Documentary films can increase nationwide interest in plant-based food

Anna T. Thomas[†], Jessica Hope[‡], and Maya Mathur[‡]

[†]Department of Computer Science, Stanford University
[‡]Quantitative Sciences Unit, Department of Medicine, Stanford University
{thomasat,jehope,mmathur}@stanford.edu

Abstract

Plant-based diets can help mitigate climate change. We investigated longitudinal effects of popular media that encourage plant-based diets from diverse perspectives, including health, environment, and animal welfare. We systematically searched for the most popular such media, which were all films. In initial correlational analyses, Google search interest for the films explained the majority (73%) of variance in search interest for plant-based food, but was not associated with consumption of meat or of plant-based alternatives. In primary analyses using pre-registered causal inference models that controlled for confounding, we estimated that each 1-SD increase in search interest for the health-focused films *What the Health* (2017), *The Game Changers* (2018), and *You Are What You Eat* (2024) increased search interest in plant-based food by 43%, 11%, and 11% respectively in the following week. These results can inform communication approaches for ongoing efforts of governments and other organizations encouraging sustainable diets.

1 Introduction

Animal agriculture is a major contributor to greenhouse gas (GHG) emissions, deforestation, water pollution, biodiversity loss, and other forms of environmental destruction [1]. Computational modeling has indicated that a reduction in consumption of animal products has significant climate change mitigation potential. For example, in a scenario in which all global animal-based food (ABF) consumption is replaced with plant-based food (PBF) by 2050, land-based GHG emissions would reduce by two-thirds relative to the business-as-usual case [2]. Moreover, recent evidence has indicated that even if fossil fuel emissions were eliminated entirely, maintaining current food systems emissions would render it impossible to limit warming to 1.5°C [3]. Motivated by environmental as well as public health and animal welfare benefits, organizations such as the United Nations' Intergovernmental Panel on Climate Change, World Health Organization, and EAT-Lancet Commission have called for a shift toward a plant-based diet [2, 4, 5]. However, this shift has not yet been achieved; recent evidence in fact suggests that meat consumption is on the rise globally [6].

Persuasive media have influenced public attitudes and behaviors in several domains. For example, a systematic review of the smoking cessation literature found that mass media campaigns emphasizing negative health effects are effective in reducing smoking [7]. The effect appears to persist over the long term [8], and one study estimated that a California anti-smoking media campaign reduced cigarette sales by 232 million packs in 1990–1992 [9]. In the realm of sustainability and animal welfare, documentaries such as *An Inconvenient Truth* (2006) and *Blackfish* (2013) have been credited with sparking important changes, including greater awareness of climate change, increased purchase of carbon offsets, legislation for orca protection, and the end of SeaWorld's breeding of orcas [10, 11]. Going back further, the book *Silent Spring* (1962) catalyzed the environmental movement and major policy changes including the formation of the U.S. Environmental Protection Agency [12]. The success of these media raises questions about whether similar approaches could also be effective for raising awareness about the problems with current global levels of ABF consumption, and for motivating individuals to reduce their own consumption of ABF.

A number of general-audience media critiquing animal agriculture have been released in the last decade, including *Cowspiracy* (2015), *How Not to Die* (2015), *What the Health* (2017), *The Game Changers* (2018), and *You Are What You Eat* (2024). These media have encouraged reduction of animal products from health, environment, and animal welfare perspectives. In the popular press, anecdotal reports have suggested that these films have sparked behavioral change [13, 14, 15], such as the purported "*Game Changers* effect" [16]. A more rigorous analysis of the impact of these media could help to guide decisions of organizations and policymakers aiming to reduce ABF consumption. To our knowledge, the only existing study on the national-level impact of media advocating plant-based diets was a correlational analysis of search interest for documentaries and search interest in plant-based diets [17]. They found associations of *What the Health* and *The Game Changers* with searches for plant-based diets. However, that study was limited in scope (considering only those two documentaries from the outset rather than a broader search of media types and advocacy angles), and did not assess effects on actual ABF consumption or demand. Their study also did not aggregate searches reflective of behavioral interventions. Finally, the analyses were strictly correlational and did not attempt to estimate longitudinal causal effects using appropriate confounding control.

In this study, we examine the impact of popular media advocating a plant-based diet. We first conduct a systematic search of media advocating a plant-based diet, and analyze the six most popular releases from among 269 candidates. We use several outcome measures of nationwide interest in plant-based diets in the United States, as well as nationwide consumption of plant-based and animal-based foods. We measured nationwide interest using Google Trends, a publicly available tool that provides relative volume of search queries [18]. It has been used extensively for applications such as monitoring popularity of tobacco substitutes, forecasting unemployment claims, and understanding population-scale dietary interests [19, 20, 21, 22, 23]. The keywords we study on Google Trends are 'plant based', 'vegan', and 'vegetarian'. The Google Trends time series we use for each keyword measures the search volume of all queries including the keyword, e.g. 'plant based celebrities' or 'vegan recipes'. To assess effects on actual consumption, we also include as primary outcomes publicly available time series on milk and plant-based milk sales, plant-based meat market share, and meat demand, based on data from Information Resources, Inc. (IRI), Nielsen, and the U.S. Department of Agriculture (USDA) [24, 25, 26]. In addition to estimating crude associations of search interest in the films with the outcomes, we also used causal inference methods for time-varying data to provide more robust test for causation [27]. We validate our estimation approach via extensive empirical benchmarking using negative controls [28]. Although observational studies do not provide decisive evidence for causation, our national-level observational design affords strong external generalizability and captures population-level effects such as social network effects.

Additionally, as secondary outcomes, we divide each Google Trends outcome into 'Informative' and 'Behavior' categories, for a total of six additional Google Trends outcomes. The goal of the 'Informative' category is to capture searches in which people are learning more about the topic, without necessarily exploring a specific course of action. This category includes queries like 'is vegan healthier', 'what is plant based', and 'vegetarian celebrities', among many others. The goal of the 'Behavior' category is to capture searches in which people are exploring specific actions they can take to adopt a plant-based diet. This includes queries like 'easy vegetarian recipes' and 'best plant based restaurants near me'. We describe our method for constructing these categories in Section 4.4. We run our analyses on the time period of January 2004 (the start date of Google Trends) to May 2024. This time interval includes the COVID-19 pandemic. However, as none of our six selected films were released during the period between the onset of the pandemic and the World Health Organization's declaration of the end of the public health emergency (2020–2023), we do not make a special adjustment for the pandemic in our analyses.

2 Results

2.1 The media with greatest peak search volume are films

We conduct an extensive review of media (books, TV shows, podcasts, magazines, newspapers, and YouTube channels) advocating plant-based diets. Our search process is depicted in Figure 1 and described in Section 4. The 28 titles meeting our screening and eligibility criteria consisted of 21 films and 7 books. We summarize the relative popularity, as measured by peak search volume, and other descriptive statistics of these works in Figure 2. In particular, films and health focused media appeared to be disproportionately popular relative

to other media types and advocacy angles. To limit the number of statistical tests in our primary analyses, all subsequent analyses focus on a subset of these 28 titles that were at least 10% as popular as the most popular release, *Okja* (2017), yielding six films.

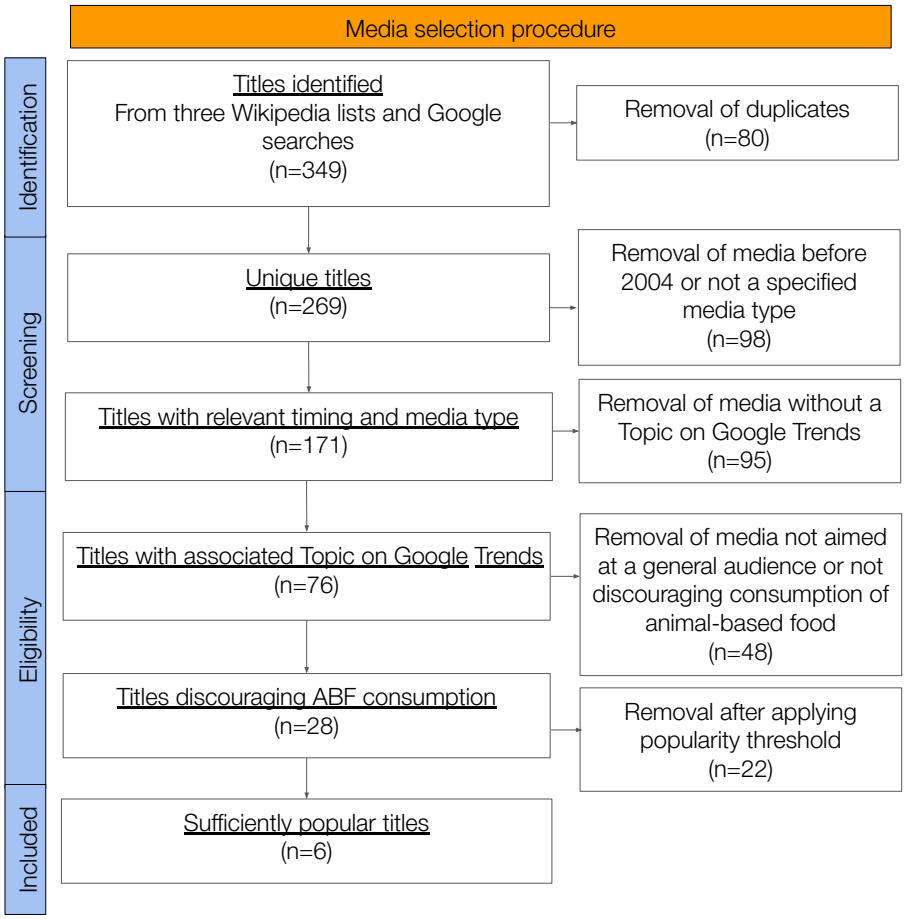

Figure 1: PRISMA diagram of systematic search for media.

2.2 Films explain the majority of variance for plant-based food search interest

Our monthly time series are shown in Figure 3, and weekly time series are shown in Supplementary Figure 7. We conduct analyses at both the month and week level for all outcomes except for the meat demand outcomes, which are only available in a monthly format. We first perform simple descriptive analyses of the selected films and pre-registered outcomes. When analyzing each film, a natural initial approach is to assess the crude (i.e., unadjusted) association between the search volume for the film and the outcomes of interest (Supplemental Tables 2 and 3). Here we find associations of the films with the search interest outcomes, but not with any of the measures of actual consumption or demand. We then estimate the improvement in predictive performance associated with including the films in simple predictive models of each outcome. The simple predictive models also included month dummy variables to capture seasonal effects. The results, shown in Table 1, indicate that including search interest in films substantially improves predictive performance (adjusted R^2) for the 'plant based' and 'vegan' Google Trends outcomes. Notably, for 'plant based', a model with the documentaries explains the majority of the variance in search volume (adjusted $R^2 = 0.64$). The predictive performance is even stronger when restricting to behavior-related searches (adjusted $R^2 = 0.77$). Of course, these analyses are simply estimating crude associations, and cannot be interpreted causally. To help assess causation, we next estimate longitudinal effects with control of several confounding variables [29].

2.3 *What the Health*, *The Game Changers*, and *You Are What You Eat* increase search interest for plant-based diets

Questions related to causal inference on time series arise in a number of domains, and our approach is informed by prior work in economics, political science, and epidemiology [30, 31]. We estimate both contemporaneous effects (i.e., the effect of increasing interest in the films on the outcomes in the same time period) and lagged effects (i.e., the effect of increasing interest in the films on the outcomes in the next time period). We estimate these effects using longitudinal causal models that rule out reverse causation and that control for a number of confounders [32], and we validate this approach via extensive empirical benchmarking using negative controls (Section 4.3.3). We summarize the significance of our findings with three evidentiary thresholds, indicated by asterisks. A single asterisk denotes multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test; a double asterisk denotes multiplicity-corrected significance when counting each individual primary and secondary test run in this paper; and a triple asterisk denotes that the test met both the conditions for a double asterisk in both original and sensitivity analyses. As shown in Supplementary Table 9, our estimation approaches passed nearly all of our stringent benchmarking tests (94% at the lowest evidentiary threshold, to 100% at the highest evidentiary threshold).

As shown in Figures 4 and 5, we find robust lagged and contemporaneous effects of *What the Health*, *The Game Changers*, and *You Are What You Eat* on the Google Trends outcomes, specifically searches for plant-based food. When converting the standardized regression coefficients shown in Figure 4 back to original units and dividing by the pre-release baseline (over a one year period), we find that a 1-SD increase in searches for *What the Health*, *The Game Changers*, and *You Are What You Eat* increased search interest for terms including 'plant based' by 24%, 9%, and 8% respectively in the following week. We conduct sensitivity analyses to assess the robustness of our findings to possible violations of the assumptions required to estimate causal effects, described in further detail in Section 4. Finally, we also conduct interrupted time series (ITS) analyses, shown in Supplementary Figures 22-25. The ITS analysis treats the Netflix release date of each film as the exposure of interest rather than Google search interest in the film. As such, this approach relies on different assumptions to estimate causal effects, as described in Section 4.3. At both a monthly and weekly resolution, the ITS results corroborate the effects of *What the Health* and *You Are What You Eat* on 'vegan' and 'plant based' searches. At a monthly resolution, the ITS results also corroborate the effects of *The Game Changers* on 'plant based' searches.

2.4 Effects persist when restricting to behavior-related searches

The 'plant based' and 'vegan' searches could reflect exploration without any particular behavioral intentions. To address this, we conduct pre-registered secondary analyses in which we divide the 'plant based', 'vegan', and 'vegetarian' categories into 'Informative' and 'Behavior' sub-categories, described in more detail in Section 4.4. The 'Behavior' category includes searches such as 'vegan near me', 'plant based restaurants', 'vegetarian recipes', etc., and the Informative sub-category includes the remainder of the original categories. As shown in Figures 4 and 5, the magnitude of the effects on the 'plant based' Behavior sub-category is similar to or stronger than the effects in the general 'plant based' category. We find that a 1-SD increase in searches for *What the Health*, *The Game Changers*, and *You Are What You Eat* increased search interest for the 'plant based' Behavior sub-category by 43%, 11%, and 11% in the following week.

2.5 Films did not affect nationwide consumption or demand for animal-based food or for plant-based alternatives

While we see robust effects on Google search interest for plant-based food, we do not observe associations with measures of food consumption or demand, as shown in Supplementary Tables 2 and 3. Our causal models similarly estimated no meaningful effects on these measures, with the exception of a lagged effect of *You Are What You Eat* on decreasing beef demand in the sensitivity analysis where the meat demand outcomes are shifted backward by one month (Supplementary Figure 13). However, this result only met our lowest evidentiary threshold, as defined in Section 2.3.

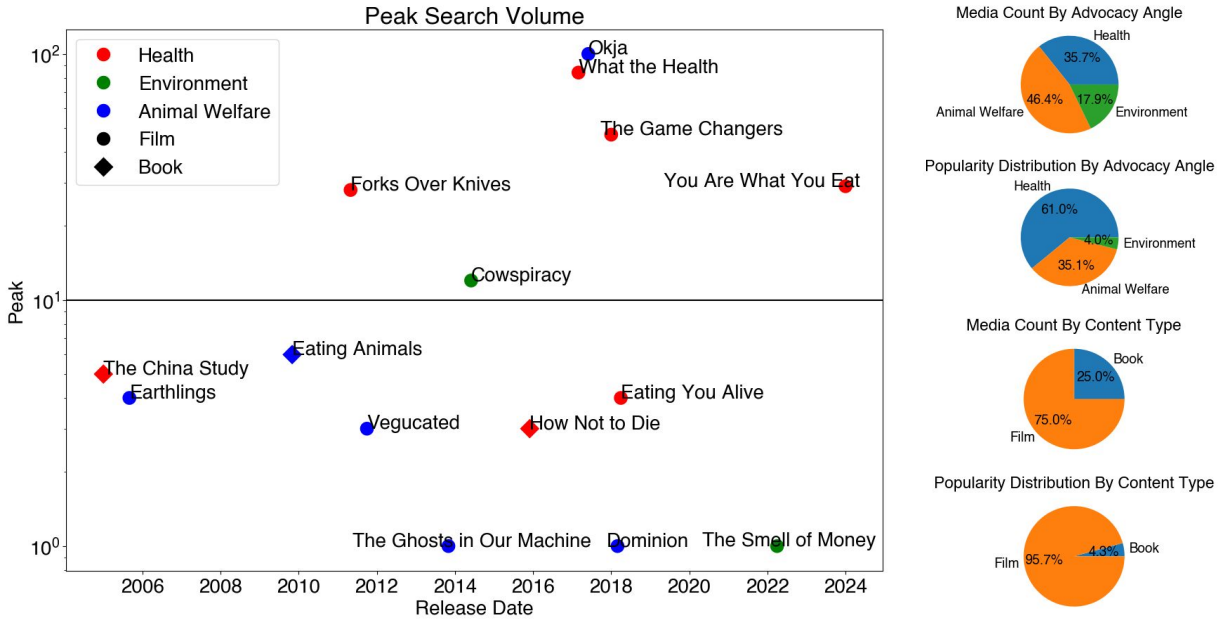

Figure 2: Popularity, media type, and primary persuasive angle in media meeting our filtering criteria. Search volume before the release date of each title was not considered. Media with zero (rounded) popularity relative to *Okja* were omitted from the scatterplot. Units are relative to *Okja*'s peak search volume. While health focused media comprise 35.7% of the total number of media meeting our criteria (N=28), they account for 61.0% of the peak search volume of these media. Additionally, while films comprise 75.0% of the media, they constitute 95.7% of the peak search volume. The horizontal line indicates the popularity threshold for inclusion in the primary analyses (10% of the peak popularity of *Okja*).

Outcome	Seasonal effects only	Seasonal effects and films	Films only
Searches: 'Plant based'	0.14	0.64	0.56
Searches: 'Vegan'	0.14	0.46	0.34
Searches: 'Vegetarian'	0.53	0.62	0.15
Milk sales [24]	0.45	0.51	0.00
Plant-based milk sales [24]	0.62	0.70	0.08
Plant-based meat sales [25]	0.11	0.34	0.11
Beef demand [26]	0.39	0.41	0.02
Chicken demand [26]	0.34	0.34	0.01
Pork demand [26]	0.44	0.44	0.02
Searches: 'Plant based', Informative	0.14	0.60	0.52
Searches: 'Vegan', Informative	0.11	0.38	0.28
Searches: 'Vegetarian', Informative	0.40	0.48	0.12
Searches: 'Plant based', Behavior	0.13	0.77	0.73
Searches: 'Vegan', Behavior	0.28	0.62	0.42
Searches: 'Vegetarian', Behavior	0.53	0.59	0.12

Table 1: The adjusted R^2 of models regressing each outcome on the films and seasonal effects (dummy variables for months), compared to regressing on seasonal effects alone. All analyses use month-level time series.

