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Web Appendix Accompanying

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Managing Advertising Campaigns for New Product Launches: An Application at Mercedes-Benz

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Web Appendix A

QUESTIONNAIRE ITEMS ON ADVERTISING KPIS (TRANSLATED FROM GERMAN INTO ENGLISH)

Advertisement recognition

Respondents are exposed to a selection of randomly rotated de-branded (no brand name and logo) advertisements. They need to recognize the advertisement and assign the correct brand to it.

Now, you see pictures, movies or links that show different advertisements. Please, look at an advertisement and indicate whether you saw it once before. You can either just look at the picture or play the movie by clicking on the respective button. If you move the mouse over the screenshot a short text appears that describes the contents of the advertisement in words. Please, decide on your own whether you want to watch and listen to the advertisement completely.

Did you ever see the advertisement before?

☐ Yes
☐ No

The next questions are conditional on recognition and refer to the correctly recognized advertisement.

Advertisement involvement and motivation

1.	When watching the advertisement, do you think other people would like to watch the advertisement?	Yes/ No	Involvement
2.	Generally, you probably do not concentrate on watching an advertisement. Nevertheless, from time to time, there are advertisements that you may like to watch. How about this advertisement of Mercedes-Benz? Is this an advertisement you like to watch?	Yes/ No	Involvement
3.	Did this advertisement increase your interest in obtaining further information about Mercedes-Benz? For example, you might see a dealership to arrange for a test drive or you visit the website of the car manufacturer.	Yes/ No	Motivation
4.	Do you think that what was shown or reported about Mercedes-Benz in this advertisement was worth seeing or listening to it?	Yes/ No	Involvement
5.	Having seen this advertisement, how would you describe your opinion about Mercedes-Benz? Would you say you now have a better opinion about Mercedes-Benz?	Yes/ No	Motivation
6.	Imagine you talk about cars with a friend. Do you believe you would mention anything positive you saw or heard about Mercedes-Benz in the advertisement? Or would you talk about certain positive impressions you got from the advertisement?	Yes/ No	Motivation

Items 1, 2, and 4 are used to measure advertising involvement. The remaining items are used for advertising motivation. For both KPIs, two out of the three questions need be answered with 'Yes' to qualify a respondent as being involved or motivated, respectively.

Web Appendix B

QUESTIONNAIRE ITEMS ON MEDIA USAGE (EXAMPLE CAMPAIGN IV) (TRANSLATED FROM GERMAN INTO ENGLISH)

Print media

General usage newspapers/magazines

In the following, we are interested in your reading habits regarding newspapers and magazines. Please, choose **all** newspapers and magazines from the list below that you read or at least browsed through during the last 12 months. *(rotated list)*

	Yes	No		Yes	No
stern	☐	☐	Wired	☐	☐
DER SPIEGEL	☐	☐	TV Spielfilm	☐	☐
FOCUS	☐	☐	brand eins	☐	☐
Auto Bild	☐	☐	Capital	☐	☐
DIE ZEIT	☐	☐	NEON	☐	☐
FOCUS MONEY	☐	☐	Men's Health	☐	☐
WirtschaftsWoche	☐	☐	Cicero	☐	☐
Welt am Sonntag	☐	☐	MERIAN	☐	☐
BUNTE	☐	☐	manager magazin	☐	☐
HÖRZU	☐	☐	VOGUE	☐	☐
Gala	☐	☐	DER FEINSCHMECKER	☐	☐
Frankfurter Allgemeine Sonntagszeitung	☐	☐	impulse	☐	☐
Frankfurter Allgemeine Zeitung	☐	☐	PLAYBOY	☐	☐
Süddeutsche Zeitung	☐	☐	auto, motor und sport	☐	☐
Handelsblatt	☐	☐	AUTO ZEITUNG	☐	☐
DIE WELT	☐	☐	freundin	☐	☐
GQ	☐	☐	tv DIGITAL	☐	☐
Elle	☐	☐	Architectural Digest	☐	☐
SCHÖNER WOHNEN	☐	☐	Fit for Fun	☐	☐
GEO	☐	☐	Architektur & Wohnen	☐	☐

Usage of daily newspapers (R = 6 days)

How often do you usually read or browse through the following **daily newspapers**? (*only newspapers selected by respondent, list rotated*)

