \times \ln(\text{tvr}_{jt}) + \gamma x_{jt} + \zeta_{jt}, \quad (4)$$

where Paid_{jt} is the duration (in seconds) of paid advertising on channel j during at time t ; s_{0t} is the “outside good,” calculated as $(1500 - \text{Paid}_{jt})$, where 1500 seconds is the total possible number of seconds that advertisers could have received; CPP_{jt} is the price per rating point for advertising placement on channel j at time t . For all the channels, CPP differs for prime and not prime time in non-proportional way; tvr_{jt} is the rating of the program on channel j at time t ; x_{jt} is the programs' characteristics such as genre, duration, time and channel fixed effects. We use here only paid advertising duration, as non-paid advertising does not influence the advertisers' demand. The coefficient γ_2 reflects the indirect network effect of the audience, it is supposed to be positive; and γ_4 reflects the change in the intensity of the audience network effect after February 2022, the sign of which is the point of interest in this study. The advertisers' demand for the ad placement is measured by the duration of commercial ad during the hour (Paid_share). The cost to advertisers, as seen above, is a parametric function of the CPP and an explanatory variable, program ratings. Using log cost would not add information to the estimation.

Equations (3) and (4) are estimated separately by the least squares, adjusting for heteroskedasticity. Instruments may not be needed due to the high frequency of the data and the institutional setting of the industry. Rating information for any given hour is not known to the channel during the hour (as seen above), so it cannot adjust the amount of advertising in equation (3) in a program as it is unfolding. The advertising contracts are set before the specific date-hour of the airing, so neither the channel nor the advertisers can alter the CPP more or adjust the quantity of advertising given unexpected audience changes in equation (4). These render the explanatory variables predetermined, or weekly dependent with respect to current unobservables, a requirement for consistent estimates. There may be across periods (many days apart) changes in programming and quantity of advertising offered, but they are based on expected ratings, not actual rating shocks (program attractiveness) that are part of the unobserved error. These can be taken as contemporaneously uncorrelated with the explanatory variables.

The information base of our research includes aggregate data on the 19 Russian TV channels for 2 years (2021 and 2022). We have collected data on programs'

ratings and characteristics, advertising duration, and the price for advertising placement. The unit of observation is the day/channel/hour interval. All in all, we have 166.345 observations for 2021¹² and 166.440 observations for 2022.

5. Estimation results

Table 3 presents the results of the estimation of the audience demand model. Columns (A), (C) and (E) use the total number of advertising seconds within the programming hour, in line with the previous literature. Columns (B), (D) and (F) break the total number of commercials into paid and non-paid ads. Columns (C) and (D) change the base specification (A) and (B) to include channel and prime time fixed effects' interactions in addition to the main effects included in the base specification. Columns (E) and (F) are an additional robustness check with the exclusion of Rossiya K channel, which has zero paid advertising (it is fully sponsored). Column (E) should be compared with column (C) and column (F) with column (D).

In all specifications of the regression models, the coefficient of paid advertising duration is statistically significant and negative, which is reasonable and consistent with the previous research results. As for the non-paid advertising effect, it is statistically significant and positive. This aligns with the hypothesis that previews have an informative function and play a role of “desired” content, at least compared to paid commercials. The total advertising duration effect is negative, as the paid commercial effect is larger and there are more paid commercials than non-paid commercials in a programming hour in general.

Moreover, we obtain statistically significant coefficients for all variables related to the effect of the February 2022 shock. Our finding is that the audience became less tolerant to the paid advertising. The same conclusion can be drawn about the non-paid advertising, although the effect is still positive. For example, in column (B), an addition of a second of non-paid advertising in the hour would lead to an increase in ratings by 1.61 before the shock. After the shock, the effect becomes 1.01 (1.61–0.60), still positive but smaller.

As for the prime time and duration variables, the corresponding coefficients are statistically significant and positive. It means that the audience likes watching TV during prime time hours and gives preference to longer programs, depending on genres.

It should be noted that we use an extensive set of fixed effects to control for unobservable preference shifters, such as channel, month of the sample, genre, day of the week, and the time slot, given the descriptive analysis above. These fixed effects should predict expected ratings that influence advertising slots in each TV show, rendering unobserved shocks to viewership unrelated to advertising quantity in the viewership demand model.