3 Discussion

Demand-side ABF reduction interventions have considerable potential to help mitigate climate change [2]. Although media campaigns have been effective in similar settings such as reducing tobacco use [7, 8, 9], existing research has not investigated the national-level impact of media on public interest in and consumption

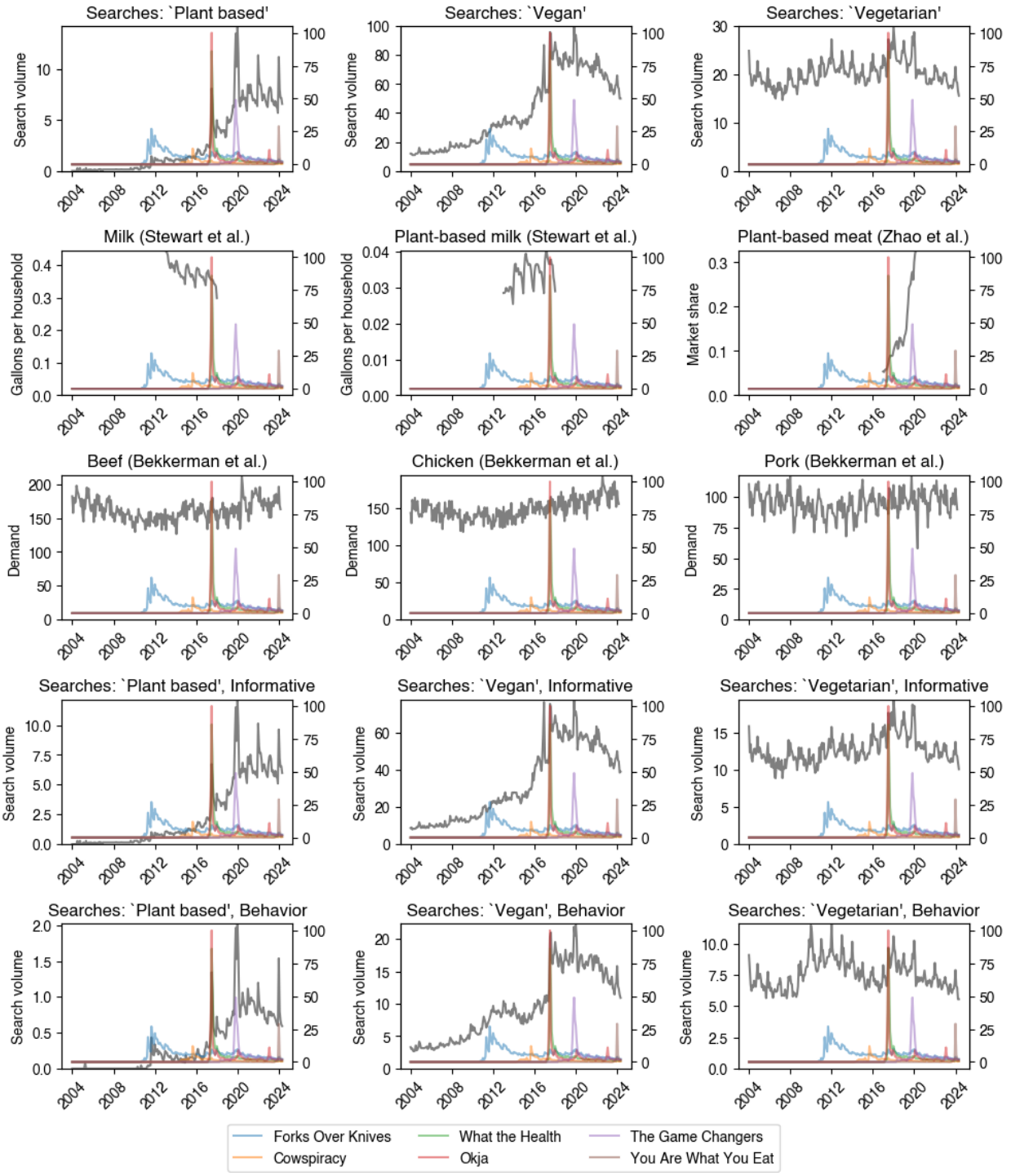

Figure 3: All primary and secondary outcomes: time series from Google Trends and various measures of consumption or demand of plant-based and animal-based food. In all cases the right y-axis is normalized search volume, as a fraction of searches for the Topic *Okja*, the most popular film. The y-axis for the first three plots is normalized search volume as a fraction of searches for the Term 'vegan', the most popular Trends outcome. The y-axis for Zhao et al. is market share within fresh meats. All time series are on a monthly basis.

of plant-based diets. Our descriptive analysis shows that search interest in six popular films explains the majority of variance in search interest in plant-based diets. Based on longitudinal causal inference models, we

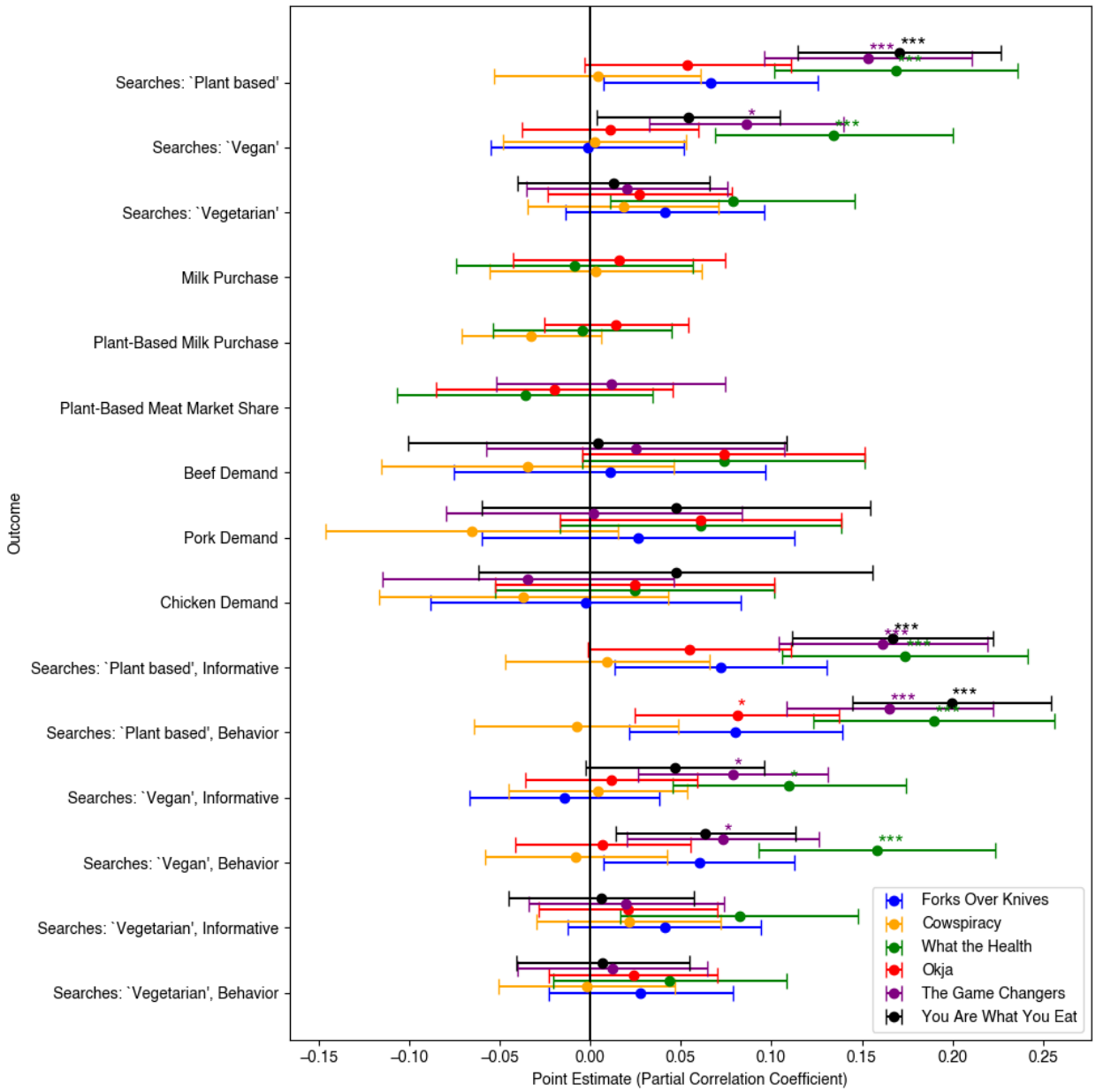

Figure 4: Lagged effects of the films on all outcomes, estimated using the model in Eq. (1). Error bars depict 95% confidence intervals. All time series are on a weekly basis (which allows for distinguishing *What the Health* and *Okja*, both released on Netflix in June 2017) except for the meat demand outcomes, which are only available in a monthly format. A single asterisk ($*$) denotes multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test; a double asterisk ($**$) denotes multiplicity-corrected significance when counting each individual primary and secondary test run in this paper; and a triple asterisk ($***$) denotes that the test met both the conditions for a double asterisk in both original and sensitivity analyses. Results for all films summed are in Supplementary Tables 18 and 19.

find that a 1-SD increase in weekly search interest for *What the Health*, *The Game Changers*, and *You Are What You Eat* increased search interest for plant-based food by 24%, 9%, and 8% respectively in the following week. These results remain statistically significant after isolating to searches that indicate behavior change intentions (e.g. "plant based near me"), as well as several sensitivity analyses and a stringent Bonferroni correction using all primary and secondary tests run in this paper.

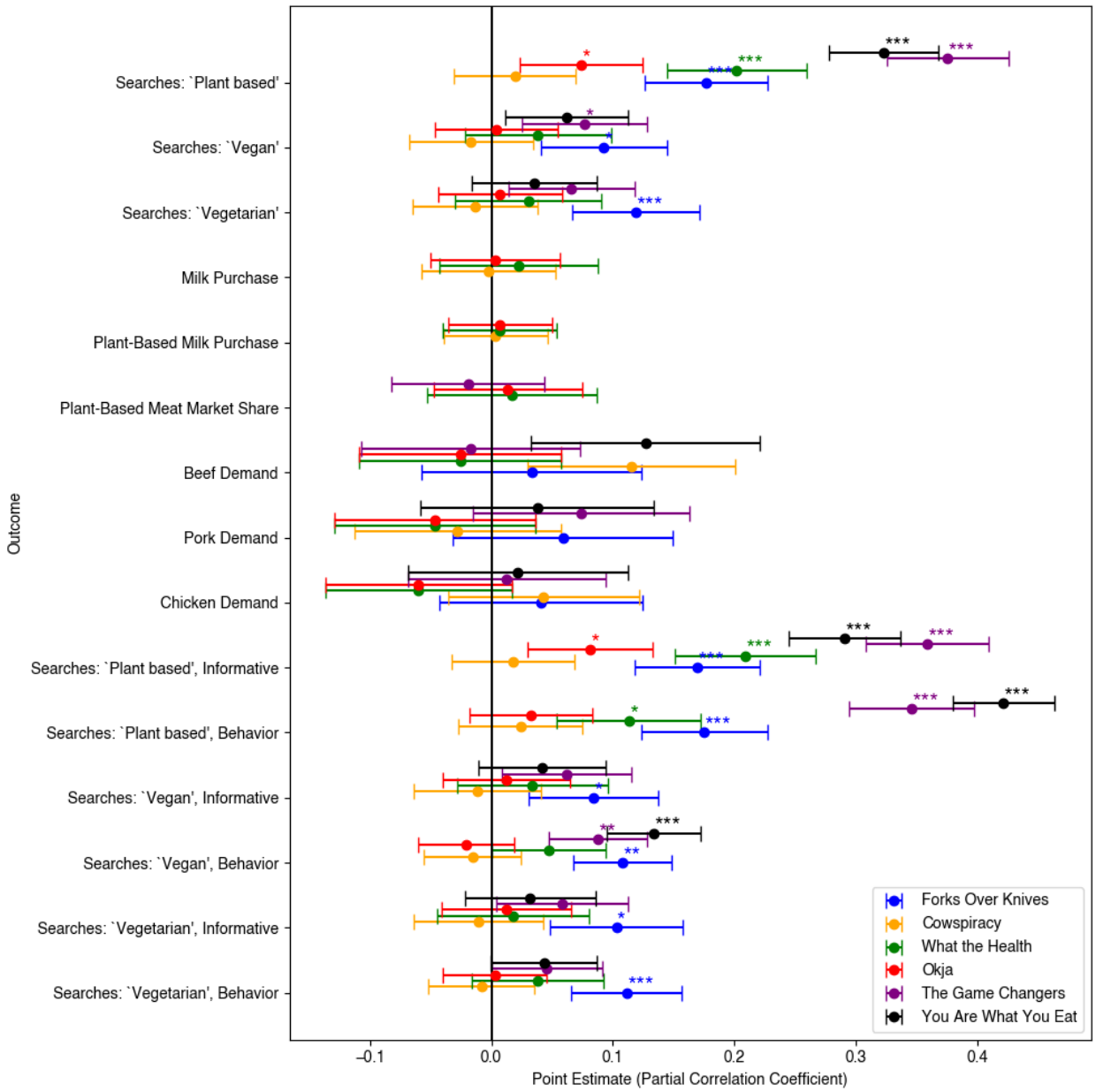

Figure 5: Contemporaneous effects of the films on all outcomes, estimated using the model in Eq. (2). Error bars depict 95% confidence intervals. All outcomes are on a weekly basis (which allows for distinguishing *What the Health* and *Okja*, both released on Netflix in June 2017) except for the meat demand outcomes, which are only available in a monthly format. A single asterisk ($*$) denotes multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test; a double asterisk ($**$) denotes multiplicity-corrected significance when counting each individual primary and secondary test run in this paper; and a triple asterisk ($***$) denotes that the test met both the conditions for a double asterisk in both original and sensitivity analyses. Results for all films summed are in Supplementary Tables 18 and 19.

Our study's national-level, observational design is both a strength and a limitation. Although randomized studies typically provide the strongest evidence for causation, such designs can sacrifice external validity. For example, our observational design captures the fact that only a small portion of the population will watch any given film, and effects may be larger for this self-selected group than for the general population. Additionally, our design captures population-level effects in which people's interests or dietary habits could

influence those of their social contacts [33, 34]. In contrast, an individually randomized design typically would capture individual-level effects of being assigned to watch a given film. Observational studies with appropriate longitudinal analyses can provide suggestive, albeit not decisive, evidence for causation [29]. To this end, we used lagged analyses to rule out reverse causation, and we controlled for likely confounding variables. However, if there are important confounders that we did not measure, these could introduce bias. Our sensitivity analyses did suggest that our findings are robust to reasonable levels of unmeasured confounding. To complement the strengths and limitations of our analysis, we encourage future work to assess the films' effects in randomized designs, ideally in food service settings where individual consumption can be measured [35]. Our work suggests that *What the Health*, *The Game Changers*, and *You Are What You Eat* would be particularly valuable to include in future experiments.

Another limitation of our work is that our analyses of the meat demand outcomes captured relatively short term effects in the subsequent month. In fact, it is not entirely clear how long it would take for a change in consumer retail behavior to impact the meat demand outcome measures, which are based on upstream supply chain measures as opposed to the retail-level sales measures used by our other consumption measures [26]. We address this by incorporating three other measures of retail-level consumer behavior and also by performing analyses with different lags, shown in the Supplement. Those results corroborate the primary results. Next, our primary model uses a linearity assumption, and nonlinear effects may not be detected. Finally, our intervention variable is search interest for the films rather than number of views. Again, the ITS analysis, which treats the film's release as the intervention rather than search interest, corroborates our findings. Additionally, due to the national-level nature of this study, we were unable to identify the characteristics of individuals who did change their behavior.

In recent years a number of governments and other organizations have taken initial steps to encourage shifting toward plant-based diets. For example, in 2023 New York City launched an "Eat A Whole Lot More Plants" campaign involving advertisements on television, radios, subways, and other channels, and also made plant-based meals the default in its hospital system [36, 37]. Los Angeles County also passed a motion in 2024 to encourage plant-based food purchasing [38]. However, more extensive policy change has been hampered in part by concerns about potential backlash [39], underscoring the importance of evidence-based approaches for communication with the general public about policy action. Backlash has already occurred in response to the EAT-Lancet Commission's recommendations for a "planetary health diet", e.g. the "#yes2meat" hashtag that became popular on Twitter [40], prompting the question of what kind of messaging is most effective in shifting attitudes and increasing openness to plant-based diets, the first step of behavior change [41]. Given the diverse harms of industrial animal agriculture, a number of possible messaging approaches are consistent with the available evidence, namely emphasizing benefits for individual health, the environment, and animal welfare. Our results suggest that the messages contained in *What the Health*, *The Game Changers*, and *You Are What You Eat* were particularly effective in increasing searches indicative of intentions to shift toward a plant-based diet. *What the Health* and *You Are What You Eat* emphasized the health benefits of a plant-based diet. *The Game Changers* emphasized that it is possible to attain high levels of strength and athletic performance on a plant-based diet, addressing a common concern [42], particularly given the association of meat with masculinity [43]. We note these films have received criticism for oversimplified claims, though the bulk of their arguments are consistent with the available literature [4, 6, 44, 45, 46]. Our analysis suggests that future media campaigns advocating plant-based diets may benefit from including similar messages and narrative techniques as these three films.

Despite the films' robust effects on search interest for plant-based diets, we do not find associations of the films with measures of consumption and demand for plant-based and animal-based food. A number of explanations may be at work. As noted, our primary estimation approach captures relatively short-term, linear effects, and our procedure may not be able to detect small, nonlinear, or delayed changes in aggregate measures of consumption or demand. It may also be that there was no aggregate effect on these measures. This would be consistent with previous individual-level randomized experiments indicating that a theory-informed documentary can substantially increase intentions to change behavior, but does not have an impact on actual behavior [47]. Additionally, our national-level study includes regions where plant-based options are not widely available, and it is possible that effects would be detected if restricted to regions where plant-based options are available. More generally, plant-based substitutes are not yet at parity with animal-based products in terms of price, taste, and convenience (PTC). It is possible that behavior change will only occur if there is both effective messaging and PTC-equivalent or superior alternative food [48]. Recent evidence suggests

that PTC-equivalent alternative food alone may not be sufficient for a widespread shift in consumption [49], underscoring the importance of educational interventions in parallel with technological development.

Overall, our results suggest that several popular health-focused films increased nationwide interest in plant-based diets, including search queries that seem to suggest behavioral intentions (e.g., "plant-based recipes"). Given that we did not observe effects on consumption of animal-based food or plant-based alternatives, we encourage future work to investigate the source of this discrepancy. Future work could also investigate the mediators of the relationship between intended and actual behavior in the context of plant-based diets – for example, the impact of the surrounding environment, social support, and alternative food availability.

4 Methods

All methods for data collection and analysis were preregistered in detail https://osf.io/k95w2/. The only deviation from our pre-registration is the omission of Neuhofer and Lusk's data on market share of plant-based meat as an outcome [50]; our pre-registered estimation approach did not produce standard errors on this data due to low sample size.

4.1 Data

Google Trends can be accessed at trends.google.com. This tool provides access to both Topics, which group terms sharing the same concept in any language, and Terms, which check for matches for a specific word or phrase in the chosen language [51]. Time series for most Google Trends analyses were downloaded in December 2023 and January 2024, and additional time series for the analyses including *You Are What You Eat* were downloaded in June 2024. Time series were digitized from Figure 2 in [24] and Figure 1 in [25] using webPlotDigitizer [52] in January 2024. The Kansas State University meat demand indices were downloaded on June 21, 2024 via the AgManager website [53]. The 'Choice Retail Beef', 'All-Fresh Retail Beef', 'Retail Pork', and 'Retail Chicken' columns in Historical Domestic Demand Indices table were used. 'Choice Retail Beef' and 'All-Fresh Retail Beef' were summed to produce a single beef demand outcome. The time interval of January 2004 to May 2024 (inclusive) was used. Additionally, as a precision covariate (i.e., a variable whose control helps reduce variance in the outcome), as described in Section 4.3, we use the U.S. Bureau of Economic Analysis's estimates of real disposable per capita income [54]. For the intervention time series, Topics were used, with the exception of *You Are What You Eat*. This is because search volume for the Term "you are what you eat" is much more closely aligned with the Netflix release date than the Topic for the film. The Term peaks during the week of December 31, 2023 to January 6, 2024, as expected given the January 1, 2024 release date, whereas the Topic shows zero search volume until the week of January 14 - 20, 2024. We verified that for the other selected films, the correlation between the Term and the Topic is at least 0.97. For the outcome time series, in order to divide search interest into 'Informative' and 'Behavior' categories as described in Section 4.4, Terms were used.