	Every/ almost every day	3-5 time per week	2-3 times per week	1-2 times per week	Less often	Never
Frankfurter Allgemeine Zeitung	☐	☐	☐	☐	☐	☐
Süddeutsche Zeitung	☐	☐	☐	☐	☐	☐
Handelsblatt	☐	☐	☐	☐	☐	☐
DIE WELT	☐	☐	☐	☐	☐	☐
Frequency (r)	5.5	4	2.5	1.5	0.5	0

Usage of weekly newspapers/magazines (R = 52 weeks)

How often do you usually read or browse through the following **weekly newspapers or magazines**? (*only mewspapers/magazines selected by respondent, list rotated*)

	Every/ almost every week	2-3 times per month	Ca. once a month	5-10 times per year	Less often	Never
stern	☐	☐	☐	☐	☐	☐
DER SPIEGEL	☐	☐	☐	☐	☐	☐
FOCUS	☐	☐	☐	☐	☐	☐
Auto Bild	☐	☐	☐	☐	☐	☐
DIE ZEIT	☐	☐	☐	☐	☐	☐
FOCUS MONEY	☐	☐	☐	☐	☐	☐
BUNTE	☐	☐	☐	☐	☐	☐
HÖRZU	☐	☐	☐	☐	☐	☐
Gala	☐	☐	☐	☐	☐	☐
Welt am Sonntag	☐	☐	☐	☐	☐	☐
Frankfurter Allgemeine Sonntagszeitung	☐	☐	☐	☐	☐	☐
WirtschaftsWoche	☐	☐	☐	☐	☐	☐
Frequency (r)	50	30	12	7.5	3	0

Usage of bi-weekly newspapers/magazines (R = 26 double-weeks)

How often do you usually read or browse through the following **bi-weekly newspapers/magazines**? (*only newspapers/magazines selected by respondent, list rotated*)

	Every/ almost every two weeks	Ca. once a month	Ca. 6-10 times per year	Ca. 3-5 times per year	Less often	Never
auto, motor und sport	☐	☐	☐	☐	☐	☐
AUTO ZEITUNG	☐	☐	☐	☐	☐	☐
freundin	☐	☐	☐	☐	☐	☐
tv DIGITAL	☐	☐	☐	☐	☐	☐
TV Spielfilm	☐	☐	☐	☐	☐	☐
Frequency (r)	24	12	8	4	2	0

Usage of monthly magazines (R = 12 months)

How often do you usually read or browse through the following **monthly magazines**? (*only magazines selected by respondent, list rotated*)

	Every/ almost every month	Ca. 6-10 times per year	Ca. 3-5 times per year	Ca. 1-2 times per years	Less often	Never
PLAYBOY	☐	☐	☐	☐	☐	☐
GQ	☐	☐	☐	☐	☐	☐
SCHÖNER WOHNEN	☐	☐	☐	☐	☐	☐
GEO	☐	☐	☐	☐	☐	☐
brand eins	☐	☐	☐	☐	☐	☐
Capital	☐	☐	☐	☐	☐	☐
NEON	☐	☐	☐	☐	☐	☐
Men's Health	☐	☐	☐	☐	☐	☐
Cicero	☐	☐	☐	☐	☐	☐
MERIAN	☐	☐	☐	☐	☐	☐
manager magazin	☐	☐	☐	☐	☐	☐
VOGUE	☐	☐	☐	☐	☐	☐
DER FEINSCHMECKER	☐	☐	☐	☐	☐	☐
impulse	☐	☐	☐	☐	☐	☐
Elle	☐	☐	☐	☐	☐	☐
Architectural Digest	☐	☐	☐	☐	☐	☐
Fit for Fun	☐	☐	☐	☐	☐	☐
Frequency (r)	11.5	8	4	7.5	0.5	0

Usage of bi-monthly magazines (R = 6 double-months)

How often do you usually read or browse through the following **bi-monthly magazines**? (*only magazines selected by respondent, list rotated*)

	Every two/ almost every two months	Ca. 4-5 times per year	Ca. 2-3 times per year	Ca. once a year	Less often	Never
Architektur&Wohnen	☐	☐	☐	☐	☐	☐
Frequency (r)	5.5	4.5	2.5	1	0.5	0

Usage of quarterly magazines (R = 4 quarters)

How often do you usually read or browse through the following quarterly **magazines**? (*only magazines selected by respondent, list rotated*)

	Ca. 4 times per year/ almost 4 times per year	Ca. 3 times per year	Ca. 2 times per year	Ca. once a year	Less often	Never
wired	☐	☐	☐	☐	☐	☐
Frequency (r)	3.75	3	2	1	0.5	0