Table 4 depicts the results of the advertisers' demand estimation. Column (G) and (H) are simplified, reduced form, specification as the price is omitted. Column (H) uses log rating (tvr). Column (I) includes (log) price. The audience effect is statistically significant and positive. This finding is

¹² Except for the first five hours on January 1st, 2021.

Table 3
Audience demand assessment.

	(A)	(B)	(C)	(D)	(E)	(F)
					Without “Rossiya K”	
Total share	−0.27*** (0.02)		−0.30*** (0.02)		−0.05** (0.02)	
After × Total	−0.26*** (0.02)		−0.26*** (0.02)		−0.33*** (0.02)	
Paid share		−0.77*** (0.03)		−0.75*** (0.03)		−0.42*** (0.03)
After*Paid		−0.36*** (0.03)		−0.34*** (0.03)		−0.39*** (0.03)
Non_paid share		1.61*** (0.05)		1.38*** (0.05)		1.31*** (0.05)
After × NonPaid		−0.60*** (0.07)		−0.62*** (0.07)		−0.58*** (0.07)
After	0.04*** (0.01)	0.07*** (0.01)	0.04** (0.01)	0.06*** (0.01)	0.06*** (0.01)	0.07*** (0.01)
Longt	0.11*** (0.00)	0.12*** (0.00)	0.10*** (0.00)	0.10*** (0.00)	0.09*** (0.00)	0.10*** (0.00)
Prime	0.18*** (0.00)	0.19*** (0.00)	0.29*** (0.01)	0.30*** (0.01)	0.34*** (0.00)	0.34*** (0.01)
Const	−5.14*** (0.01)	−5.16*** (0.01)	−5.17*** (0.01)	−5.19*** (0.01)	−5.23*** (0.01)	−5.25*** (0.01)
R^2	0.8442	0.8455	0.8489	0.8499	0.8519	0.8526
N	332,785	332,785	332,785	332,785	315,270	315,270
Fixed effects						
Channel	Yes	Yes	Yes	Yes	Yes	Yes
Channel#Prime			Yes	Yes	Yes	Yes
Month#Year	Yes	Yes	Yes	Yes	Yes	Yes
Genre	Yes	Yes	Yes	Yes	Yes	Yes
Day_week	Yes	Yes	Yes	Yes	Yes	Yes
Timeband	Yes	Yes	Yes	Yes	Yes	Yes

Note: Dependent variable: $\ln(s_{jt}) - \ln(s_{0t}) = \ln(TVR_{jt}) - \ln(TVR_{0t})$. Models' coefficient standard errors are robust to heteroscedasticity; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Authors' calculations.

consistent with previous research results that point that wide audience attracts advertisers.

The estimation of the February 2022 shock shows the decrease in demand for advertisement placement, as seen in the descriptive statistics above. Such an effect appears to be not driven by audience changes or price changes, as the effect is negative conditional on those variables (columns H and I). A possible explanation for this result may be the withdrawal of many foreign brands from the Russian market, including advertised ones.

Cross-network effects became weaker after the break, meaning that an additional audience level was not as attractive to advertisers as before the break. The price elasticity of demand for advertising decreased as well. While an additional audience is less enticing for advertisers, reducing its demand, the ad-

Table 4
Advertisers' demand assessment.

	(G)	(H)	(I)
After	0.02 (0.02)	-0.17*** (0.02)	-4.13*** (0.08)
TVR	0.23*** (0.00)		
After × TVR	-0.13*** (0.00)		
LnTVR		0.45*** (0.00)	0.49*** (0.00)
After × LnTVR		-0.12*** (0.00)	-0.16*** (0.00)
LogPrice			-0.50*** (0.01)
After × LogPrice			0.34*** (0.01)
Prime	0.21*** (0.01)	0.02* (0.01)	
Longt	0.06*** (0.00)	0.01** (0.00)	0.02*** (0.00)
Const	-0.66*** (0.01)	-0.22*** (0.01)	5.24*** (0.12)
R^2	0.38	0.43	0.34
N	266,674	266,021	262,541
Fixed Effects			
Channel	Yes	Yes	Yes
Channel#Prime	Yes	Yes	
Month#Year	Yes	Yes	Yes

Note: Dependent variable: $\ln(\text{Paid}_{it}) - \ln(s_{0t})$. Models' coefficient standard errors are robust to heteroscedasticity; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Authors' calculations.

vertising becomes less sensitive to price per rating increases. As we use time and channel fixed effects, the price elasticity coefficient is identified from within channel variation, particularly before and after the shock. While the fixed effects control for real price changes (inflation/exchange rate adjusted, common to all channels), the coefficients reflect the preference changes of advertisers.