4.2 Media search procedure

We started with three lists from Wikipedia enumerating films, books, TV shows, podcasts, magazines, newspapers, and YouTube channels related to a plant-based diet [55, 56, 57], and supplemented these lists with Google searches for additional media. Specifically, queries took the form of 'popular' × ['plant based', 'plant-based', 'vegan', 'vegetarian'] × ['books', 'movies', 'films', 'documentaries', 'TV shows', 'podcasts', 'newspapers', 'magazines', 'YouTube channels']. For each search, the first five results were considered. Our initial list of candidate media included 269 distinct works. We then performed initial filtering based on timing (first released after January 2004, due to the start of Google Trends) and media type. We performed additional filtering based on data availability (existing as a Topic on Google Trends, since Google considers Topics to be more reliable [58]) and content (advocating a plant-based or vegetarian diet or otherwise documented, i.e. via anecdotal reports in the media, to persuade a general audience to reduce ABF consumption). Media that encouraged reducing only a specific kind of ABF consumption were excluded. For example, *Seaspiracy* (2021) only encouraged reducing fish consumption, so was excluded.

4.3 Statistical analyses

We begin with descriptive analyses summarizing the associations between search interest for the films and our outcomes. These were conducted via simple (univariate) linear regressions, fit via generalized least squares. We then consider assumptions and procedures under which we can perform causal inference. We use an autoregressive distributed lag model based on assumptions of linearity and a Markov property (that direct causal effects only occur in the same or next time period, although indirect causal effects can occur over any time period). Our causal assumptions are shown in graphical form in Figure 6. A key challenge to causal inference in this setting is the possibility of unmeasured confounders, meaning unmeasured common causes of search interest in the films and our outcomes. For example, a similarly timed event such as the release of another film, a public figure prominently shifting their diet, a PETA investigation in the press, etc. could be a confounder as it may be responsible both for an increase in interest in the films and changes in the outcomes. Alternatively, month or season could be a confounder; for example, people might search more for plant-based documentaries and for our outcomes around Earth Day or the New Year. Additionally, controlling for variables that affect the outcome (precision covariates) can help improve statistical precision [59]. Finally, model misspecification may also be an issue. We address these challenges in three ways: 1) controlling for potential confounders and precision covariates (which we collectively refer to as time-varying covariates) in our regressions, 2) conducting sensitivity analyses to model misspecification and unmeasured confounding, and 3) empirically benchmarking our procedure using time series where we do not expect any causal relationship (i.e., negative controls), to assess our false positive rate.

4.3.1 Time-varying covariates and regressions

We fit the following regression models in order to control for confounding under the assumptions in Figure 6. The variables we control for are as follows:

- Seasonal trends, via including a Month categorical variable.
- Search interest in the most common motivations for a plant-based diet: health, environment, and animal welfare, as measured by the Google Trends topics for Health, Sustainability, Climate Change, Climate, and Animal Welfare.
- Per capita real disposable income, which is a known predictor of meat demand [60]. This is only included for the consumption and demand outcomes.
- Search interest for the Term "food", to address possible changes in general levels of search interest in food. This is only included for the Google Trends outcomes.
- Search interest in the other films. This is only included for models where the intervention variable is a single film.

We include propensity scores in our models to confer a double robustness property [30, 32]. Specifically, our estimates will be statistically consistent if either the outcome model or the propensity model is correctly specified, even if the other model is misspecified. The specific regressions we run are:

$$Y_t \sim X_{t-1} + \mathrm{PS}_{t-1} + \mathbf{L}_{t-1} + X_{t-2} + Y_{t-2} + \mathbf{L}_{t-2} \tag{1}$$

for the lagged effect and

$$Y_t \sim X_t + \mathrm{PS}_t + \mathbf{L}_t + X_{t-1} + Y_{t-1} + \mathbf{L}_{t-1} \tag{2}$$

for the contemporaneous effect. X_t is search interest, Y_t is the outcome, and $\mathbf{L}_t$ is the set of time-varying covariates. Note that the lagged model eliminates the possibility of reverse causation. The lagged effect is estimated as the coefficient on X_{t-1} in (1), and the contemporaneous effect is estimated as the coefficient on X_t in (2).

The propensity score PS_t is estimated from the following regression:

$$X_t \sim X_{t-1} + Y_{t-1} + \mathbf{L}_{t-1} + \mathbf{L}_t \tag{3}$$

Models are fit via generalized least squares. Bonferroni correction is applied, with the denominator being the number of interventions tested: six for monthly, seven for weekly (due to also testing all documentaries summed as an intervention). Findings which remained significant after this correction are distinguished with an asterisk ($*$). We additionally distinguish findings ($**$) which remained significant when correcting for all primary and secondary tests run in this paper (522), and those which also were robust to sensitivity analyses described in Section 4.3.2. The latter are distinguished with $***$.

4.3.2 Sensitivity analyses

Three separate sensitivity analyses used in determining the $***$ distinction were as follows:

- Removing the propensity score from the models
- Removing $\mathbf{L}_{t-1}$ from (1). Our primary model for the lagged effect controls for L_{t-1} measured at the same time as X_{t-1} because we speculate there may be short-term confounding effects that may not be fully captured by controlling for L_{t-2} (which is one month prior in the analyses run at a monthly resolution). This primary approach is conservative because we expect any mediation through $\mathbf{L}_{t-1}$ to be in the same direction as the direct effect not through $\mathbf{L}_{t-1}$, such that the estimated total effect would be underestimated [61]. The sensitivity analysis removing L_{t-1} avoids the potential issue of controlling for mediators, though might result in residual confounding.
- Removing $\mathbf{L}_t$ from (2). The rationale is the same as above.

Additionally, we use the E-value method to quantify sensitivity to unmeasured confounding [62, 63]. The E-value quantifies the minimum strength of association, on the risk-ratio scale, that an unmeasured confounder would need to have with both the intervention and outcome in order to nullify the intervention-outcome association. As reported in Supplementary Tables 10 – **??**, the results typically indicated relatively good robustness to unmeasured confounding.

Finally, interrupted time series (ITS) analyses were conducted as a sensitivity analysis to the use of Google Trends search volume as the intervention variable. In the ITS analyses, a binary intervention variable based on the Netflix released date is used. Specifically, the following regression was run:

$$Y_t \sim I_t + I_t * \text{Time} + \mathbf{L}_t \tag{4}$$

where $\mathbf{L}_t$ is as defined in Section 4.3.1, and includes Time and Month terms. We refer to the coefficient on I_t as the intercept, and the coefficient on $I_t * \text{Time}$ as the slope. A post-intervention time period of five months is used, as only five months are available after the release of *You Are What You Eat*. As a sensitivity analysis to ITS, we remove the $\mathbf{L}_t$ terms.

The ITS design relies on the assumption that both the pre- and post-intervention time series are described by a linear model with an intercept and slope term, and that the shift between the pre- and post-intervention models occurs exactly at the Netflix release date. In contrast, the primary models use Google search volume for the films, naturally taking into account pre-release advertising and later resurgences in popularity.

4.3.3 Empirical benchmarking

To benchmark the false-positive rate of our estimation approach, we analyzed several time series datasets with similar properties, but in which we expected there to be no causal effect. To do so, we use popular music releases, namely the albums of Billboard's top two artists of the 2010s, Drake and Taylor Swift, and related search queries. The search queries associated with each artist are the artist's name and suffixes 'songs', 'lyrics', 'tour', and 'album'. Negative controls are generated by swapping X_t or Y_t between the films and albums, since these should be unrelated [28]. Time series are shown in Supplementary Figure 12, and results are shown in Supplementary Table 9.

4.3.4 Implementation details

We estimated effects using generalized least squares with autoregressive errors (via Python's statsmodels package), which accounts for heteroskedasticity and autocorrelation in the time series outcome data. The

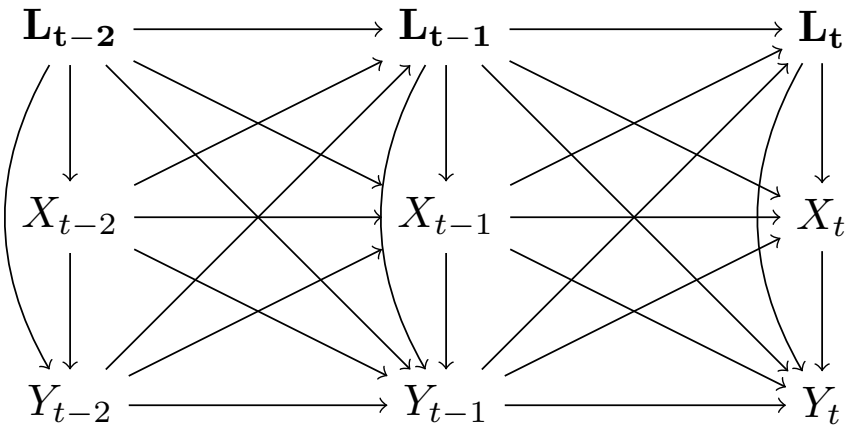

Figure 6: A set of assumptions for the causal relationships among search interest X_t, outcome Y_t, and time-varying confounders $\mathbf{L_t}$. We also test robustness to violations of these assumptions.

order of the autoregressive covariance is set to 1, and a maximum number of 50 iterations is passed as a parameter to the fitting function. We perform first order differencing for all analyses except for the interrupted time series analyses. For these analyses, we instead control for both month dummy variables and continuous time, as in [64]. Standardization (to mean zero and standard deviation of one) was performed for all variables in all analyses.

4.4 Division of search interest into 'Informative' and 'Behavior' categories

The goal of the Informative category is to capture searches in which people are learning more about the topic, without necessarily exploring a specific course of action. This includes queries like 'is vegan healthier', 'what is plant based', and 'vegetarian celebrities'. The goal of the Behavior category is to capture searches in which people are exploring specific actions they can take to adopt a plant-based diet. This includes queries like 'easy vegetarian recipes' and 'best plant based restaurants near me'.

For veganism, Informative is defined by subtracting the vegan Behavior category from the 'vegan' Term's time series, and so on for vegetarianism and plant-based. For these analyses, we do not use the hyphenated term 'plant-based' due to low search volume, i.e. less than 1% of the search volume for 'vegan' (Google does not report exact volume for searches with volume less than 1%). The subtraction is performed because the Google Trends search volume will return all searches that include the term, so otherwise Behavior is a subset of Informative.

To define the Behavior category, we need to choose a set of behavior terms to search for alongside 'vegan', 'plant based', and 'vegetarian'. We do so by looking at the 'Related queries' for each of the 'Veganism', 'Vegetarianism', 'Plant-based diet', 'Vegan nutrition', and 'Vegetarian cuisine' Topics. These were selected by starting with the obvious Topics of 'Veganism', 'Vegetarianism', and 'Plant-based', and adding in the 'Related topics' for each that are relevant. After selecting behavior-related terms from these lists for each Topic, we arrive at the six behavior terms ['recipes', 'recipe', 'restaurants', 'restaurant', 'near me', 'diet plan']. 'diet plans' was not on the lists as a popular query, and also had very low search volume ($< 1\%$ or 0% related to 'vegan', 'plant based', and 'vegetarian'), so was not included. For each of 'vegan', 'vegetarian', and 'plant based', the search volume for the term plus the two suffixes 'restaurant near me' and 'restaurants near me' (e.g. 'vegan restaurant near me' and 'vegan restaurants near me') is subtracted from the Behavior category, to reduce double counting. The vegan Behavior category is defined by all possible combinations of 'vegan' and the six behavior terms listed above, and similarly for the plant-based and vegetarian Behavior categories.

For Informative outcomes, we add the difference of the Terms 'food' and 'food near me' to the set of time-varying covariates $\mathbf{L}_t$ defined in Section 4.3.1. For Intended Behavior outcomes, we sum the 'bare' terms corresponding to the six behavior terms, replacing 'near me' with 'food near me', and add this sum to $\mathbf{L}_t$.

Ethics approval. Not applicable.

Data availability. All data and code required to reproduce the results are publicly available and documented at https://github.com/hsflabstanford/media-impacts.

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5 Supplementary information

5.1 Time series

Figure 7 displays the twelve outcomes available at a weekly resolution.

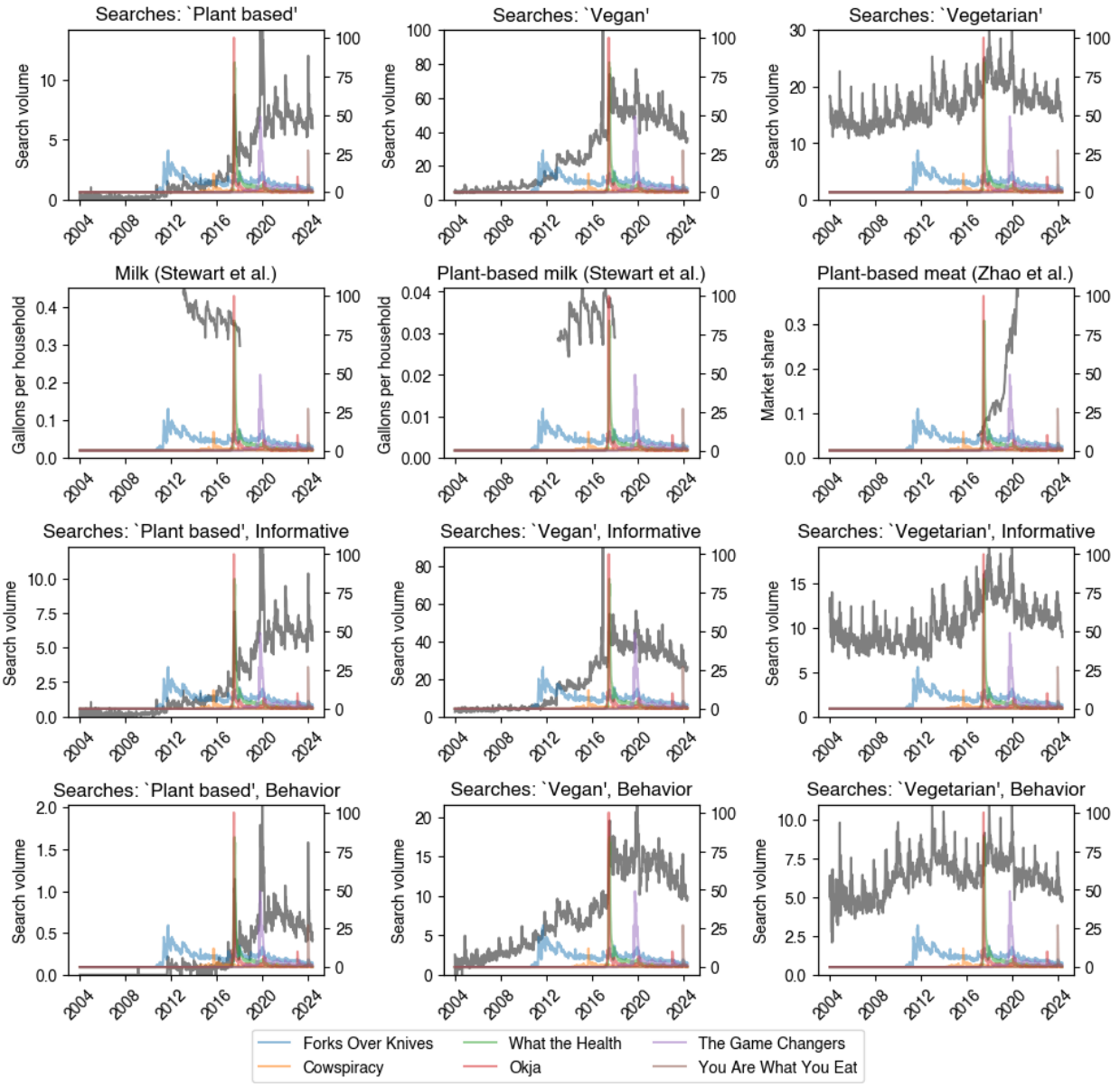

Figure 7: All primary and secondary outcomes available on a weekly basis: time series from Google Trends and various measures of consumption or demand of plant-based and animal-based food. In all cases the right y-axis is normalized search volume, as a fraction of searches for the Topic *Okja*, the most popular film. The y-axis for the first three plots is normalized search volume as a fraction of searches for the Term 'vegan', the most popular Trends outcome. The y-axis for Zhao et al. is market share within fresh meats.

5.2 Further analyses

5.2.1 Associations

Results for association analyses, as described in Section 4.3, are shown in Figures 8 and 9, and Tables 2 and 3. The adjusted R^2 results on a weekly basis are shown in Table 4.

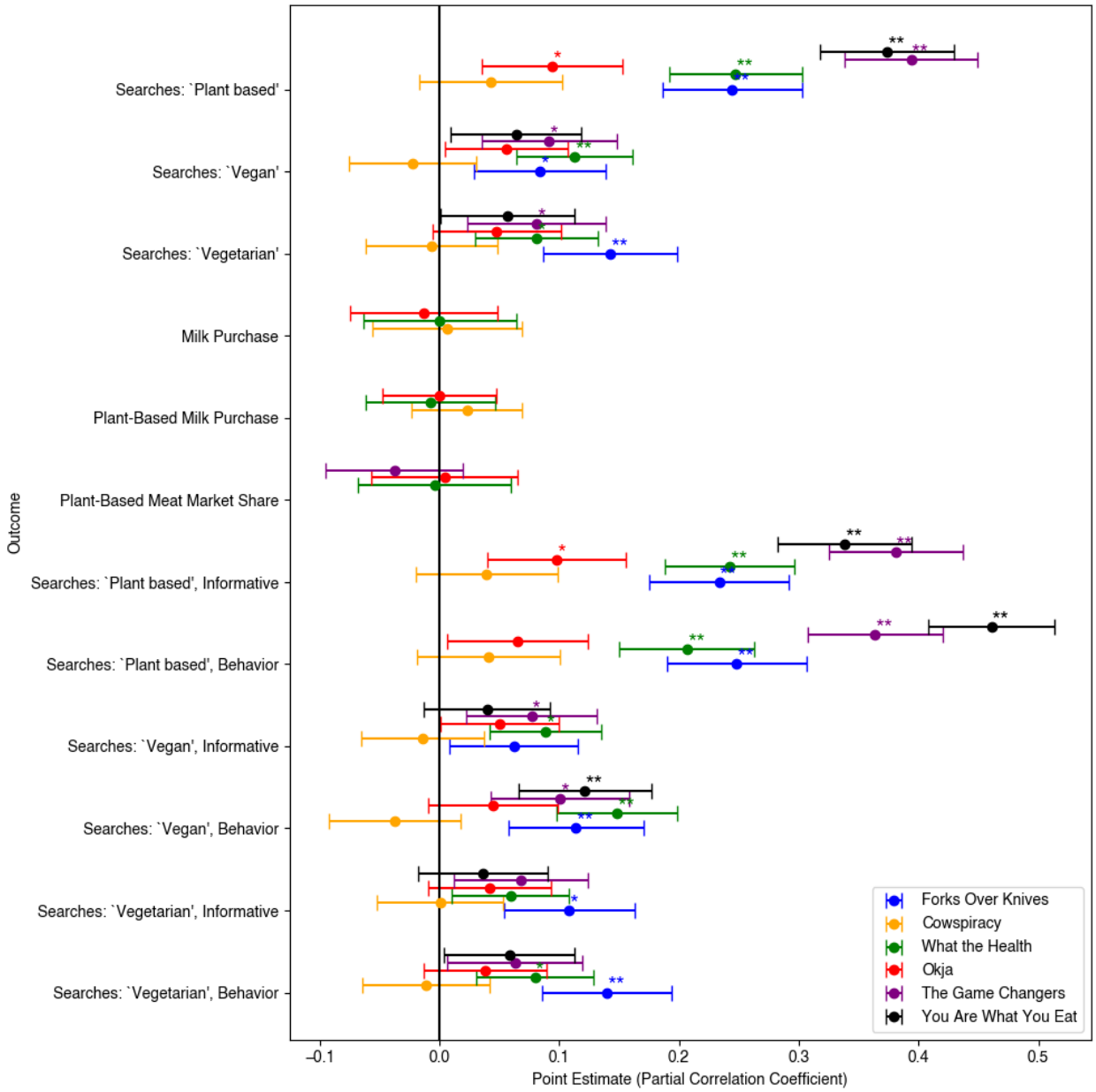

Figure 8: Associations of the films with all outcomes available on a weekly basis, estimated using simple univariate regression fit via generalized least squares. A single asterisk ($*$) denotes multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test; a double asterisk ($**$) denotes multiplicity-corrected significance when counting each individual primary and secondary test run in this paper. The $***$ designation is not applicable here since we did not conduct sensitivity analyses for the association model.