Online media

In the following, we are interested in your usage of cetain websites. Please, indicate how often you usually visit the websites shown below. Please, provide your best guess if you do not exactly remember your visits. ***(rotated list) (R = 7)***

	Se-veral times per day	Once a day	5-6 times per week	3-4 times per week	1-2 times per week	3-4 times per month	1-2 times per month	Less often	Ne-ver
WELT.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
mobile.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
AutoScout24.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
zeit.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
AutoBild.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
FAZ.net	☐	☐	☐	☐	☐	☐	☐	☐	☐
Focusonline.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Web.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
SpiegelOnline.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Sueddeutsche.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Stern.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
auto-motor-und-sport.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Handelsblatt.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Youtube.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Bild.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Yahoo.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Autoplenum.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Motortalk.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
T-Online.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Finanzen.net	☐	☐	☐	☐	☐	☐	☐	☐	☐
vimeo.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Frequency (r)	21	7	5.5	3.5	1.5	0.8	0.3	0.1	0

And how long do you stay on these sites during a visit? Please, provide your best guess if you do not remember exactly. (*only websites selected by respondent, list rotated*)

	Less than a minute per visit	1 - 2 mi-nutes per visit	3 - 5 mi-nutes per visit	6 - 10 mi-nutes per visit	11 - 20 mi-nutes per visit	21 - 30 mi-nutes per visit	31 - 60 mi-nutes per visit	More than 60 mi-nutes per visit	1 - 2 hours per visit
WELT.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
mobile.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
AutoScout24.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
zeit.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
AutoBild.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
FAZ.net	☐	☐	☐	☐	☐	☐	☐	☐	☐
Focusonline.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Web.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
SpiegelOnline.de	☐	☐	☐	☐	☐	☐	☐	☐	☐

Sueddeutsche.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Stern.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
auto-motor-und-sport.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Handelsblatt.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Youtube.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Bild.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Yahoo.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Autoplenum.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Motortalk.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
T-Online.de	☐	☐	☐	☐	☐	☐	☐	☐	☐
Finanzen.net	☐	☐	☐	☐	☐	☐	☐	☐	☐
vimeo.de	☐	☐	☐	☐	☐	☐	☐	☐	☐

Calculation of OTS for banner advertising

The calculation of OTS for banner advertising is different from those for TV and print because the exposure probability for a person in a given week is not only driven by the person's probability of visiting the focal website but also by the chance of a banner ad to be delivered to the visitor. Three factors, the number of visitors to the websites, the number of pages viewed by these visitors, and the number of ad impressions bought by the company drive the chance of banner ad delivery. Let a website have 75,000 unique daily visitors who view 500,000 pages, on average, per day. If the company bought 55,000 impressions per day the visitor's probability of receiving a banner ad is 55,000/500,000 = 2.75%.

This probability measure replaces h^{Web} in expression (6). Following expression (5), a person's viewing "probability" is calculated with r^{Web}/R^{Web}. Because $R^{Web} = 7$ and r^{Web} may be as large as 21 if a person visits the website several times a day, we do not measure a viewing probability but rather a frequency per day. Put differently, the restriction $0 \leq r^{Web} \leq R^{Web}$ does not hold for banner advertising. This is only a question of definition. We could have set $R^{Web} = 21$ to stay within the restriction $0 \leq r^{Web} \leq R^{Web}$.

Note that the frequency of banner ad delivery is defined at the daily level. Multiplying $(h^{Web}\ r^{Web})/R^{Web}$ with 7 provides the total opportunities-to-see the banner advertisement in a given week on the focal website.

TV media

General usage of TV channels

Let's turn to television. For each of the following TV channels, please indicate **whether you watch** the channel **at all** either at home or somewhere else – even if it is only occasionally. Which of the following TV channels do you watch **at least occasionally**? ***(rotated list)***

	Yes, I watch this channel at least occasionally	No, I never watch this channel
ARD	☐	☐
ZDF	☐	☐
RTL	☐	☐
Sat1	☐	☐
ProSieben	☐	☐
Kabel 1	☐	☐
RTL 2	☐	☐
VOX	☐	☐
N24	☐	☐
n-tv	☐	☐
Eurosport	☐	☐
Sport1	☐	☐

Usage per timeslot – weekdays (**R = 5**)

Please, think about the weekdays Monday thru Friday: At which times on a normal weekday do you usually watch ***[Name channel***], either at home or somewhere else?