To provide more credibility to the results, in Appendix B we estimated the models (3) and (4) for month-by-month to see if the estimated effects were affected by seasonality, i.e., if the change in February 2022 and later, was driven by possibly lower coefficients at the end of winter and spring that may re-occur annually. Figs. B1–B3 in Appendix B, that summarize the paid and non-paid advertising effects from the audience demand equation (3) and the viewership effect on the advertising demand equation (4), suggest that there are seasonality effects within the year. Nevertheless, the main results in Tables 3 and 4 above hold. In February, March and other months of 2022, compared with the same months in 2021, in the viewership demand, (i) the paid advertising negative coefficient becomes more negative and (ii) the non-paid becomes closer to zero and,

in the advertising demand, so does the audience effect. Note that the confidence intervals in the month-by-month regressions are larger than in Tables 3 and 4 as the sample size is much smaller.

We see several reasons for such a change in advertisers' preferences. First, many foreign brands exited Russia and stopped advertising on Russian TV channels. Domestic producers and companies from countries that did not join sanctions got a chance to capture the vacant part of the market. Structural changes in the markets of goods and services resulted in changes in the list of brands advertised on television in favor of domestic brands. Thus, changes in advertisers' preferences are, at least partly, resulted from changes in the list of companies that buy airtime. It seems that local companies are less sensitive to programs' viewership and price per rating point.

The second reason is structural changes on advertised products' markets in Russia. The exit of many well-known brands from the country made the markets up for grabs for new local brands and brands from countries that did not join sanctions. TV advertising is an effective way to inform a large part of the population about non-familiar products. Given that the speed of entering the market does matter, the factors that influence the related costs (including CPP and TVR) are expected to affect less the decision on ad placement under intensive non-price competition for market share.

6. Conclusions

The paper is aimed at exploring a long-debated question in the literature, namely whether ad breaks are a bonus or a nuisance to audiences by examining commercial and non-paid advertising network effects on viewership demand. Institutional features of the Russian TV market, jointly with high frequency, detailed TV programing and audience data allow a cleaner identification of demand parameters. Also, events in the country generated the opportunity to estimate demand parameter changes when there is a cognizable short, important shift in the public's interest. This shift was reflected in TV programing changes, so it remains to be seen if structural parameters were affected as well.

The results indicate that paid advertising duration in programs reduces viewership, and non-paid advertising has a positive, albeit smaller, effect on the audience. The former was known from other TV market estimates in the literature. The latter is previously unknown. After the start of the Ukrainian conflict, Russian audiences became less tolerant to paid advertising and more willing to accept non-paid advertising. On the other side of the platform, we confirm a negatively sloped demand for advertising with positive viewership effects. After the change in audience interest, there is a reduction in the strength of the network effect (in symmetry with the viewership demand) combined with an attenuation of the demand elasticity. This empirically confirms that the strength of the network effects is not a fixed characteristic of a media market. It may change significantly under external shocks that affect viewers' and advertisers' preferences.

It would be interesting to know if the preference changes were observed in other countries, closer or further from the same changes observed in late February 2022. This is the direction for further studies.