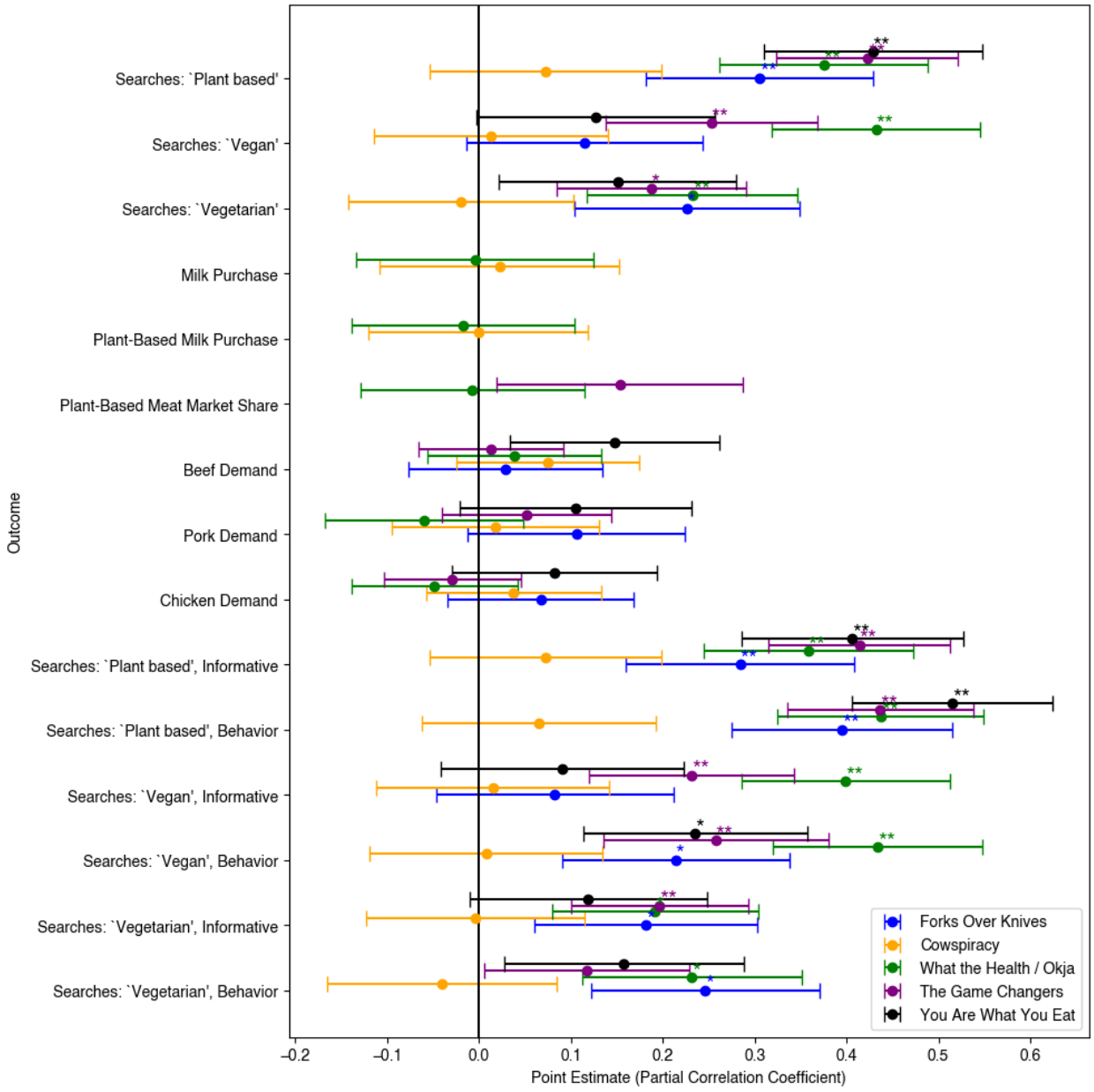

Figure 9: Associations of the films with all outcomes, estimated using simple univariate regression fit via generalized least squares. All outcomes are on a monthly basis. Definitions of the asterisks are in Section 2.3. A single asterisk ($*$) denotes multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test; a double asterisk ($**$) denotes multiplicity-corrected significance when counting each individual primary and secondary test run in this paper. The $***$ designation is not applicable here since we did not conduct sensitivity analyses for the association model.

5.2.2 Autoregressive distributed lag model

Lagged Figure 10 and Table 6 depict the results for the lagged model at a monthly resolution. Table 5 depicts the results for the lagged model at a weekly resolution, containing the same data as Figure 4.

Contemporaneous Figure 11 and Table 7 depict the results for the contemporaneous model at a monthly resolution. Table 8 depicts the results for the lagged model at a weekly resolution, containing the same data

Outcome	FOK	Cowspiracy	WTH	Okja	TGC	YAWYE
Searches: 'Plant based'	**0.24** (5.36e-16)	0.04 (0.16)	**0.25** (1.05e-17)	**0.09** (1.75e-03)	**0.39** (2.99e-40)	**0.37** (6.16e-37)
Searches: 'Vegan'	**0.08** (2.79e-03)	-0.02 (0.41)	**0.11** (5.71e-06)	0.06 (3.38e-02)	**0.09** (1.45e-03)	0.06 (2.11e-02)
Searches: 'Vegetarian'	**0.14** (6.88e-07)	-0.01 (0.82)	**0.08** (2.11e-03)	0.05 (8.02e-02)	**0.08** (6.18e-03)	0.06 (4.80e-02)
Milk sales		0.01 (0.83)	0.00 (0.99)	-0.01 (0.68)		
Plant-based milk sales		0.02 (0.33)	-0.01 (0.79)	-0.00 (1.00)		
Plant-based meat sales			-0.00 (0.90)	0.00 (0.88)	-0.04 (0.20)	
Searches: 'Vegan', Informative	0.06 (2.25e-02)	-0.01 (0.59)	**0.09** (2.21e-04)	0.05 (4.71e-02)	**0.08** (5.93e-03)	0.04 (0.14)
Searches: 'Vegetarian', Informative	**0.11** (9.83e-05)	0.00 (0.98)	0.06 (1.75e-02)	0.04 (0.11)	0.07 (1.70e-02)	0.04 (0.19)
Searches: 'Plant based', Informative	**0.23** (7.14e-15)	0.04 (0.19)	**0.24** (8.74e-18)	**0.10** (9.76e-04)	**0.38** (7.06e-38)	**0.34** (9.90e-31)
Searches: 'Vegan', Behavior	**0.11** (7.45e-05)	-0.04 (0.18)	**0.15** (1.01e-08)	0.04 (0.10)	**0.10** (6.36e-04)	**0.12** (2.13e-05)
Searches: 'Vegetarian', Behavior	**0.14** (5.18e-07)	-0.01 (0.68)	**0.08** (1.53e-03)	0.04 (0.15)	0.06 (2.83e-02)	0.06 (3.58e-02)
Searches: 'Plant based', Behavior	**0.25** (1.93e-16)	0.04 (0.18)	**0.21** (1.11e-12)	0.07 (3.08e-02)	**0.36** (4.31e-34)	**0.46** (8.19e-58)

Table 2: Associations of the films with outcomes, estimated using a simple univariate regression fit with generalized least squares. p-values are in parentheses. All time series are on a weekly basis. Some entries are blank due to the time series not overlapping with release dates of films. Bolded coefficients correspond to meeting our first evidentiary threshold: multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test.

Outcome	FOK	Cowspiracy	WTH/Okja	TGC	YAWYE
Searches: 'Plant based'	**0.31** (2.31e-06)	0.07 (0.26)	**0.38** (5.30e-10)	**0.42** (4.04e-15)	**0.43** (1.73e-11)
Searches: 'Vegan'	0.12 (8.03e-02)	0.01 (0.84)	**0.43** (1.32e-12)	**0.25** (2.55e-05)	0.13 (5.63e-02)
Searches: 'Vegetarian'	**0.23** (3.67e-04)	-0.02 (0.75)	**0.23** (9.44e-05)	**0.19** (4.55e-04)	0.15 (2.31e-02)
Beef Demand	0.03 (0.59)	0.07 (0.14)	0.04 (0.43)	0.01 (0.74)	0.15 (1.18e-02)
Pork Demand	0.11 (7.94e-02)	0.02 (0.75)	-0.06 (0.28)	0.05 (0.27)	0.11 (0.10)
Chicken Demand	0.07 (0.20)	0.04 (0.44)	-0.05 (0.29)	-0.03 (0.45)	0.08 (0.15)
Milk sales		0.02 (0.74)	-0.00 (0.94)		
Plant-based milk sales		-0.00 (0.99)	-0.02 (0.78)		
Plant-based meat sales			-0.01 (0.91)	0.15 (3.11e-02)	
Searches: 'Vegan', Informative	0.08 (0.21)	0.02 (0.82)	**0.40** (4.78e-11)	**0.23** (7.14e-05)	0.09 (0.18)
Searches: 'Vegetarian', Informative	**0.18** (3.58e-03)	-0.00 (0.95)	**0.19** (9.12e-04)	**0.20** (9.03e-05)	0.12 (7.13e-02)
Searches: 'Plant based', Informative	**0.28** (1.14e-05)	0.07 (0.26)	**0.36** (3.00e-09)	**0.41** (1.13e-14)	**0.41** (2.70e-10)
Searches: 'Vegan', Behavior	**0.21** (8.20e-04)	0.01 (0.91)	**0.43** (1.91e-12)	**0.26** (5.15e-05)	**0.24** (1.96e-04)
Searches: 'Vegetarian', Behavior	**0.25** (1.35e-04)	-0.04 (0.53)	**0.23** (1.71e-04)	0.12 (4.13e-02)	0.16 (1.87e-02)
Searches: 'Plant based', Behavior	**0.39** (5.49e-10)	0.07 (0.32)	**0.44** (4.87e-13)	**0.44** (2.88e-15)	**0.51** (1.48e-17)

Table 3: Associations of the films with all outcomes, estimated using a simple univariate regression fit with generalized least squares. p-values are in parentheses. All time series are on a monthly basis. Some entries are blank due to the time series not overlapping with release dates of films. Bolded coefficients correspond to meeting our first evidentiary threshold: multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test.

as Figure 5.

5.2.3 Benchmarking analyses

Figure 12 depicts the control time series used for benchmarking analyses, and Table 9 shows the results of the benchmarking.

5.2.4 Lagged analyses

To account for possibly delayed effects on the KSU demand indices, we also run our analyses with lagged versions (with lags of 1, 2, and 3 months) of the KSU outcomes, as shown in Figures 13-21. No additional significant findings were detected, except for a lagged effect of *You Are What You Eat* in decreasing beef demand with a lag of 1 that met our lowest evidentiary threshold ($*$).

5.2.5 Sensitivity analyses

E-values are displayed in Tables 10, 11, 12,and 13.

Outcome	Seasonal effects only	Seasonal effects and films	Films only
Searches: 'Plant based'	0.01	0.43	0.42
Searches: 'Vegan'	0.01	0.04	0.04
Searches: 'Vegetarian'	0.10	0.12	0.03
Milk sales [24]	0.19	0.18	-0.01
Plant-based milk sales [24]	0.26	0.25	0.01
Plant-based meat sales [25]	0.07	0.06	-0.01
Searches: 'Plant based', Informative	0.01	0.39	0.38
Searches: 'Vegan', Informative	0.00	0.02	0.02
Searches: 'Vegetarian', Informative	0.05	0.06	0.02
Searches: 'Plant based', Behavior	0.03	0.50	0.49
Searches: 'Vegan', Behavior	0.06	0.11	0.06
Searches: 'Vegetarian', Behavior	0.13	0.14	0.03

Table 4: The adjusted R^2 of models regressing each outcome on the films and seasonal effects (dummy variables for months), compared to regressing on seasonal effects alone. All analyses use week-level time series.

Outcome	FOK	Cowspiracy	WTH	Okja	TGC	YAWYE
Searches: 'Plant based'	**0.07** (2.77e-02)	0.00 (0.89)	**0.17** (1.02e-06)	0.05 (6.47e-02)	**0.15** (2.09e-07)	**0.17** (3.21e-09)
Searches: 'Vegan'	-0.00 (0.96)	0.00 (0.93)	**0.13** (6.22e-05)	0.01 (0.66)	**0.09** (1.65e-03)	0.05 (3.60e-02)
Searches: 'Vegetarian'	0.04 (0.14)	0.02 (0.50)	**0.08** (2.29e-02)	0.03 (0.30)	0.02 (0.48)	0.01 (0.64)
Milk sales		0.00 (0.92)	-0.01 (0.80)	0.02 (0.59)		
Plant-based milk sales		-0.03 (9.94e-02)	-0.00 (0.86)	0.01 (0.48)		
Plant-based meat sales			-0.04 (0.32)	-0.02 (0.55)	0.01 (0.73)	
Searches: 'Vegan', Informative	-0.01 (0.59)	0.00 (0.87)	**0.11** (8.64e-04)	0.01 (0.63)	**0.08** (3.39e-03)	0.05 (6.47e-02)
Searches: 'Vegetarian', Informative	0.04 (0.13)	0.02 (0.41)	**0.08** (1.41e-02)	0.02 (0.41)	0.02 (0.47)	0.01 (0.82)
Searches: 'Plant based', Informative	**0.07** (1.58e-02)	0.01 (0.75)	**0.17** (6.23e-07)	0.05 (5.56e-02)	**0.16** (4.52e-08)	**0.17** (4.71e-09)
Searches: 'Vegan', Behavior	0.06 (2.58e-02)	-0.01 (0.76)	**0.16** (2.48e-06)	0.01 (0.78)	**0.07** (6.83e-03)	0.06 (1.24e-02)
Searches: 'Vegetarian', Behavior	0.03 (0.29)	-0.00 (0.94)	0.04 (0.18)	0.02 (0.32)	0.01 (0.65)	0.01 (0.78)
Searches: 'Plant based', Behavior	**0.08** (7.53e-03)	-0.01 (0.79)	**0.19** (2.98e-08)	**0.08** (5.09e-03)	**0.17** (1.75e-08)	**0.20** (1.82e-12)

Table 5: Lagged effects of the films on all outcomes, estimated using the model in Eq. (1). p-values are in parentheses. All time series are on a weekly basis. Bolded coefficients correspond to meeting our first evidentiary threshold: multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test.

5.2.6 Interrupted time series analyses

To investigate how the results change when using the release date as an intervention variable, we also perform an interrupted time series analysis [64]. Results are displayed in Figures 22, 23, 24, and 25 and Tables 14, 15, 16, and 17.

5.2.7 Sum of all documentaries as an intervention

We also pre-registered tests involving the sum of all documentaries as an intervention. The results are shown in Table 18 (monthly) and Table 19 (weekly).

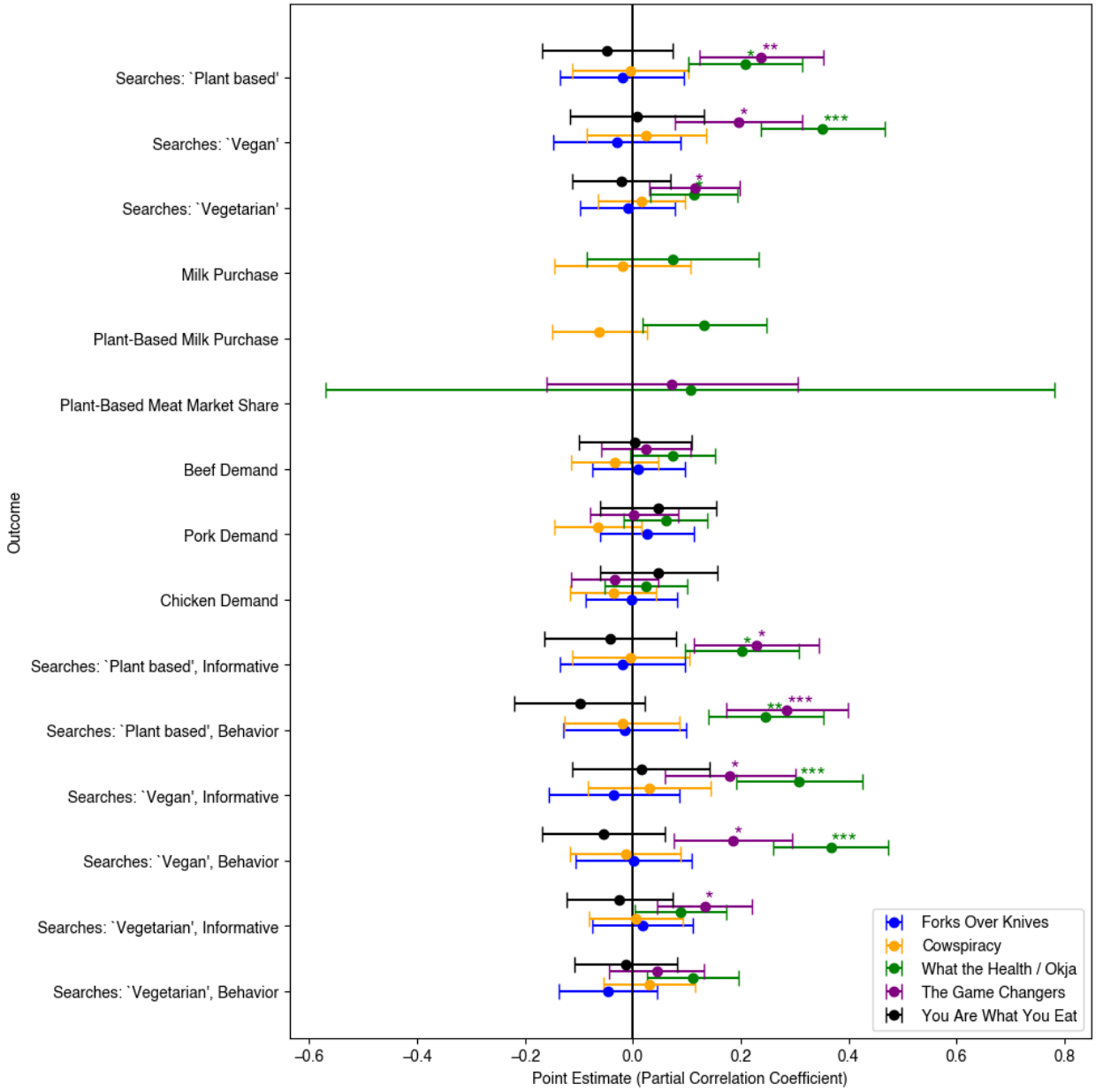

Figure 10: Lagged effects of the films on all outcomes, estimated using the model in Eq. (1). Error bars depict 95% confidence intervals. All outcomes are on a monthly basis. A single asterisk ($*$) denotes multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test; a double asterisk ($**$) denotes multiplicity-corrected significance when counting each individual primary and secondary test run in this paper; and a triple asterisk ($***$) denotes that the test met both the conditions for a double asterisk in both original and sensitivity analyses.