	Daily	Almost daily	1-2 times per week	Less often	Never
Before 7 pm	☐	☐	☐	☐	☐
Between 7 and 8 pm	☐	☐	☐	☐	☐
Between 8 and 9 pm	☐	☐	☐	☐	☐
Between 9 and 10 pm	☐	☐	☐	☐	☐
Between 10 and 11 pm	☐	☐	☐	☐	☐
Between 11 pm and 12 am	☐	☐	☐	☐	☐
After 12 am	☐	☐	☐	☐	☐
Frequency (r)	5	3.5	1.5	0.5	0

Yesterday's question for timeslots - weekdays

Did you watch ***[Name channel***] at these times yesterday [if day of interview = Tuesday to Saturday] / last Friday [if day of interview = Sunday to Monday]?

	Yes	No
Between 7 and 8 pm	☐	☐
Between 8 and 9 pm	☐	☐
Between 9 and 10 pm	☐	☐
Between 10 and 11 pm	☐	☐
Between 11 pm and 12 am	☐	☐

Usage per timeslot – weekends (**R = 4**)

Let's focus on weekends now. At which times do you usually watch ***[Name channel***], either at home or somewhere else? Please indicate how often you watched ***[Name channel***] at the following times during the last four weeks.

	On each weekend	On **3 out of 4 weekends**	On 2 **out of 4 weekends**	On **1 out of 4 weekends**	never
Before 7 pm	☐	☐	☐	☐	☐
Between 7 and 8 pm	☐	☐	☐	☐	☐
Between 8 and 9 pm	☐	☐	☐	☐	☐
Between 9 and 10 pm	☐	☐	☐	☐	☐
Between 10 and 11 pm	☐	☐	☐	☐	☐
Between 11 pm and 12 am	☐	☐	☐	☐	☐
After 12 am	☐	☐	☐	☐	☐
Frequency (r)	4	3	2	1	0

Yesterday's question for timeslots - weekends

Did you watch ***[Name channel***] at these times on the last weekend?

	Yes	No
Between 7 and 8 pm	☐	☐
Between 8 and 9 pm	☐	☐
Between 9 and 10 pm	☐	☐
Between 10 and 11 pm	☐	☐
Between 11 pm and 12 am	☐	☐

Web Appendix C

OPTIMAL MEDIA MIX

Before we solve the maximization problem set up in expression (3) of the paper, let us first develop an expression for the elasticity of the proportion of motivated customers w.r.t. expenditures in channel l, e_{P_M, Adv_l} . Take the first derivative of P_M w.r.t. Adv_l

$$\frac{\partial P_M}{\partial Adv_l} = \frac{\partial P_R}{\partial Adv_l} P_{I|R} P_{M|R,I} + \frac{\partial P_I}{\partial Adv_l} P_R P_{M|R,I} + \frac{\partial P_M}{\partial Adv_l} P_R P_{I|R} \ . \tag{A.1}$$

Expand the terms on the right hand side as follows

$$\frac{\partial P_M}{\partial Adv_l} = \frac{\partial P_R}{\partial Adv_l} \frac{Adv_l}{P_R} \frac{1}{Adv_l} P_R \, P_{I|R} P_{M|R,I} + \frac{\partial P_{I|R}}{\partial Adv_l} \frac{Adv_l}{P_{I|R}} \frac{1}{Adv_l} P_{I|R} P_R P_{M|R,I}$$
$$+ \frac{\partial P_{M|R,I}}{\partial Adv_l} \frac{Adv_l}{P_{M|R,I}} \frac{1}{Adv_l} P_{M|R,I} P_R P_{I|R}$$

and multiply with $\frac{Adv_l}{P_R P_{I|R} P_{M|R,I}} = \frac{Adv_l}{P_M}$ to obtain

$$\frac{\partial P_M}{\partial Adv_l} \frac{Adv_l}{P_M} = \frac{\partial P_R}{\partial Adv_l} \frac{Adv_l}{P_R} + \frac{\partial P_{I|R}}{\partial Adv_l} \frac{Adv_l}{P_{I|R}} + \frac{\partial P_{M|R,I}}{\partial Adv_l} \frac{Adv_l}{P_{M|R,I}} \ ,$$

which we can rewrite in terms of elasticities e

$$e_{P_M, Adv_l} = e_{P_R, Adv_l} + e_{P_{I|R}, Adv_l} + e_{P_{M|R,I}, Adv_l} \ . \tag{A.2}$$

As is evident from expression A.2, the elasticity of the proportion of motivated customers w.r.t. expenditures in channel l corresponds to the sum of the stage-specific elasticities of the (conditional) probabilities.