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References

- Argentesi, E., & Filistrucchi, L. (2007). Estimating market power in a two-sided market: The case of newspapers. *Journal of Applied Econometrics*, 22(7), 1247–1266. <https://doi.org/10.1002/jae.997>
- Bae, G., & Kim, H. (2022). The impact of online video highlights on TV audience ratings. *Electronic Commerce Research*, 22, 405–425. <https://doi.org/10.1007/s10660-020-09421-4>
- Berry, S., Levinsohn, J., & Pakes, A. (1995). Automobile prices in market equilibrium. *Econometrica*, 63(4), 841–890. <https://doi.org/10.2307/2171802>
- Berry, S., & Waldfogel, J. (1999). Free entry and social inefficiency in radio broadcasting. *RAND Journal of Economics*, 30(3), 397–420. <https://doi.org/10.2307/2556055>
- Evans, D. S., & Schmalensee, R. (2016). *Matchmakers: The new economics of multisided platforms*. Boston, MA: Harvard Business Review Press.
- Fan, Y. (2013). Ownership consolidation and product characteristics: A study of the U.S. daily newspaper market. *American Economic Review*, 103(5), 1598–1628. <https://doi.org/10.1257/aer.103.5.1598>
- Ferrer, R., & Richter, P. (2025). *Targeting viewers' heterogeneous ad aversion: Evidence from a two-sided market* (Preprint). Universitat Pompeu Fabra. <https://paulrichter.netlify.app/publication/working-paper-2/>
- Ivaldi, M., & Muller-Vibes, C. (2018). The differentiated effect of advertising on readership: Evidence from a two-sided market approach. *Marketing Letters*, 29(3), 363–376. <https://doi.org/10.1007/s11002-018-9464-7>
- Ivaldi, M., & Zhang, J. (2022). Platform mergers: Lessons from a case in the digital TV market. *The Journal of Industrial Economics*, 70(3), 591–630. <https://doi.org/10.1111/joie.12274>
- Jeziorski, P. (2010). Effects of mergers in two-sided markets: The US radio industry. *American Economic Journal: Microeconomics*, 6(4), 35–73. <https://doi.org/10.1257/mic.6.4.35>
- Khlyupina, V. (2024). Estimation of the indirect network effect: On the example of television advertising. *Applied Econometrics*, 73, 102–118. <https://doi.org/10.22394/1993-7601-2024-73-102-118>
- Lambrecht, A., Tucker, C., & Zhang, X. (2024). TV advertising and online sales: A case study of intertemporal substitution effects for an online travel platform. *Journal of Marketing Research*, 61(2), 248–270. <https://doi.org/10.1177/00222437231180171>
- Mediascope (2024). *Mediascope TV index 2024* (in Russian).
- Pontual Ribeiro, E., & Golovanova, S. (2020). A unified presentation of competition analysis in two-sided markets. *Journal of Economic Surveys*, 34(3), 548–571. <https://doi.org/10.1111/joes.12362>
- Rysman, M. (2004). Competition between networks: A study of the market for yellow pages. *Review of Economic Studies*, 71(2), 483–512. <https://doi.org/10.1111/0034-6527.00512>
- Song, M. (2021). Estimating platform market power in two-sided markets with an application to magazine advertising. *American Economic Journal: Microeconomics*, 13(2), 35–67. <https://doi.org/10.1257/mic.20160052>
- UNCTAD (2020). *The COVID-19 crisis: Accentuating the need to bridge digital divides*. UNCTAD Report.
- Wilbur, K.C. (2008). A two-sided, empirical model of television advertising and viewing markets. *Marketing Science*, 27(3), 356–378. <https://doi.org/10.1287/mksc.1070.0303>
- Zhang, J. (2017). *Competition and regulation of the advertising financed media platforms*. Doctoral thesis, PSL Research University. <https://theses.hal.science/tel-02425680/>
- Zhang, J. (2025). Welfare analysis of regulation on media platform advertising. *Journal of the European Economic Association*, 23(2), 481–520. <https://doi.org/10.1093/jeea/jvae032>

Appendix A

Table A1
Variable description and descriptive statistics.

Variable	Description	Mean		Standard dev.		Min		Max	
		2021	2022	2021	2022	2021	2022	2021	2022
TVR_j	The rating of the channel j during time period t	0.63	0.65	0.74	0.80	0.00	0.00	9.42	12.04
$\ln(TVR_j) - \ln(TVR_0)$	The difference between the logarithm of and the logarithm of the rating of the “outside good” ($1 - S_j TVR_j$)	-5.60	-5.61	1.37	1.42	-11.50	-11.50	-2.00	-1.70
$Paid_share$	The share of paid ad during the hour, calculated as the duration of commercial and sponsor ad in seconds, divided by 3600	0.13	0.10	0.08	0.79	0.00	0.00	0.42	0.28
CPP	Cost per rating point (CPP), thousand rubles	105.32	126.76	70.42	89.54	22.8	23.8	436.74	574.92
$NonPaid_share$	The share of non-paid ad during the hour, calculated as the duration of non-paid ad in seconds, divided by 3600	0.04	0.04	0.03	0.03	0.00	0.00	0.95	0.30
$Total_share$	Total ad share; calculated as the total duration of ad (both, paid and non-paid) in seconds, divided by 3600	0.17	0.15	0.09	0.09	0.00	0.00	0.95	0.39
$Longt$	Binary var.; = 1 if program duration > one hour	0.34	0.32	0.47	0.47	0.00	0.00	1.00	1.00
$Prime$	Binary var.; = 1 for Prime hours	0.34	0.33	0.47	0.47	0.00	0.00	1.00	1.00

Source: Authors' calculations based on raw data from Mediascope.