Outcome	FOK	Cowspiracy	WTH/Okja	TGC	YAWYE
Searches: 'Plant based'	-0.02 (0.73)	-0.01 (0.93)	**0.21** (1.46e-04)	**0.24** (6.69e-05)	-0.05 (0.45)
Searches: 'Vegan'	-0.03 (0.63)	0.02 (0.67)	**0.35** (7.34e-09)	**0.20** (1.40e-03)	0.01 (0.91)
Searches: 'Vegetarian'	-0.01 (0.83)	0.02 (0.70)	**0.11** (6.35e-03)	**0.11** (7.55e-03)	-0.02 (0.65)
Beef Demand	0.01 (0.81)	-0.03 (0.40)	0.07 (6.62e-02)	0.02 (0.55)	0.00 (0.94)
Pork Demand	0.03 (0.55)	-0.07 (0.11)	0.06 (0.13)	0.00 (0.96)	0.05 (0.39)
Chicken Demand	-0.00 (0.96)	-0.04 (0.37)	0.02 (0.53)	-0.03 (0.40)	0.05 (0.40)
Milk sales		-0.02 (0.76)	0.07 (0.37)		
Plant-based milk sales		-0.06 (0.18)	**0.13** (3.20e-02)		
Plant-based meat sales			**0.11** (0.77)	0.07 (0.56)	
Searches: 'Vegan', Informative	-0.04 (0.57)	0.03 (0.60)	**0.31** (4.32e-07)	**0.18** (4.03e-03)	0.02 (0.82)
Searches: 'Vegetarian', Informative	0.02 (0.71)	0.01 (0.90)	0.09 (4.49e-02)	**0.13** (3.75e-03)	-0.03 (0.62)
Searches: 'Plant based', Informative	-0.02 (0.74)	-0.00 (0.94)	**0.20** (2.38e-04)	**0.23** (1.29e-04)	-0.04 (0.50)
Searches: 'Vegan', Behavior	0.00 (0.98)	-0.01 (0.79)	**0.37** (1.26e-10)	**0.19** (1.06e-03)	-0.05 (0.35)
Searches: 'Vegetarian', Behavior	-0.05 (0.32)	0.03 (0.49)	**0.11** (1.07e-02)	0.04 (0.32)	-0.01 (0.78)
Searches: 'Plant based', Behavior	-0.02 (0.79)	-0.02 (0.72)	**0.25** (9.18e-06)	**0.28** (1.49e-06)	-0.10 (0.11)

Table 6: Lagged effects of the films on all outcomes, estimated using the model in Eq. (1). p-values are in parentheses. All time series are on a monthly basis. Bolded coefficients correspond to meeting our first evidentiary threshold: multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test.

Outcome	FOK	Cowspiracy	WTH/Okja	TGC	YAWYE
Searches: 'Plant based'	0.12 (1.57e-02)	0.02 (0.65)	**0.34** (1.94e-12)	**0.35** (2.20e-11)	**0.34** (1.43e-12)
Searches: 'Vegan'	0.04 (0.46)	0.01 (0.83)	**0.38** (4.31e-12)	**0.15** (7.73e-03)	**0.11** (6.02e-02)
Searches: 'Vegetarian'	0.10 (2.41e-02)	-0.01 (0.77)	**0.18** (5.20e-06)	0.08 (5.96e-02)	0.04 (0.39)
Beef Demand	0.03 (0.47)	0.12 (8.56e-03)	-0.03 (0.55)	-0.02 (0.72)	0.13 (8.88e-03)
Pork Demand	0.06 (0.20)	-0.03 (0.52)	-0.05 (0.27)	0.07 (0.11)	0.04 (0.44)
Chicken Demand	0.04 (0.33)	0.04 (0.28)	-0.06 (0.13)	0.01 (0.76)	0.02 (0.63)
Milk sales		0.02 (0.72)	**0.11** (0.17)		
Plant-based milk sales		-0.04 (0.37)	0.06 (0.31)		
Plant-based meat sales			0.03 (0.95)	0.08 (0.58)	
Searches: 'Vegan', Informative	0.02 (0.68)	0.01 (0.91)	**0.35** (6.44e-10)	0.13 (2.41e-02)	0.07 (0.21)
Searches: 'Vegetarian', Informative	0.08 (8.96e-02)	-0.01 (0.89)	**0.16** (3.72e-04)	0.07 (0.12)	0.03 (0.53)
Searches: 'Plant based', Informative	0.10 (5.27e-02)	0.02 (0.67)	**0.32** (2.13e-11)	**0.35** (7.88e-11)	**0.32** (1.08e-10)
Searches: 'Vegan', Behavior	**0.11** (1.44e-02)	0.04 (0.37)	**0.36** (4.07e-15)	**0.14** (1.92e-03)	**0.18** (3.75e-05)
Searches: 'Vegetarian', Behavior	0.10 (1.09e-02)	0.00 (0.96)	**0.11** (2.12e-03)	0.03 (0.40)	0.05 (0.25)
Searches: 'Plant based', Behavior	**0.23** (1.40e-06)	0.02 (0.60)	**0.38** (4.54e-16)	**0.33** (1.76e-11)	**0.44** (5.31e-25)

Table 7: Contemporaneous effects of the films on all outcomes, estimated using the model in Eq. (2). p-values are in parentheses. All time series are on a monthly basis. Bolded coefficients correspond to meeting our first evidentiary threshold: multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test.

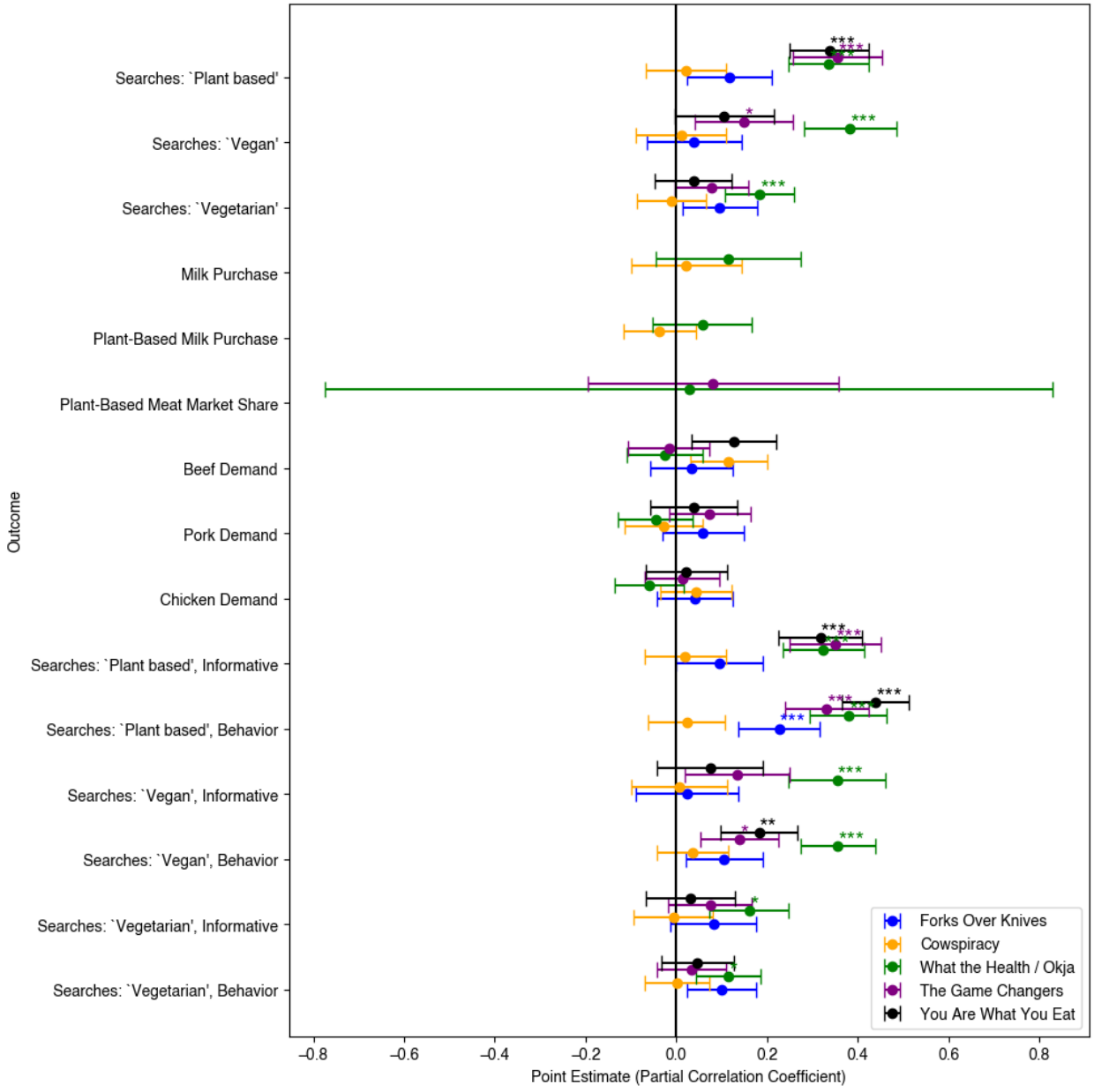

Figure 11: Contemporaneous effects of the films on all outcomes, estimated using the model in Eq. (2). Error bars depict 95% confidence intervals. All outcomes are on a monthly basis. A single asterisk ($*$) denotes multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test; a double asterisk ($**$) denotes multiplicity-corrected significance when counting each individual primary and secondary test run in this paper; and a triple asterisk ($***$) denotes that the test met both the conditions for a double asterisk in both original and sensitivity analyses.

Outcome	FOK	Cowspiracy	WTH	Okja	TGC	YAWYE
Searches: 'Plant based'	**0.18** (1.57e-11)	0.02 (0.45)	**0.20** (1.02e-11)	**0.07** (4.08e-03)	**0.38** (2.04e-44)	**0.32** (1.75e-41)
Searches: 'Vegan'	**0.09** (5.15e-04)	-0.02 (0.52)	0.04 (0.21)	0.00 (0.87)	**0.08** (3.76e-03)	0.06 (1.72e-02)
Searches: 'Vegetarian'	**0.12** (1.00e-05)	-0.01 (0.61)	0.03 (0.32)	0.01 (0.79)	**0.07** (1.29e-02)	0.04 (0.18)
Milk sales		-0.00 (0.93)	0.02 (0.50)	0.00 (0.91)		
Plant-based milk sales		0.00 (0.87)	0.01 (0.77)	0.01 (0.74)		
Plant-based meat sales			0.02 (0.64)	0.01 (0.67)	-0.02 (0.55)	
Searches: 'Vegan', Informative	**0.08** (2.15e-03)	-0.01 (0.67)	0.03 (0.29)	0.01 (0.64)	0.06 (2.26e-02)	0.04 (0.12)
Searches: 'Vegetarian', Informative	**0.10** (2.17e-04)	-0.01 (0.70)	0.02 (0.58)	0.01 (0.65)	0.06 (3.52e-02)	0.03 (0.24)
Searches: 'Plant based', Informative	**0.17** (1.48e-10)	0.02 (0.49)	**0.21** (2.84e-12)	**0.08** (1.89e-03)	**0.36** (3.50e-40)	**0.29** (8.87e-33)
Searches: 'Vegan', Behavior	**0.11** (2.49e-07)	-0.02 (0.44)	0.05 (4.87e-02)	-0.02 (0.30)	**0.09** (2.33e-05)	**0.13** (2.71e-11)
Searches: 'Vegetarian', Behavior	**0.11** (1.69e-06)	-0.01 (0.71)	0.04 (0.17)	0.00 (0.89)	0.05 (4.84e-02)	0.04 (5.13e-02)
Searches: 'Plant based', Behavior	**0.18** (6.94e-11)	0.02 (0.36)	**0.11** (1.99e-04)	0.03 (0.21)	**0.35** (8.23e-37)	**0.42** (5.04e-73)

Table 8: Contemporaneous effects of the films on all outcomes, estimated using the model in Eq. (2). p-values are in parentheses. All time series are on a weekly basis. Bolded coefficients correspond to meeting our first evidentiary threshold: multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test.

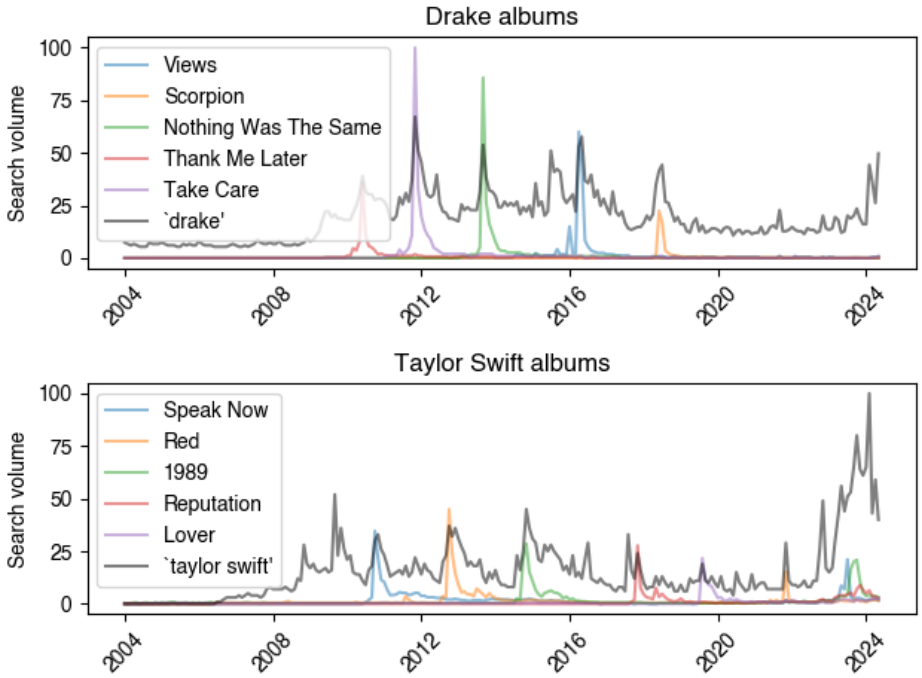

Figure 12: Control time series used for benchmarking analysis. The Terms 'drake' and 'taylor swift' are on the same scale, and the Topics for each album are on the same scale.

Evidentiary threshold	Contemporaneous	Lagged
$*$	0.00	0.06
$**$	0.00	0.03
$***$	0.00	0.03

Table 9: We evaluate the false positive rate of our procedure by creating pairs of intervention and outcome time series with no expected causal relationship, as described in Section 4.3.3. Each table entry is the false positive rate. A single asterisk ($*$) denotes multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test; a double asterisk ($**$) denotes multiplicity-corrected significance when counting each individual primary and secondary test run in this paper; and a triple asterisk ($***$) denotes that the test met both the conditions for a double asterisk in both original and sensitivity analyses.

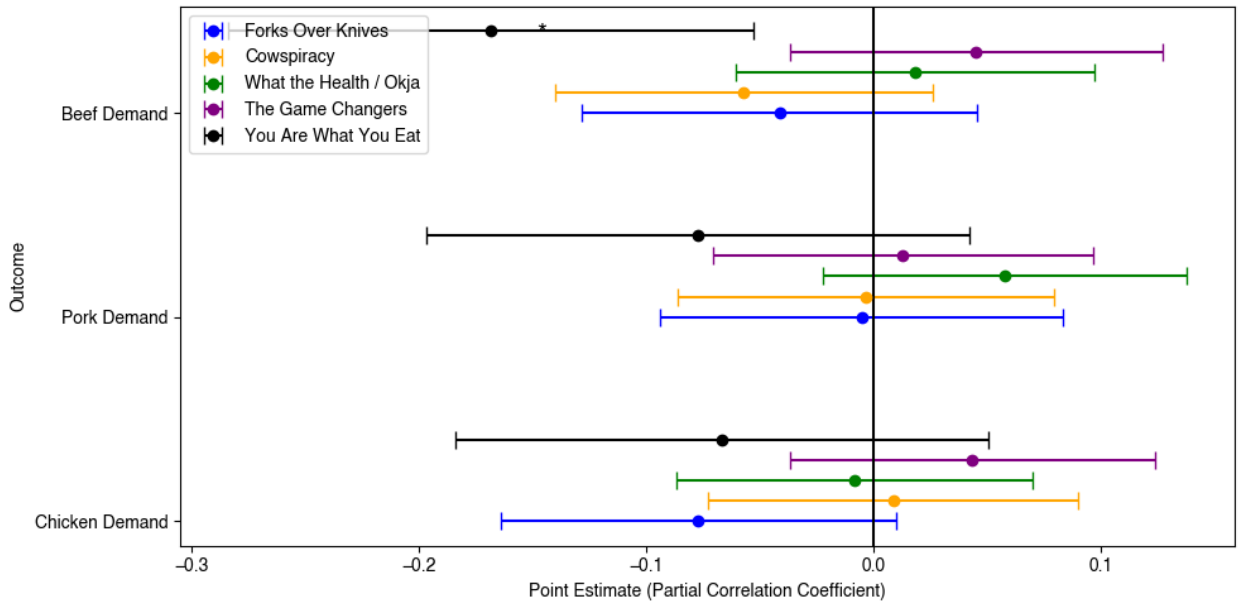

Figure 13: Lagged effects of the films on the KSU meat demand outcomes, estimated using the model in Eq. (1). KSU outcomes were shifted backward by one month. Error bars depict 95% confidence intervals. All time series are on a monthly basis. A single asterisk ($*$) denotes multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test.

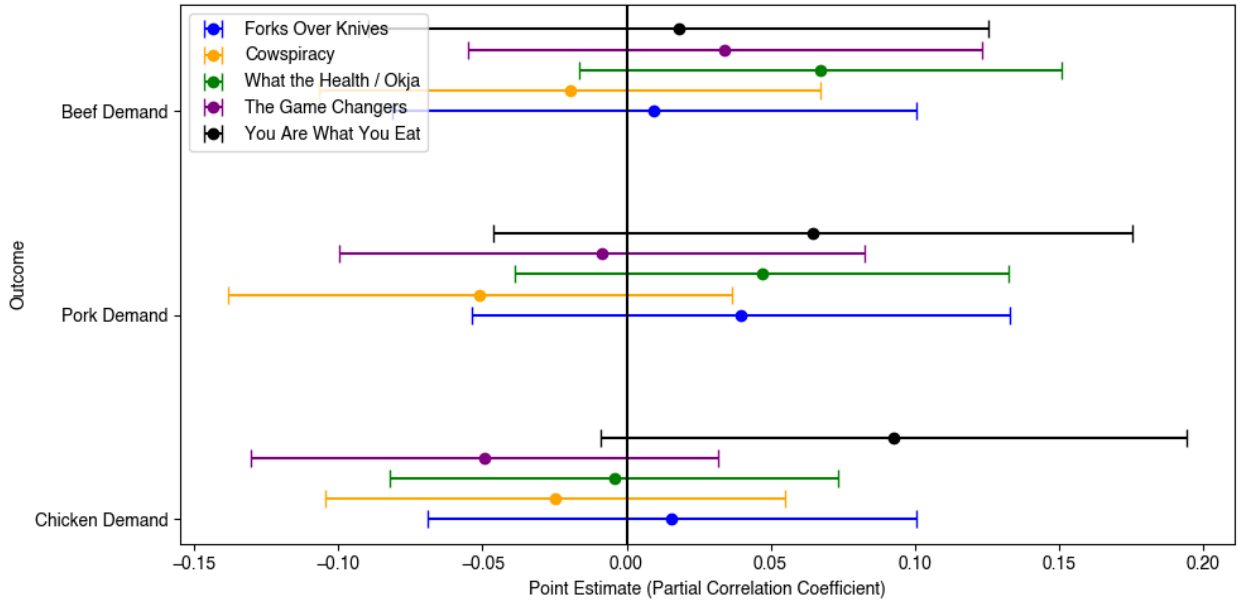

Figure 14: Contemporaneous effects of the films on the KSU meat demand outcomes, estimated using the model in Eq. (2). KSU outcomes were shifted backward by one month. Error bars depict 95% confidence intervals. All time series are on a monthly basis.