Considering the constrained maximization problem (3) of the paper, we set up the following Lagrange function

$$L = P_R(\mathbf{Adv}) P_{I|R}(\mathbf{Adv}) P_{M|R,I}(\mathbf{Adv}) - m(\sum\nolimits_{l \in L} Adv_l - B)$$

and obtain the first-order conditions (FOC) that must hold

$$\frac{\partial L}{\partial Adv_l} = \frac{\partial P_M}{\partial Adv_l} - m = 0, \quad \forall l \in L$$

and (A.3)

$$\frac{\partial L}{\partial m} = \sum\nolimits_{l \in L} Adv_l - B = 0 \, ,$$

where m is the Lagrange multiplier. Transform and expand the FOC to obtain

$$\frac{\partial P_M}{\partial Adv_l}\frac{Adv_l^*}{P_M^*}\frac{P_M^*}{Adv_l^*} = m^* \quad \Leftrightarrow Adv_l^* = \frac{P_M^*}{m^*}e^*_{P_M,Adv_l}, \quad \forall l \in L \tag{A.4}$$

and

$$B = \sum_{l\in L} Adv_l^* . \tag{A.5}$$

The asterisk indicates that variables are in their optimum. Insert expression (A.4) into (A.5). We then obtain the optimal share of the budget allocated to channel *l* by

$$\frac{Adv_l^*}{B} = \frac{(P_M^*/m^*)e^*_{P_M,Adv_l}}{\sum_{l\in L}(P_M^*/m^*)e^*_{P_M,Adv_l}} = \frac{e^*_{P_M,Adv_l}}{\sum_{l\in L} e^*_{P_M,Adv_l}} \tag{A.6}$$

Substitute $e^*_{P_M,Adv_l}$ for expression (A.2) to derive our final allocation solution (4)

$$Adv_l^* = \frac{e^*_{P_R,Adv_l} + e^*_{P_{l|R},Adv_l} + e^*_{P_{M|R,I},Adv_l}}{\sum_{l\in L} e^*_{P_R,Adv_l} + e^*_{P_{l|R},Adv_l} + e^*_{P_{M|R,I},Adv_l}} \times B,$$

with $e^*_{P_R,Adv_l} + e^*_{P_{l|R},Adv_l} + e^*_{P_{M|R,I},Adv_l} \geq 0$ and $\sum_{l\in L} e^*_{P_R,Adv_l} + e^*_{P_{l|R},Adv_l} + e^*_{P_{M|R,I},Adv_l} > 0, \ \forall l \in L.$

Web Appendix D

TESTS AND ADDITIONAL RESULTS

Web Appendix D reports descriptive statistics on the treatment variable, OTS, results of Harman's test for common method bias (Podsakoff, MacKenzie, and Lee 2003), model performance tests, estimation results for the three other launch campaigns, model selection tests, and estimation results of alternative model specifications. Due to the page limit, we do not report further robustness checks but provide full details upon request.

Table D.1

Descriptive statistics on cumulated OTS

	Cumulated OTS TV	Cumulated OTS Print	Cumulated OTS Online
Campaign I			
Relative size of quasi-control group	4.9 %	31.4 %	61.5 %
Relative size of quasi-experimental group[1)]	95.1 %	68.6 %	38.5 %
Mean	14.61	4.87	3.26
(Standard error)	(.44)	(.21)	(.22)
Minimum	.00	.00	.00
Maximum	48.69	48.59	50.00
# observations	849	849	849
Campaign II			
Relative size of quasi-control group	21.3 %	58.1 %	54.0 %
Relative size of quasi-experimental group[1)]	78.7 %	41.9 %	46.0 %
Mean	4.27	1.72	3.49
(Standard error)	(.17)	(.09)	(.21)
Minimum	.00	.00	.00
Maximum	35.72	23.01	50.00
# observations	847	847	847
Campaign III			
Relative size of quasi-control group	5.2 %	29.2 %	55.0 %
Relative size of quasi-experimental group[1)]	94.8 %	70.8 %	45.0 %
Mean	6.68	1.74	.91
(Standard error)	(.22)	(.07)	(.05)
Minimum	.00	.00	.00
Maximum	50.00	14.17	12.06
# observations	853	853	853
Campaign IV			
Relative size of quasi-control group	10.2 %	38.7 %	30.9 %
Relative size of quasi-experimental group[1)]	89.8 %	61.3 %	69.1 %
Mean	6.41	3.41	5.90
(Standard error)	(.20)	(.12)	(.23)
Minimum	.00	.00	.00
Maximum	50.00	28.21	40.64
# observations	930	930	930