Appendix B

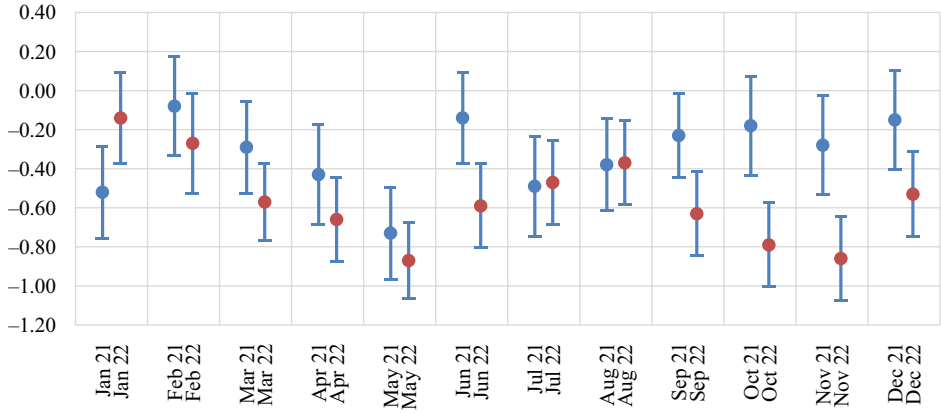


Fig. B1. Cross-network effects month-by-month: Paid ads effect.

Source: Conducted by the authors.

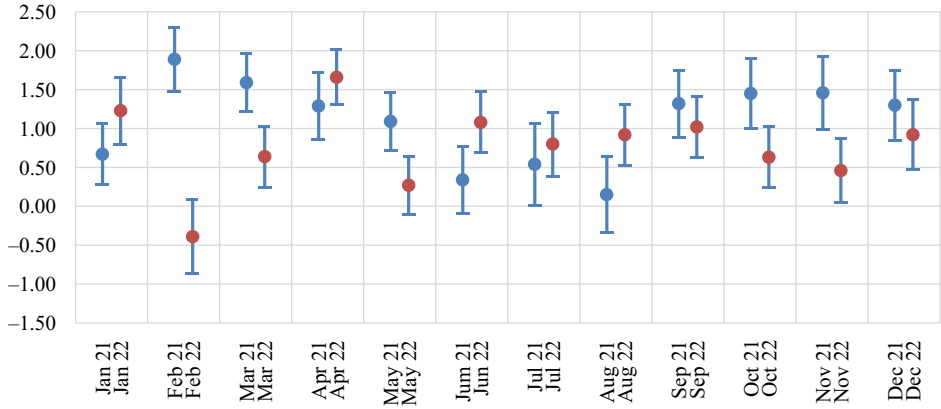


Fig. B2. Cross-network effects month-by-month: Non-paid ads effect.

Source: Conducted by the authors.

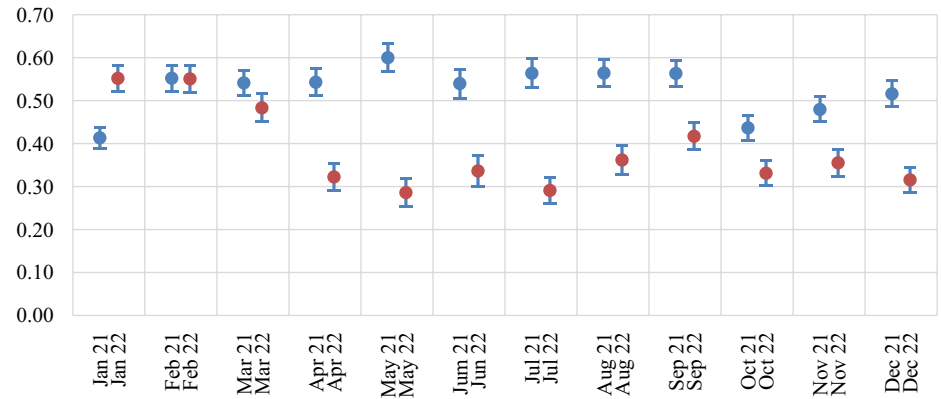


Fig. B3. Cross-network effects month-by-month: Audience effect.

Source: Conducted by the authors.