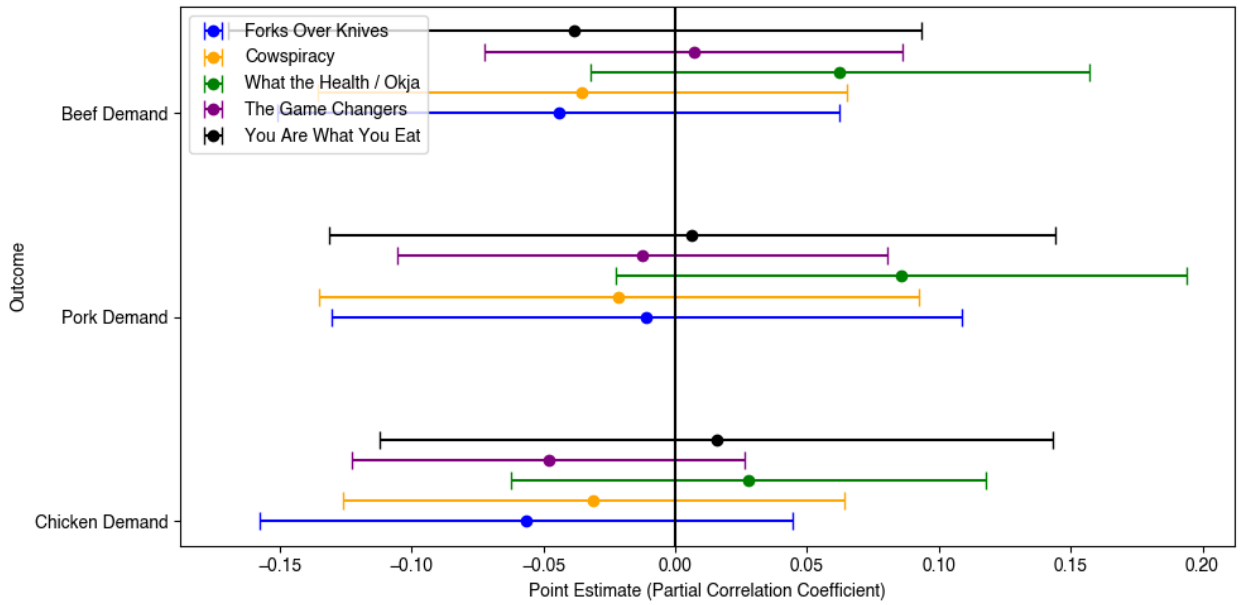

Figure 15: Associations of the films with the KSU meat demand outcomes, estimated using a simple univariate regression fit with generalized least squares. KSU outcomes were shifted backward by one month. Error bars depict 95% confidence intervals. All time series are on a monthly basis.

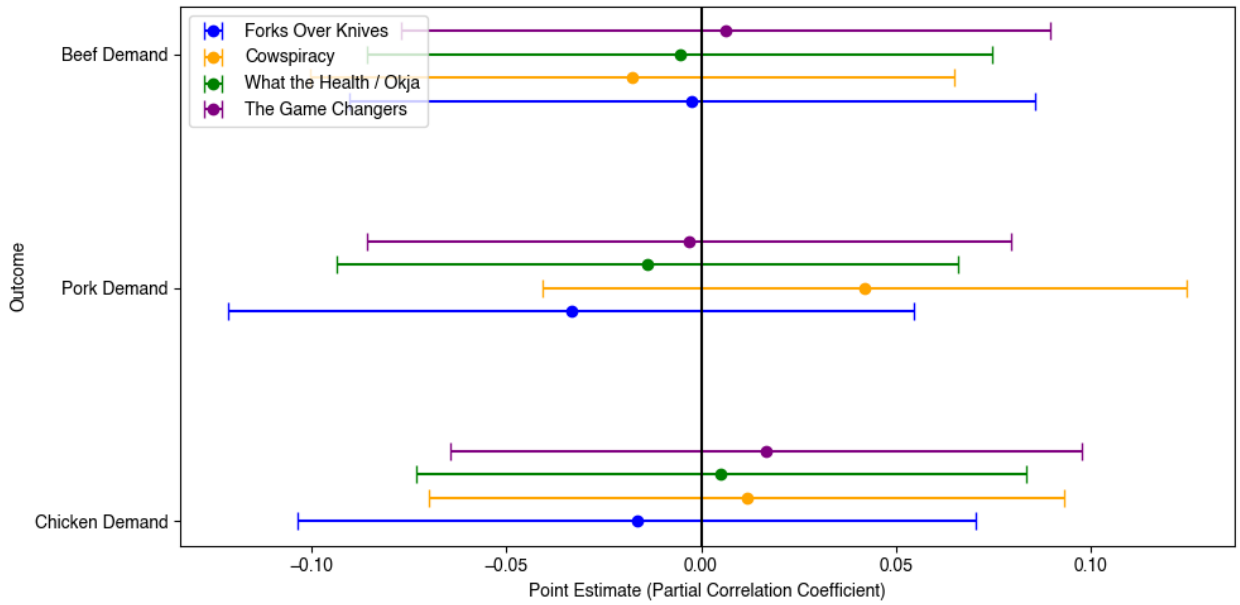

Figure 16: Lagged effects of the films on the KSU meat demand outcomes, estimated using the model in Eq. (1). KSU outcomes were shifted backward by two months. Error bars depict 95% confidence intervals. All time series are on a monthly basis. *You Are What You Eat* (released in January 2024) is excluded from this analysis since the KSU demand indices are only available until March 2024.

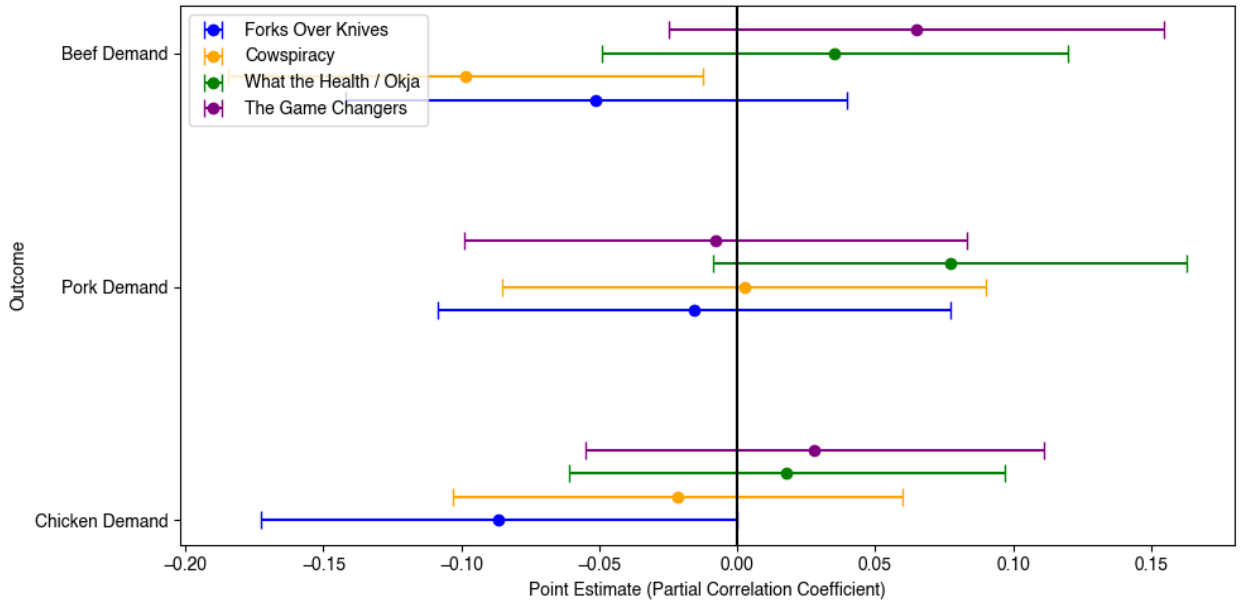

Figure 17: Contemporaneous effects of the films on the KSU meat demand outcomes, estimated using the model in Eq. (2). KSU outcomes were shifted backward by two months. Error bars depict 95% confidence intervals. All time series are on a monthly basis. *You Are What You Eat* (released in January 2024) is excluded from this analysis since the KSU demand indices are only available until March 2024.

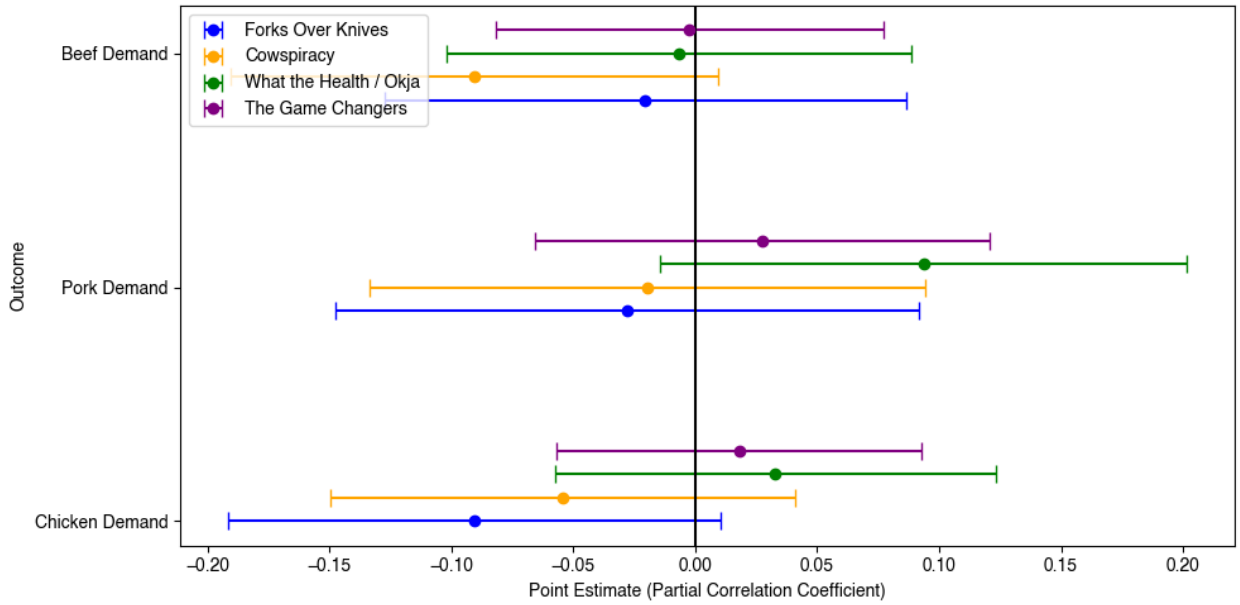

Figure 18: Associations of the films with the KSU meat demand outcomes, estimated using a simple univariate regression fit with generalized least squares. KSU outcomes were shifted backward by two months. Error bars depict 95% confidence intervals. All time series are on a monthly basis. *You Are What You Eat* (released in January 2024) is excluded from this analysis since the KSU demand indices are only available until March 2024.

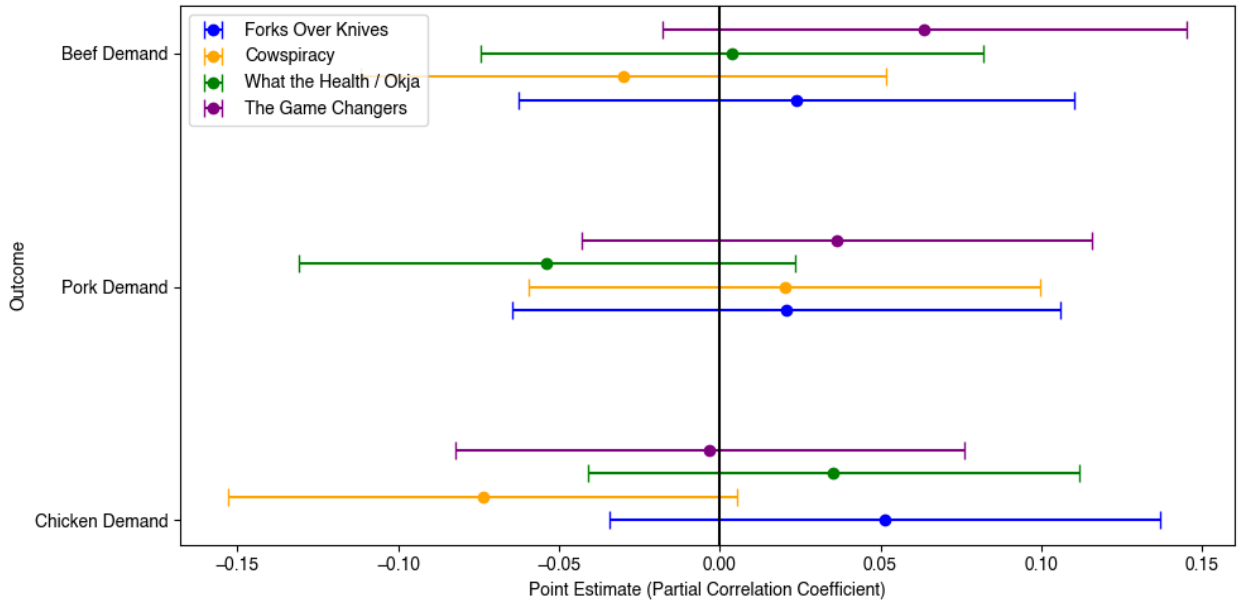

Figure 19: Lagged effects of the films on the KSU meat demand outcomes, estimated using the model in Eq. (1). KSU outcomes were shifted backward by three months. Error bars depict 95% confidence intervals. All time series are on a monthly basis. *You Are What You Eat* (released in January 2024) is excluded from this analysis since the KSU demand indices are only available until March 2024.

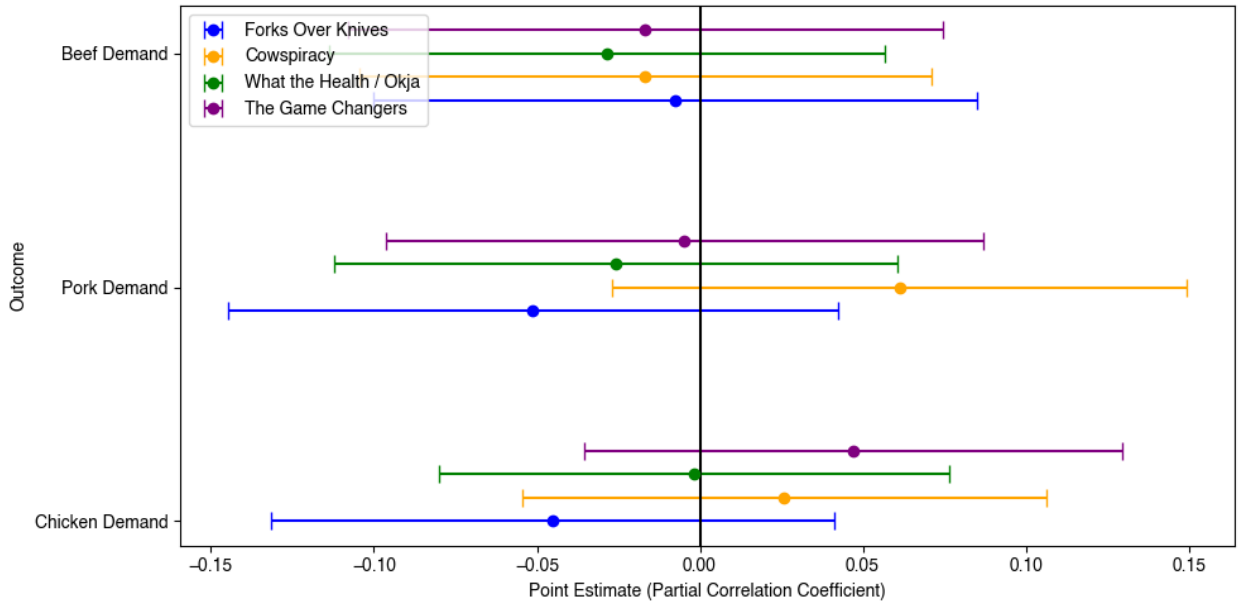

Figure 20: Contemporaneous effects of the films on the KSU meat demand outcomes, estimated using the model in Eq. (2). KSU outcomes were shifted backward by three months. Error bars depict 95% confidence intervals. All time series are on a monthly basis. *You Are What You Eat* (released in January 2024) is excluded from this analysis since the KSU demand indices are only available until March 2024.

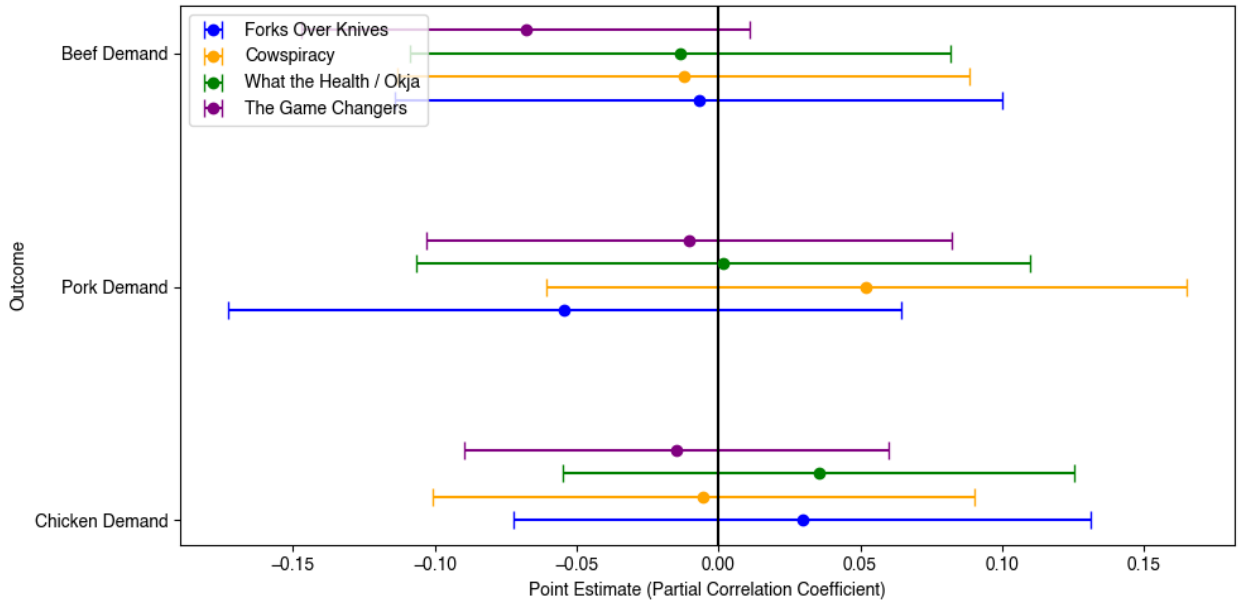

Figure 21: Associations of the films with the KSU meat demand outcomes, estimated using a simple univariate regression fit with generalized least squares. KSU outcomes were shifted forward by three months. Error bars depict 95% confidence intervals. All time series are on a monthly basis. *You Are What You Eat* (released in January 2024) is excluded from this analysis since the KSU demand indices are only available until March 2024.