Notes. OTS figures are disguised and scaled to a maximum of 50 for confidentiality reasons. Note that sizes of control and experimental group also vary because advertising in a specific channel did not necessarily start in the first week of the campaign.

[1)] Cumulated OTS in the experimental group are 1 or larger.

Note that the differences in investment level only impact the range of the treatment variable, OTS. But they do not drive the variation across individuals, which is the unit of analysis. As long as there is sufficient variation within the range there should be no influence on our results. Nevertheless, as a robustness check, we created subsamples in which we restricted the maximum OTS to be the same for all three channels and re-estimated the models. Results are almost exactly replicated.

Harman's single factor test suggests that common method bias is not an issue. If it was, we would need to extract a single factor representing both ad KPI variables (focal dependent measures) and spend variables (focal predictor variables). However, as Table D.2 shows, we extract two factors that account for more than 70% of the variance. Ad KPIs variables load on the first factor, while spend variables load in the second factor.

Table D.2

Factor Analysis Results for Harman's Single Factor Test

	Campaign I		*Campaign II*	
	Factor 1 Ad KPI	Factor 2 Ad spend	Factor 1 Ad KPI	Factor 2 Ad spend
Eigenvalue	3.003	1.168	3.046	1.133
Percent of variance	50.1 %	19.5 %	50.8 %	18.9 %
	Factor loadings		Factor loadings	
Ln(TV)	.359	**.664***	.465	**.567***
Ln(Print)	.468	**.579***	.477	**.607***
Ln(Online)	.391	**.450***	.362	**.478***
(Unaided) Recognition	**.918***	-.223	**.897***	-.251
Being involved	**.939***	-.255	**.931***	-.283
Being motivated	**.883***	-.274	**.895***	-.266
	Campaign III		*Campaign IV*	
	Factor 1 Ad KPI	Factor 2 Ad spend	Factor 1 Ad KPI	Factor 2 Ad spend
Eigenvalue	2.908	1.335	2.888	1.217
Percent of variance	48.5 %	22.2 %	48.1 %	20.3 %
	Factor loadings		Factor loadings	
Ln(TV)	.187	**.647***	.313	**.605***
Ln(Print)	.417	**.645***	.424	**.593***
Ln(Online)	.444	**.577***	.317	**.586***
(Unaided) Recognition	**.894***	-.236	**.903***	-.230
Being involved	**.940***	-.241	**.945***	-.225
Being motivated	**.905***	-.230	**.895***	-.229

Note: Extraction method = Principal component analysis
* Indicates highest factor loading

Table D.3

Model Performance Statistics (Classification Rate)

	(Unaided) Recognition	Being involved	Being motivated
Campaign I			
Benchmark I: Maximum chance rule	33.7 %	61.0 %	47.5 %
Benchmark II: Proportional chance rule	34.1 %	44.4 %	36.0 %
Focal model (Equation 1)	**56.8 %**	**68.9 %**	**66.1 %**
Campaign II			
Benchmark I: Maximum chance rule	45.2 %	45.6 %	33.3 %
Benchmark II: Proportional chance rule	35.5 %	32.9 %	29.5 %
Focal model (Equation 1)	**54.2 %**	**57.5 %**	**47.9 %**
Campaign III			
Benchmark I: Maximum chance rule	51.2 %	45.9 %	42.6 %
Benchmark II: Proportional chance rule	35.5 %	32.1 %	31.2 %
Focal model (Equation 1)	**61.1 %**	**60.2 %**	**49.8 %**
Campaign IV			
Benchmark I: Maximum chance rule	46.1 %	46.1 %	36.5 %
Benchmark II: Proportional chance rule	34.2 %	34.4 %	30.9 %
Focal model (Equation 1)	**52.2 %**	**55.5 %**	**44.7 %**

Notes. Superior model in bold. Note that the dependent variable has 4 categories. The classification rate measures the number of correct predictions across the 4 categories relative to the total number of observations. The benchmark models predict by using knowledge about actual category frequencies. The maximum chance rule is based on the idea that an easy choice would be the largest category for prediction. The proportional chance rule considers correct prediction in all categories and is based on observed frequencies in all categories (Hair et al. 2014).

Table D.4

Estimation Results for Campaign I (Equation 1)

Dependent variable		(Unaided) Recognition		Being involved		Being motivated	
		Coefficient	Wald statistic	Coefficient	Wald statistic	Coefficient	Wald statistic
Baseline for Prob (y_{is} = l)			(92.03)		(132.1)		(65.39)
l = 0		[1]		[1]		[1]	
l = 1		-8.742		-5.811		-7.176	
l = 2		-19.230		-15.405		-17.124	
l = 3		-31.115		-26.608		-28.781	
SD of baseline		41.577	(34.45)	52.838	(21.65)	65.028	(18.73)
Advertising stock by channel							
Ln(TV)	Mean	.438	(27,39)	.326	(18.24)	.250	(11.81)
	SD	.121	(29,15)	.174	(21.97)	.234	(19.16)
Ln(Print)	Mean	.079	(17,14)	.084	(9.79)	.097	(10.25)
	SD	-	*NS*	-	*NS*	-	*NS*
Ln(Online)	Mean	.059	(16,81)	.037	*NS*	.015	*NS*
	SD	-	*NS*	.011	(5.97)	.009	(6.03)
Controls							
Ln(Competitive brand index)		.466	(15,21)	.865	(19.80)	1.548	(31.37)
Sampling source			*NS*		*NS*		(4.149)
Source 1		[1]		[1]		[1]	
Source 2		-		-		-.502	
Week dummies		[2]		[2]		[2]	
Log Likelihood		-890.97		-506.16		-501.24	
N (sample size)		840		537		480	

NS = not significant (p > .05)
[1] Set to zero for identification purpose
[2] Not reported (available upon request).

Table D.5

Estimation Results for Campaign II (Equation 1)

Dependent variable		(Unaided) Recognition		Being involved		Being motivated	
		Coefficient	Wald statistic	Coefficient	Wald statistic	Coefficient	Wald statistic
Baseline for Prob (y_{is} = l)			(41.86)		(96.10)		(59.64)
l = 0		[1]		[1]		[1]	
l = 1		-5.642		-5.834		-6.906	
l = 2		-11.740		-13.957		-15.388	
l = 3		-18.214		-22.737		-24.313	
SD of baseline		11.370	(17.12)	19.179	(11.75)	18.070	(11.04)
Advertising stock by channel							
Ln(TV)	Mean	.261	(16.47)	.417	(11.95)	.416	(14.11)
	SD	.030	(10.00)	.094	(12.36)	.083	(11.44)
Ln(Print)	Mean	.071	(14.49)	.058	(10.82)	.049	(6.48)
	SD	.004	(6.77)	-	*NS*	-	*NS*
Ln(Online)	Mean	.048	(18.05)	.043	(5.40)	.061	(9.39)
	SD	-	*NS*	-	*NS*	-	*NS*
Controls							
Ln(Competitive brand index)		.272	(8.54)	.548	(10.84)	.632	(10.26)
Sampling source			(3.99)		(4.32)		*NS*
Source 1		[1]		[1]		[1]	
Source 2		.261		.423		-	
Week dummies		[2]		[2]		[2]	
Log Likelihood		-904.10		-467.47		-405.09	
N (sample size)		845		421		351	

NS = not significant (p > .05)
[1] Set to zero for identification purpose
[2] Not reported (available upon request).

Table D.6

Estimation Results for Campaign III (Equation 1)

Dependent variable		(Unaided) Recognition		Being involved		Being motivated	
		Coefficient	Wald statistic	Coefficient	Wald statistic	Coefficient	Wald statistic
Baseline for Prob (y_{is} = l)			(33.64)		(84.83)		(18.77)
l = 0		[1]		[1]		[1]	
l = 1		-5.485		-7.239		-.950	
l = 2		-11.318		-16.858		-4.125	
l = 3		-17.960		-27.108		-8.030	
SD of baseline		21.463	(19.42)	214.29	(14.24)	7.043	(4.12)
Advertising stock by channel							
Ln(TV)	Mean	.187	(14.38)	.488	(15.32)	.029	*NS*
	SD	.156	(17.56)	.989	(14.75)	-	*NS*
Ln(Print)	Mean	.041	(8.54)	.086	(11.41)	.075	(3.99)
	SD	.005	(5.51)	-	*NS*	-	*NS*
Ln(Online)	Mean	.132	(11.77)	.009	*NS*	.064	*NS*
	SD	.020	(9.24)	.016	(6.95)	-	*NS*
Controls							
Ln(Competitive brand index)		.464	(11.91)	.904	(18.58)	.815	(4.89)
Sampling source			(15.10)		*NS*		*NS*
Source 1		[1]		[1]		[1]	
Source 2		.779		-		-	
Week dummies		[2]		[2]		[2]	
Log Likelihood		-936.26		-472.84		-398.27	
N (sample size)		851		412		331	