Outcome	FOK	Cowspiracy	WTH/Okja	TGC	YAWYE
Searches: 'Plant based'	(1.16, 1.00)	(1.07, 1.00)	(1.71, 1.43)	(1.79, 1.48)	(1.26, 1.00)
Searches: 'Vegan'	(1.19, 1.00)	(1.17, 1.00)	(2.10, 1.79)	(1.68, 1.35)	(1.09, 1.00)
Searches: 'Vegetarian'	(1.10, 1.00)	(1.14, 1.00)	(1.46, 1.21)	(1.46, 1.20)	(1.16, 1.00)
Beef Demand	(1.11, 1.00)	(1.21, 1.00)	(1.34, 1.00)	(1.18, 1.00)	(1.06, 1.00)
Pork Demand	(1.18, 1.00)	(1.32, 1.00)	(1.30, 1.00)	(1.04, 1.00)	(1.26, 1.00)
Chicken Demand	(1.05, 1.00)	(1.22, 1.00)	(1.17, 1.00)	(1.21, 1.00)	(1.26, 1.00)
Milk sales		(1.15, 1.00)	(1.34, 1.00)		
Plant-based milk sales		(1.31, 1.00)	(1.51, 1.14)		
Plant-based meat sales			(1.44, 1.00)	(1.34, 1.00)	
Searches: 'Vegan', Informative	(1.22, 1.00)	(1.20, 1.00)	(1.98, 1.67)	(1.63, 1.30)	(1.13, 1.00)
Searches: 'Vegetarian', Informative	(1.14, 1.00)	(1.08, 1.00)	(1.38, 1.05)	(1.51, 1.25)	(1.18, 1.00)
Searches: 'Plant based', Informative	(1.15, 1.00)	(1.06, 1.00)	(1.69, 1.41)	(1.77, 1.46)	(1.24, 1.00)
Searches: 'Vegan', Behavior	(1.03, 1.00)	(1.13, 1.00)	(2.14, 1.85)	(1.65, 1.35)	(1.28, 1.00)
Searches: 'Vegetarian', Behavior	(1.25, 1.00)	(1.20, 1.00)	(1.45, 1.18)	(1.25, 1.00)	(1.12, 1.00)
Searches: 'Plant based', Behavior	(1.13, 1.00)	(1.15, 1.00)	(1.81, 1.53)	(1.92, 1.62)	(1.41, 1.00)

Table 10: *E*-values (tuple for point estimate and confidence interval) for the monthly lagged analyses.

Outcome	FOK	Cowspiracy	WTH/Okja	TGC	YAWYE
Searches: 'Plant based'	(1.47, 1.17)	(1.16, 1.00)	(2.05, 1.82)	(2.11, 1.84)	(2.06, 1.82)
Searches: 'Vegan'	(1.23, 1.00)	(1.11, 1.00)	(2.18, 1.90)	(1.55, 1.24)	(1.43, 1.00)
Searches: 'Vegetarian'	(1.41, 1.12)	(1.11, 1.00)	(1.64, 1.44)	(1.36, 1.00)	(1.22, 1.00)
Beef Demand	(1.21, 1.00)	(1.46, 1.20)	(1.18, 1.00)	(1.14, 1.00)	(1.49, 1.21)
Pork Demand	(1.30, 1.00)	(1.19, 1.00)	(1.26, 1.00)	(1.34, 1.00)	(1.23, 1.00)
Chicken Demand	(1.24, 1.00)	(1.24, 1.00)	(1.30, 1.00)	(1.12, 1.00)	(1.16, 1.00)
Milk sales		(1.16, 1.00)	(1.46, 1.00)		
Plant-based milk sales		(1.22, 1.00)	(1.29, 1.00)		
Plant-based meat sales			(1.19, 1.00)	(1.36, 1.00)	
Searches: 'Vegan', Informative	(1.17, 1.00)	(1.08, 1.00)	(2.11, 1.81)	(1.51, 1.15)	(1.35, 1.00)
Searches: 'Vegetarian', Informative	(1.37, 1.00)	(1.08, 1.00)	(1.58, 1.34)	(1.34, 1.00)	(1.20, 1.00)
Searches: 'Plant based', Informative	(1.41, 1.00)	(1.15, 1.00)	(2.02, 1.78)	(2.09, 1.82)	(2.00, 1.76)
Searches: 'Vegan', Behavior	(1.43, 1.16)	(1.22, 1.00)	(2.11, 1.89)	(1.52, 1.27)	(1.64, 1.41)
Searches: 'Vegetarian', Behavior	(1.42, 1.17)	(1.04, 1.00)	(1.46, 1.24)	(1.21, 1.00)	(1.26, 1.00)
Searches: 'Plant based', Behavior	(1.76, 1.52)	(1.17, 1.00)	(2.17, 1.94)	(2.04, 1.80)	(2.35, 2.14)

Table 11: E-values (tuple for point estimate and confidence interval) for the monthly contemporaneous analyses.

Outcome	FOK	Cowspiracy	WTH	Okja	TGC	YAWYE
Searches: 'Plant based'	(1.32, 1.09)	(1.06, 1.00)	(1.61, 1.42)	(1.28, 1.00)	(1.56, 1.41)	(1.61, 1.46)
Searches: 'Vegan'	(1.04, 1.00)	(1.05, 1.00)	(1.51, 1.33)	(1.11, 1.00)	(1.38, 1.21)	(1.28, 1.06)
Searches: 'Vegetarian'	(1.24, 1.00)	(1.15, 1.00)	(1.36, 1.11)	(1.18, 1.00)	(1.16, 1.00)	(1.12, 1.00)
Milk sales		(1.05, 1.00)	(1.10, 1.00)	(1.14, 1.00)		
Plant-based milk sales		(1.21, 1.00)	(1.07, 1.00)	(1.13, 1.00)		
Plant-based meat sales			(1.22, 1.00)	(1.15, 1.00)	(1.11, 1.00)	
Searches: 'Vegan', Informative	(1.13, 1.00)	(1.07, 1.00)	(1.45, 1.25)	(1.12, 1.00)	(1.36, 1.18)	(1.26, 1.00)
Searches: 'Vegetarian', Informative	(1.24, 1.00)	(1.16, 1.00)	(1.37, 1.14)	(1.16, 1.00)	(1.15, 1.00)	(1.08, 1.00)
Searches: 'Plant based', Informative	(1.34, 1.13)	(1.10, 1.00)	(1.62, 1.43)	(1.28, 1.00)	(1.59, 1.43)	(1.60, 1.45)
Searches: 'Vegan', Behavior	(1.30, 1.09)	(1.09, 1.00)	(1.58, 1.40)	(1.09, 1.00)	(1.34, 1.16)	(1.31, 1.13)
Searches: 'Vegetarian', Behavior	(1.19, 1.00)	(1.04, 1.00)	(1.25, 1.00)	(1.17, 1.00)	(1.12, 1.00)	(1.09, 1.00)
Searches: 'Plant based', Behavior	(1.36, 1.16)	(1.09, 1.00)	(1.66, 1.48)	(1.36, 1.17)	(1.60, 1.44)	(1.69, 1.54)

Table 12: E-values (tuple for point estimate and confidence interval) for the weekly lagged analyses.

Outcome	FOK	Cowspiracy	WTH	Okja	TGC	YAWYE
Searches: 'Plant based'	(1.63, 1.49)	(1.15, 1.00)	(1.69, 1.54)	(1.34, 1.17)	(2.16, 2.03)	(2.02, 1.90)
Searches: 'Vegan'	(1.40, 1.24)	(1.14, 1.00)	(1.23, 1.00)	(1.07, 1.00)	(1.35, 1.18)	(1.31, 1.11)
Searches: 'Vegetarian'	(1.47, 1.32)	(1.12, 1.00)	(1.20, 1.00)	(1.09, 1.00)	(1.32, 1.13)	(1.22, 1.00)
Milk sales		(1.05, 1.00)	(1.17, 1.00)	(1.06, 1.00)		
Plant-based milk sales		(1.06, 1.00)	(1.09, 1.00)	(1.09, 1.00)		
Plant-based meat sales			(1.14, 1.00)	(1.12, 1.00)	(1.15, 1.00)	
Searches: 'Vegan', Informative	(1.37, 1.20)	(1.11, 1.00)	(1.21, 1.00)	(1.12, 1.00)	(1.31, 1.10)	(1.24, 1.00)
Searches: 'Vegetarian', Informative	(1.43, 1.26)	(1.11, 1.00)	(1.15, 1.00)	(1.12, 1.00)	(1.29, 1.07)	(1.20, 1.00)
Searches: 'Plant based', Informative	(1.61, 1.47)	(1.14, 1.00)	(1.71, 1.56)	(1.36, 1.20)	(2.12, 1.98)	(1.93, 1.81)
Searches: 'Vegan', Behavior	(1.44, 1.32)	(1.13, 1.00)	(1.26, 1.02)	(1.16, 1.00)	(1.38, 1.26)	(1.51, 1.40)
Searches: 'Vegetarian', Behavior	(1.45, 1.32)	(1.09, 1.00)	(1.23, 1.00)	(1.05, 1.00)	(1.25, 1.02)	(1.25, 1.00)
Searches: 'Plant based', Behavior	(1.62, 1.48)	(1.17, 1.00)	(1.46, 1.28)	(1.21, 1.00)	(2.08, 1.94)	(2.30, 2.18)

Table 13: E-values (tuple for point estimate and confidence interval) for the weekly contemporaneous analyses.

Outcome	FOK	Cowspiracy	WTH/Okja	TGC	YAWYE
Searches: 'Plant based'	-0.06 (0.59)	-0.02 (0.71)	**0.61** (3.43e-17)	**0.50** (7.84e-23)	**0.18** (2.06e-10)
Searches: 'Vegan'	**-0.17** (1.26e-02)	0.01 (0.88)	0.10 (4.94e-02)	0.01 (0.67)	0.02 (0.48)
Searches: 'Vegetarian'	-0.22 (9.60e-02)	-0.06 (0.50)	0.20 (3.01e-02)	0.03 (0.65)	-0.00 (0.94)
Beef Demand	-0.09 (0.26)	0.27 (3.56e-02)	0.15 (0.19)	0.19 (0.12)	0.22 (1.72e-02)
Pork Demand	0.02 (0.88)	-0.03 (0.78)	0.13 (0.21)	0.14 (0.17)	0.02 (0.80)
Chicken Demand	0.07 (0.65)	0.24 (6.25e-02)	0.08 (0.52)	0.25 (2.16e-02)	0.07 (0.37)
Milk sales		-0.02 (0.79)	-0.04 (0.50)		
Plant-based milk sales		**-0.12** (2.85e-03)	-0.04 (0.53)		
Plant-based meat sales			0.11 (nan)	**0.18** (2.66e-03)	
Searches: 'Vegan', Informative	-0.16 (6.33e-02)	0.03 (0.45)	0.10 (7.47e-02)	0.00 (0.92)	0.01 (0.78)
Searches: 'Vegetarian', Informative	-0.10 (0.52)	0.06 (0.54)	**0.26** (1.12e-02)	0.10 (0.23)	-0.02 (0.76)
Searches: 'Plant based', Informative	-0.08 (0.50)	-0.02 (0.72)	**0.58** (3.49e-16)	**0.36** (2.26e-12)	**0.17** (1.91e-09)
Searches: 'Vegan', Behavior	-0.10 (6.35e-02)	0.01 (0.86)	**0.21** (6.23e-07)	0.03 (0.27)	0.05 (1.14e-02)
Searches: 'Vegetarian', Behavior	-0.16 (5.13e-02)	0.01 (0.89)	0.08 (0.25)	-0.08 (0.20)	0.04 (0.42)
Searches: 'Plant based', Behavior	0.00 (0.99)	-0.01 (0.86)	**0.76** (3.46e-22)	**0.46** (5.17e-18)	**0.26** (3.67e-16)

Table 14: Intercept coefficients and p- values from interrupted time series model in Eq. (4). All time series are on a monthly basis. Bolded coefficients correspond to meeting our first evidentiary threshold: multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test.

Outcome	FOK	Cowspiracy	WTH/Okja	TGC	YAWYE
Searches: 'Plant based'	**0.57** (3.92e-07)	**0.23** (4.15e-05)	**-0.18** (1.14e-03)	**-0.18** (7.77e-06)	**-0.10** (3.99e-04)
Searches: 'Vegan'	**0.23** (2.58e-03)	**0.16** (9.21e-06)	**0.15** (7.62e-03)	-0.03 (0.54)	**-0.06** (2.36e-02)
Searches: 'Vegetarian'	0.12 (0.38)	0.03 (0.77)	0.05 (0.59)	**-0.15** (3.34e-02)	-0.08 (0.19)
Beef Demand	0.11 (0.14)	**-0.09** (0.47)	-0.08 (0.45)	**-0.16** (0.20)	-0.33 (3.18e-02)
Pork Demand	-0.07 (0.57)	0.10 (0.33)	**-0.16** (7.88e-02)	**-0.31** (1.80e-03)	**-0.18** (0.29)
Chicken Demand	-0.26 (7.40e-02)	**-0.06** (0.64)	-0.01 (0.91)	-0.19 (7.16e-02)	-0.24 (0.11)
Milk sales		-0.00 (0.97)	0.01 (0.84)		
Plant-based milk sales		**-0.12** (2.95e-04)	0.12 (0.16)		
Plant-based meat sales			0.17 (nan)	0.02 (0.47)	
Searches: 'Vegan', Informative	**0.25** (5.67e-03)	**0.20** (1.50e-07)	0.13 (3.19e-02)	-0.01 (0.77)	**-0.06** (5.22e-02)
Searches: 'Vegetarian', Informative	0.19 (0.19)	**0.14** (0.13)	0.05 (0.57)	**-0.18** (2.71e-02)	**-0.10** (0.16)
Searches: 'Plant based', Informative	**0.46** (8.17e-05)	**0.23** (5.89e-05)	**-0.15** (1.31e-02)	-0.11 (2.11e-02)	**-0.09** (1.45e-03)
Searches: 'Vegan', Behavior	**0.18** (1.79e-03)	0.02 (0.56)	**0.14** (3.53e-04)	-0.08 (4.76e-02)	**-0.06** (7.60e-03)
Searches: 'Vegetarian', Behavior	-0.05 (0.61)	**-0.10** (0.19)	0.08 (0.28)	**-0.15** (4.29e-02)	-0.01 (0.84)
Searches: 'Plant based', Behavior	**0.83** (1.86e-12)	**0.18** (4.07e-03)	**-0.30** (2.52e-06)	**-0.20** (5.88e-05)	**-0.18** (2.01e-08)

Table 15: Slope coefficients and p- values from interrupted time series model in Eq. (4). All time series are on a monthly basis. Bolded coefficients correspond to meeting our first evidentiary threshold: multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test.

Outcome	FOK	Cowspiracy	WTH/Okja	TGC	YAWYE
Searches: 'Plant based'	**-0.21** (4.45e-02)	0.05 (0.28)	**0.10** (4.74e-03)	0.05 (9.45e-02)	**0.23** (1.61e-31)
Searches: 'Vegan'	-0.04 (0.58)	-0.03 (0.33)	0.02 (0.52)	-0.02 (0.42)	0.06 (1.23e-02)
Searches: 'Vegetarian'	-0.07 (0.57)	-0.07 (0.34)	**0.10** (0.11)	0.06 (0.23)	0.14 (9.78e-03)
Milk sales		-0.01 (0.88)	0.05 (0.39)		
Plant-based milk sales		-0.02 (0.76)	-0.01 (0.75)		
Plant-based meat sales			**-0.08** (6.82e-04)	-0.01 (0.73)	
Searches: 'Vegan', Informative	-0.02 (0.84)	-0.03 (0.34)	0.03 (0.50)	-0.03 (0.35)	0.04 (0.16)
Searches: 'Vegetarian', Informative	0.06 (0.57)	-0.01 (0.94)	0.15 (4.22e-02)	0.06 (0.32)	**0.12** (4.37e-02)
Searches: 'Plant based', Informative	-0.17 (0.10)	0.04 (0.30)	**0.12** (1.88e-03)	0.05 (6.75e-02)	**0.21** (5.44e-25)
Searches: 'Vegan', Behavior	-0.06 (0.15)	-0.02 (0.64)	0.02 (0.37)	0.01 (0.53)	**0.11** (3.59e-10)
Searches: 'Vegetarian', Behavior	-0.18 (8.25e-03)	-0.06 (0.31)	-0.01 (0.85)	0.01 (0.90)	**0.12** (3.28e-02)
Searches: 'Plant based', Behavior	**-0.35** (8.46e-04)	0.01 (0.84)	**0.10** (4.74e-02)	0.03 (0.38)	**0.40** (2.89e-45)

Table 16: Intercept coefficients and p- values from interrupted time series model in Eq. (4). All time series are on a weekly basis. Bolded coefficients correspond to meeting our first evidentiary threshold: multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test.

Outcome	FOK	Cowspiracy	WTH/Okja	TGC	YAWYE
Searches: 'Plant based'	**0.57** (1.51e-08)	0.07 (0.12)	0.13 (2.93e-02)	0.11 (3.47e-02)	**-0.13** (2.09e-04)
Searches: 'Vegan'	0.07 (0.28)	**0.16** (2.41e-04)	**0.17** (8.75e-04)	0.06 (0.19)	**-0.11** (3.85e-03)
Searches: 'Vegetarian'	-0.02 (0.86)	**0.17** (2.85e-02)	0.14 (4.12e-02)	0.02 (0.69)	**-0.18** (3.59e-03)
Milk sales		0.10 (0.23)	-0.00 (0.99)		
Plant-based milk sales		-0.08 (0.43)	-0.00 (0.95)		
Plant-based meat sales			0.00 (0.94)	-0.02 (0.71)	
Searches: 'Vegan', Informative	0.05 (0.57)	**0.22** (1.53e-04)	**0.17** (4.82e-03)	0.06 (0.27)	-0.09 (4.10e-02)
Searches: 'Vegetarian', Informative	-0.04 (0.73)	**0.27** (8.71e-04)	**0.20** (9.53e-03)	0.03 (0.68)	-0.15 (3.08e-02)
Searches: 'Plant based', Informative	**0.48** (1.44e-06)	0.06 (0.18)	0.14 (1.81e-02)	0.11 (3.77e-02)	**-0.12** (1.33e-03)
Searches: 'Vegan', Behavior	0.07 (5.73e-02)	0.02 (0.52)	**0.18** (1.25e-06)	0.05 (0.16)	**-0.12** (9.31e-05)
Searches: 'Vegetarian', Behavior	0.05 (0.44)	-0.05 (0.36)	0.04 (0.53)	0.00 (0.98)	**-0.16** (9.51e-03)
Searches: 'Plant based', Behavior	**1.13** (1.28e-22)	0.04 (0.45)	0.15 (4.12e-02)	**0.20** (1.73e-03)	**-0.29** (1.01e-10)

Table 17: Slope coefficients and p- values from interrupted time series model in Eq. (4). All time series are on a weekly basis. Bolded coefficients correspond to meeting our first evidentiary threshold: multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test.

Outcome	Association	Contemporaneous	Lagged
Searches: 'Plant based'	**0.55** (3.43e-22)	**0.49** (7.56e-21)	**0.21** (6.48e-04)
Searches: 'Vegan'	**0.49** (3.76e-16)	**0.44** (2.35e-15)	**0.37** (2.68e-09)
Searches: 'Vegetarian'	**0.31** (1.41e-07)	**0.23** (8.27e-09)	**0.14** (1.25e-03)
Beef Demand	0.07 (0.18)	0.02 (0.65)	0.08 (3.19e-02)
Pork Demand	-0.01 (0.81)	-0.02 (0.56)	0.06 (0.13)
Chicken Demand	-0.03 (0.49)	-0.04 (0.33)	0.03 (0.49)
Milk sales	0.00 (0.98)	0.05 (0.50)	-0.02 (0.80)
Plant-based milk sales	-0.01 (0.86)	-0.03 (0.63)	0.03 (0.58)
Plant-based meat sales	0.01 (0.84)	0.07 (0.37)	0.05 (0.45)
Searches: 'Vegan', Informative	**0.44** (1.27e-13)	**0.39** (3.59e-12)	**0.32** (1.11e-07)
Searches: 'Vegetarian', Informative	**0.26** (3.78e-06)	**0.21** (4.06e-06)	**0.12** (5.69e-03)
Searches: 'Plant based', Informative	**0.53** (3.01e-20)	**0.47** (5.95e-19)	**0.21** (6.24e-04)
Searches: 'Vegan', Behavior	**0.52** (4.28e-18)	**0.45** (6.20e-22)	**0.37** (6.27e-10)
Searches: 'Vegetarian', Behavior	**0.30** (1.28e-06)	**0.15** (3.56e-05)	0.11 (9.17e-03)
Searches: 'Plant based', Behavior	**0.64** (2.35e-30)	**0.58** (1.13e-27)	**0.22** (4.26e-04)

Table 18: Associations and contemporaneous and lagged effects of all films (summed) on the outcomes. All time series are on a monthly basis. Bolded coefficients correspond to meeting our first evidentiary threshold: multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test.

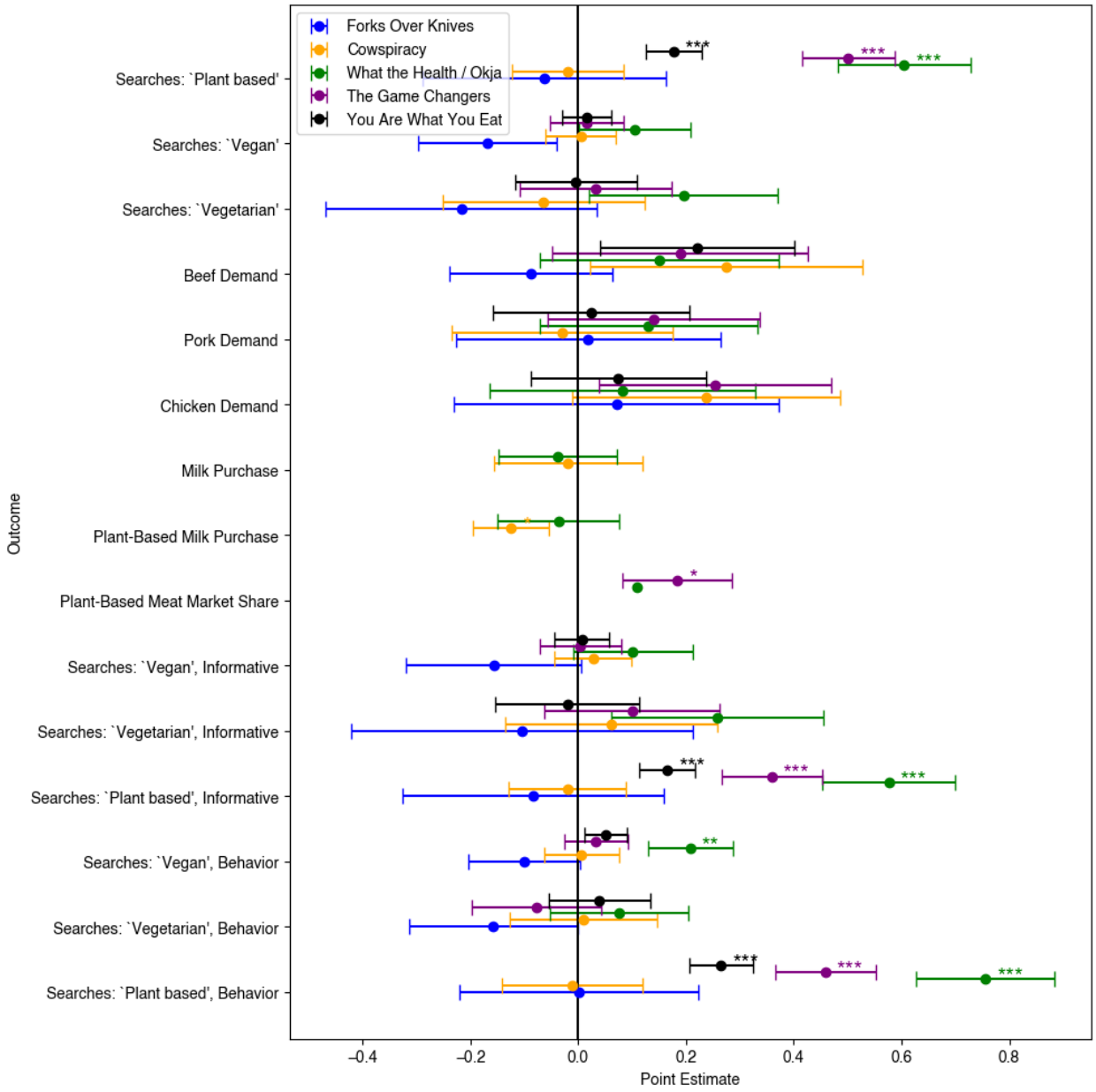

Figure 22: Intercept coefficients estimated from the interrupted time series model in Eq. (4). Each analysis is run on a monthly time series consisting of 2004 to five months after its release, an interval chosen based on the minimum post-intervention time series length across the films. Error bars depict 95% confidence intervals. Due to low sample size, our procedure did not produce valid standard errors for the plant-based meat market share outcome for *Okja* and *What the Health*. A single asterisk denotes significance where the Bonferroni denominator is the number of distinct interventions (each film individually plus all films summed), a double asterisk denotes significance where the Bonferroni denominator is all tests run in this paper, and a triple asterisk denotes that the test met both the conditions for a double asterisk and passed all sensitivity analyses.

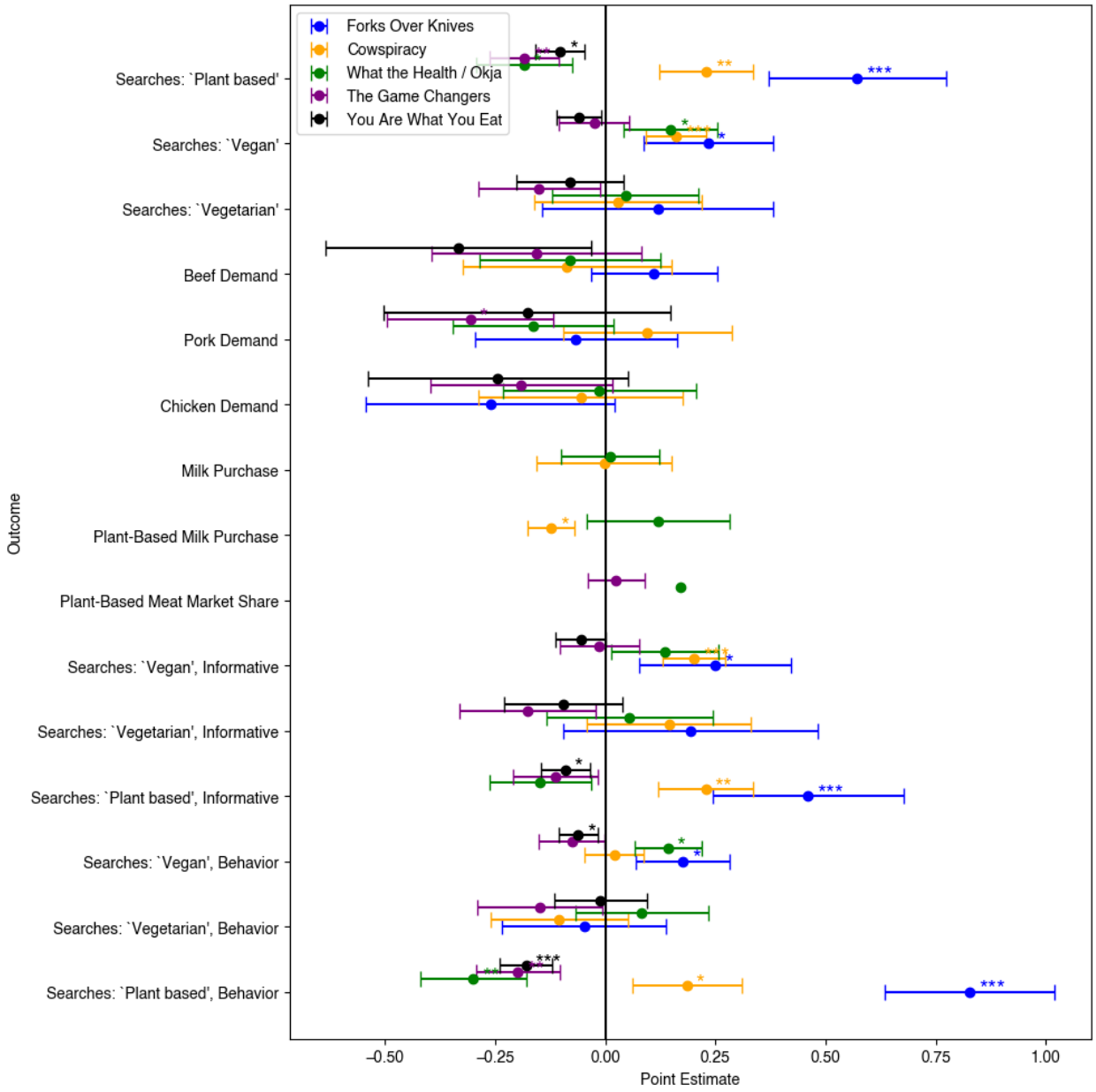

Figure 23: Slope coefficients estimated from the interrupted time series model in Eq. (4). Each analysis is run on a monthly time series consisting of 2004 to five months after its release, an interval chosen based on the minimum post-intervention time series length across the films. Error bars depict 95% confidence intervals. Due to low sample size, our procedure did not produce valid standard errors for the plant-based meat market share outcome for *Okja* and *What the Health*. A single asterisk denotes significance where the Bonferroni denominator is the number of distinct interventions (each film individually plus all films summed), a double asterisk denotes significance where the Bonferroni denominator is all tests run in this paper, and a triple asterisk denotes that the test met both the conditions for a double asterisk and passed all sensitivity analyses.

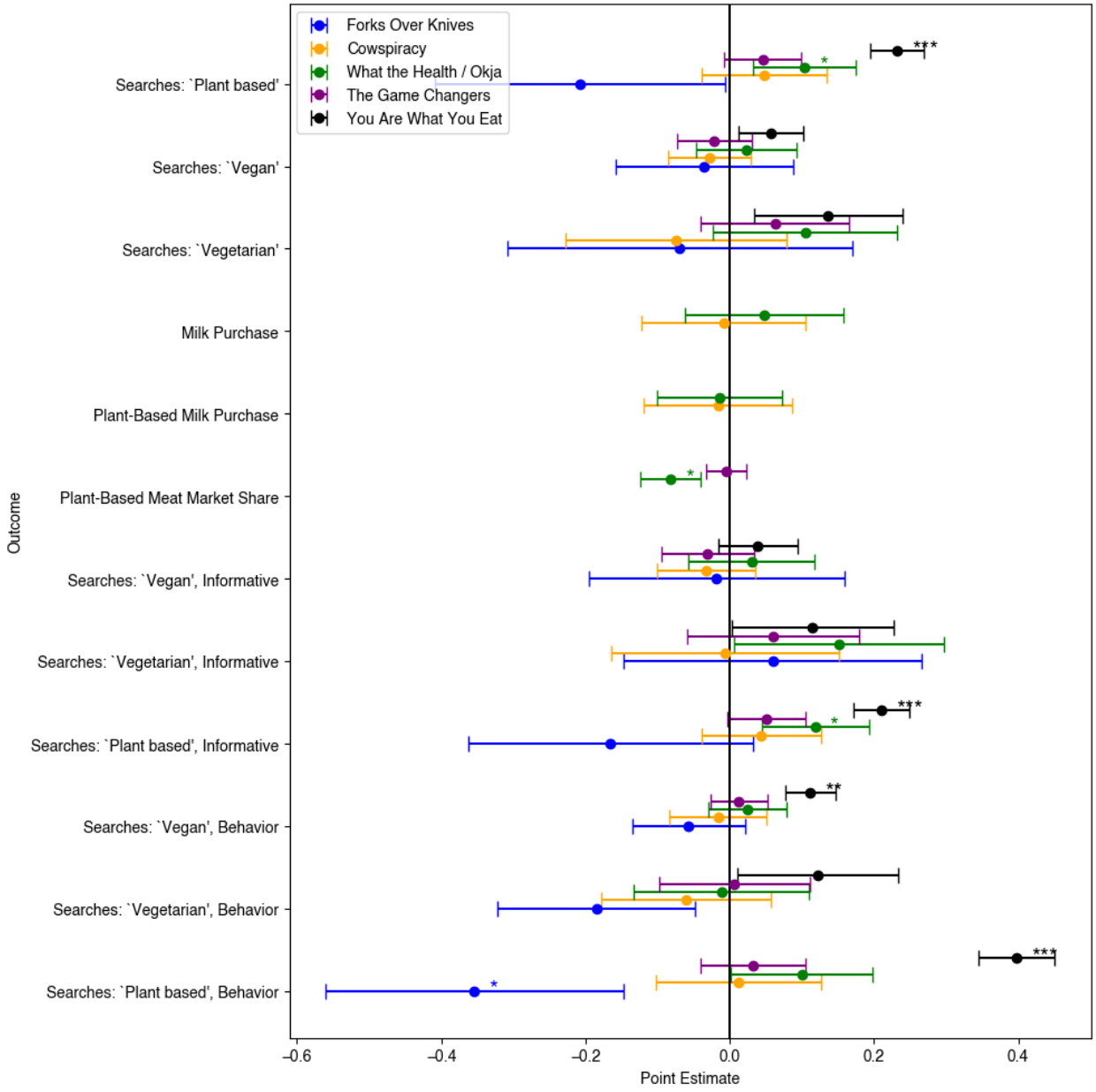

Figure 24: Intercept coefficients estimated from the interrupted time series model in Eq. (4). Each analysis is run on a weekly time series consisting of 2004 to five months after its release, an interval chosen based on the minimum post-intervention time series length across the films. Error bars depict 95% confidence intervals. A single asterisk denotes significance where the Bonferroni denominator is the number of distinct interventions (each film individually plus all films summed), a double asterisk denotes significance where the Bonferroni denominator is all tests run in this paper, and a triple asterisk denotes that the test met both the conditions for a double asterisk and passed all sensitivity analyses.

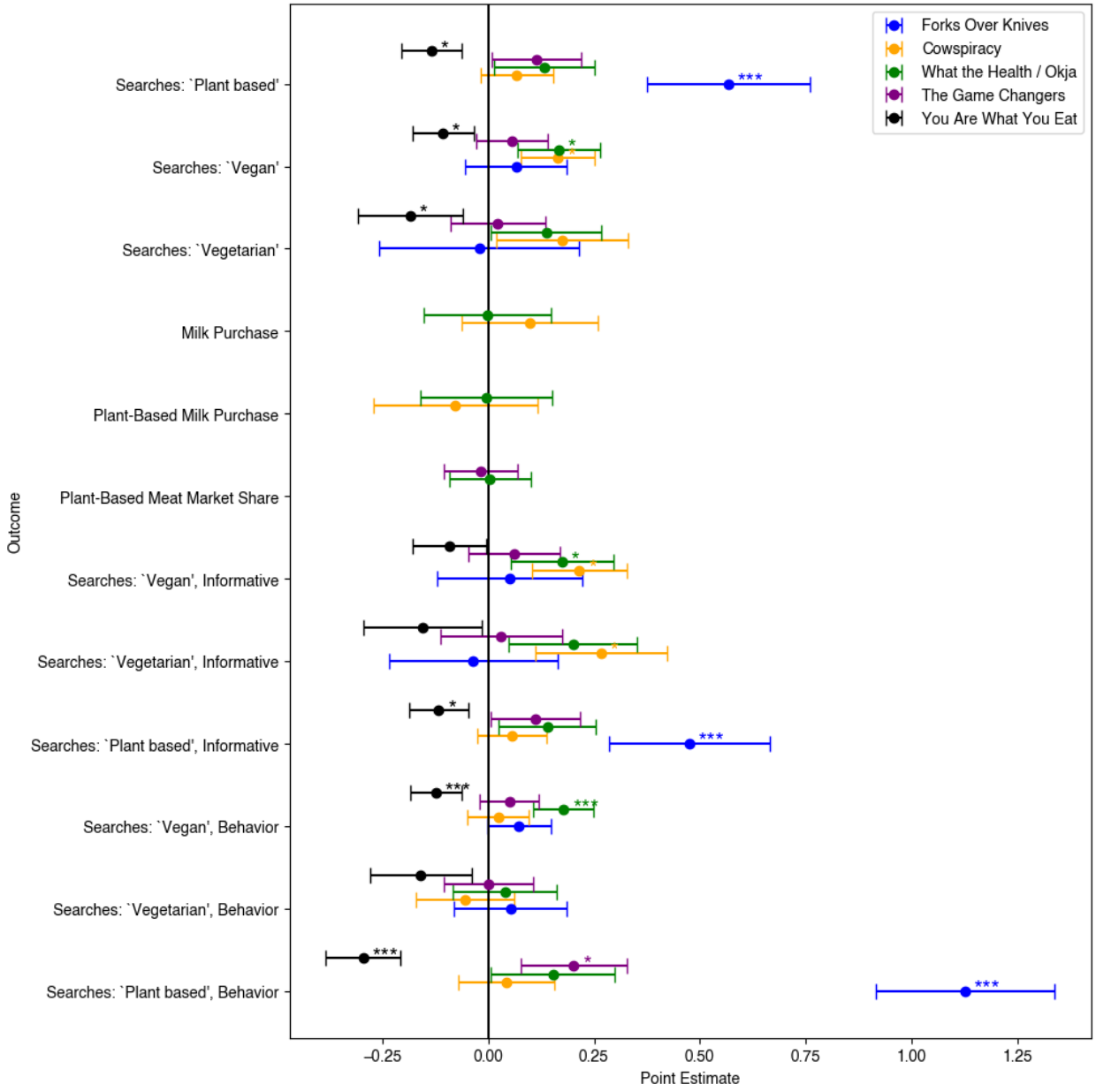

Figure 25: Slope coefficients estimated from the interrupted time series model in Eq. (4). Each analysis is run on a weekly time series consisting of 2004 to five months after its release, an interval chosen based on the minimum post-intervention time series length across the films. Error bars depict 95% confidence intervals. A single asterisk denotes significance where the Bonferroni denominator is the number of distinct interventions (each film individually plus all films summed), a double asterisk denotes significance where the Bonferroni denominator is all tests run in this paper, and a triple asterisk denotes that the test met both the conditions for a double asterisk and passed all sensitivity analyses.

Outcome	Association	Contemporaneous	Lagged
Searches: 'Plant based'	**0.43** (2.15e-55)	**0.40** (4.16e-41)	**0.22** (5.84e-12)
Searches: 'Vegan'	**0.14** (5.23e-08)	**0.10** (3.64e-04)	**0.11** (8.69e-05)
Searches: 'Vegetarian'	**0.13** (7.79e-07)	**0.09** (1.99e-03)	**0.07** (1.18e-02)
Milk sales	-0.02 (0.57)	0.01 (0.78)	0.01 (0.73)
Plant-based milk sales	-0.02 (0.61)	0.01 (0.63)	0.01 (0.69)
Plant-based meat sales	-0.02 (0.51)	0.00 (0.93)	-0.04 (0.26)
Searches: 'Vegan', Informative	**0.11** (6.17e-06)	**0.09** (1.53e-03)	**0.09** (8.21e-04)
Searches: 'Vegetarian', Informative	**0.10** (5.98e-05)	**0.08** (5.56e-03)	0.06 (1.66e-02)
Searches: 'Plant based', Informative	**0.41** (9.56e-52)	**0.39** (5.99e-39)	**0.22** (1.84e-12)
Searches: 'Vegan', Behavior	**0.17** (2.65e-10)	**0.11** (5.43e-07)	**0.14** (1.00e-06)
Searches: 'Vegetarian', Behavior	**0.12** (4.22e-06)	**0.07** (2.66e-03)	0.05 (6.66e-02)
Searches: 'Plant based', Behavior	**0.41** (5.13e-49)	**0.34** (3.54e-32)	**0.27** (4.80e-18)

Table 19: Associations and contemporaneous and lagged effects of all films (summed) on the outcomes. All time series are on a weekly basis. Bolded coefficients correspond to meeting our first evidentiary threshold: multiplicity-corrected significance at a familywise $\alpha = 0.05$ when counting each intervention (each film individually plus all films summed) as a test.