NS = not significant (p > .05)
[1] Set to zero for identification purpose
[2] Not reported (available upon request).

Table D.7

Model selection and model fit criteria (unaided recognition)

	Hierarchical system of 7 binary/ordered logit models	Focal ordered logit model (Equation 1)
Campaign I		
(Weighted) log likelihood	-609.47	-890.97
# parameters	124	19
# observations	849	849
SIC	1,148.25	**1,005.94**
CAIC	2,296.51	**1,928.88**
BIC	2,296.49	**1,909.88**
Improvement over PCC[1)]	43%	**66%**
Campaign II		
(Weighted) log likelihood	-614.97	-904.10
# parameters	117	18
# observations	845	845
SIC	1,123.06	**964.75**
CAIC	2,246.14	**1,947.51**
BIC	2,246.12	**1,929.51**
Improvement over PCC[1)]	42%	**53%**
Campaign III		
(Weighted) log likelihood	-637.27	-936.55
# parameters	120	19
# observations	851	851
SIC	1,158.81	**1,000.64**
CAIC	2,317.64	**2,020.28**
BIC	2,317.62	**2,001.28**
Improvement over PCC[1)]	52%	**72%**
Campaign IV		
(Weighted) log likelihood	-708.79	-1,040.31
# parameters	122	19
# observations	930	930
SIC	1,244.44	**1,105.25**
CAIC	2,488.89	**2,229.49**
BIC	2,488.87	**2,210.49**
Improvement over PCC[1)]	38%	**52%**

Notes. Superior model in bold. To compare model fit in terms of log likelihood it would not be fair to sum up the 7 likelihoods (and observations) for the system of 7 logit models. Instead, we take the weighted average log likelihood. A respondent may recognize the advertisement in 7 different ways, which capture the unique outcome contribution of the 7 models. S/he can correctly recognize the ad only in TV, print, or online channel, in 2 out of 3 channels, or in all 3 channels together. The relative proportions of these recognitions determine the weights.

[1)] PCC = proportional chance criterion. We measure the improvement of model fit in terms of the classification rate over PCC. PCC is a benchmark model that predicts class membership based on knowledge of actual class frequencies. 25% improvement over PCC is considered a significant improvement (Hair et al. 2014).

Table D.8

Estimation Results for Campaign IV: Alternative Model Specifications

Dependent variable = Recognition		Linear model		Poisson model		Zero-inflated Poisson model	
		Coefficient	Wald statistic	Coefficient	Wald statistic	Coefficient	Wald statistic
Intercept		-.442	(6.70)	-4.410	(39.05)	-4.193	(33.99)
SD of baseline		1.198	(39.01)	5.518	(31.47)	5.076	(28.31)
Advertising stock by channel							
Ln(TV)	Mean	.052	(20.77)	.194	(15.45)	.188	(14.43)
	SD	.002	(15.87)	.009	(8.14)	.009	(7.86)
Ln(Print)	Mean	.030	(33.19)	.087	(17.73)	.082	(16.13)
	SD	.006	(53.05)	.004	(8.68)	.003	(7.17)
Ln(Online)	Mean	.022	(14.51)	.031	(10.73)	.031	(10.85)
	SD	-	*NS*	-	*NS*		
Controls							
Ln(Competitive brand index)		.120	(5.20)	.187	(6.09)	.182	(5.61)
Sampling source			(5.14)		(11.01)		(9.36)
Source 1		[1]		[1]		[1]	
Source 2		.092		.161		.153	
Week dummies		[2]		[2]		[2]	
Log Likelihood		-1,206.96		-1,075.72		-1,075.25	
N (sample size)		930		930		930	

NS = not significant (p > .05)
[1] Set to zero for identification purpose
[2] Not reported (available upon request).

References

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