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The Swedish Media Debate on GMO Between 1994 and 2018: What Attention was Given to Farmers' Perspectives?

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ABSTRACT

This paper presents a longitudinal study of the debate on GMO in the Swedish media, comparing coverage of the topic in the general press and agricultural press. We studied 1399 articles about GMO in food and agriculture published between 1994 and 2018 in Sweden's daily and evening newspapers and agricultural publications. A combination of content analysis and statistical simulation techniques was used to identify structural breaks in the dataset and contribute understanding about how the debate shifted over time. Particular attention was paid to issues of importance to farmers in the Swedish media discourse. Our findings indicate that the debate was most intense in the mid-1990s, after which the frequency of reporting on GMOs declined overall and the debate steadily became less negative. Farmers' perspectives were given more attention than expected in the general media but, surprisingly, smallholder farming and food security in the Global South, which has been central to global and elite debates on GMO, did not appear to substantially affect media discourses in Sweden.

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1. Introduction

The use of genetically modified organisms (GMO) in food and agriculture has been a source of controversy in Europe since the mid-1990s (Gaskell et al., 2000). With the award of the 2020 Nobel Prize in Chemistry to the developers of CRISPR/CAS9,¹ a method for gene editing, there are indications that this debate is now being revived. Hopes are again being raised that a new technology will be able to produce crops that are more nutritious, resilient to global warming (Doxzen & Henderson, 2020) and, as recently claimed by the philanthrocapitalist Bill Gates, “could help end extreme poverty by enabling millions of farmers in the developing world to grow crops and raise livestock that are more productive, more nutritious, and hardier” (Gates, 2018, p. 166). Meanwhile, there is growing criticism in the public sphere about its unforeseen risks (GM Watch, 2020; Ribero, 2020), the lack of time given for ethical reflection (Schultz-Bergin, 2018), and allegations of vested financial interests of the scientists proposing the technology (Ribero, 2020). As such, the issues with CRISPR highlighted to date in media with a global reach are very similar to those raised about GMO. While it remains to be seen how the public debate on modern versions of gene editing

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develop, a review of the evolution of the debate around conventional GMO might offer some indications of what lies ahead.

Numerous publications have aimed to offer explanations for the persistent European negativity to GMO (Bauer et al., 2001; Cook et al., 2006; Maesele, 2015). Nevertheless, there remain gaps in our knowledge of this debate. Filling these gaps and providing a better understanding of the development of the GMO debate in Europe over time could offer some insight into potential issues in the public's response to CRISPR. This paper addresses two remaining gaps in our understanding of the GMO debate through a longitudinal study of the discourse on GMO in the general and agriculture press.

The first gap that this study aimed to address stems from the fact that the majority of studies on the European public debate on GMO focus on the first 10 years after it was introduced (Bauer et al., 2001; Cook, 2004; Marks et al., 2007; Marris, 2001). Indeed, these early years included a significant amount of controversy about the technology. However, as indicated, for example, by the Eurobarometer, public perception of GMO has changed over time and the European public as a whole has become slightly less negative overall since the mid-1990s (EFSA, 2019; Gaskell et al., 2000). However, little is known about how the debate has evolved since the early 2000s.

The second gap concerns our lack of knowledge about European farmers' views on GM crops. Despite the fact that the GM crops available on the global market since the mid-1990s have had clear impacts on farming practice, but provide no obvious changes in the food products that reach consumers, the public debate and academic reporting on GMO have been overly concerned with consumer attitudes (Fischer & Hess, 2021). The GM crops that have dominated the global market since the mid-1990s are herbicide tolerant and insect-resistant (Bt) crops. Herbicide tolerance makes weeding easier and insect resistance reduces the need for spraying pesticides (as long as pests do not develop resistance), that is, both modifications simplify farm practice and potentially reduce the need for labor (Fischer & Eriksson, 2016). In the EU, where only one insect-resistant maize is accepted for planting and is grown only to a limited extent, farmers mainly get in contact with GMO through fodder imports of GM soy. GM fodder is generally somewhat cheaper for farmers than conventionally produced fodder. However the meat and milk from animals that have eaten GM fodder are not labeled, so there are no obvious effects for consumers (Fischer & Hess, 2021). In fact, European consumers rarely get in contact with GMO in food products at all. Despite this, European farmers have been given a limited voice and generally little attention in the GMO debate (Fischer & Eriksson, 2016; Fischer & Hess, 2021; Gaskell et al., 2000; Legge & Durant, 2010). Farmers have generally only been present in the debate in the subject position of the "poor farmer in the Global South" (Herrick, 2008; Whitty et al., 2013). Recent statements on CRISPR indicate that this focus has continued to the present day (Gates, 2018).

The aim of this paper is to contribute a better understanding of these two issues from a longitudinal study of the debate on GMO in food and agriculture in Sweden. With the objective of learning more about how the debate in the farming community compares with the public debate overall and the extent to which issues of importance to farmers also feature in the general public debate, we compared coverage of GMO in food and agriculture in the largest Swedish daily and evening papers and the major agricultural magazines between 1994 and 2018. The research questions guiding this study were:

- (1) How does the media discourse in Sweden on GMO in food and agriculture relate to the dominant European discourse as described in the academic literature?
- (2) Has this discourse shifted over time in terms of topics and tone of reporting? If yes, how?
- (3) What attention has been given to farmers and topics of importance to Swedish farmers in the media discourse in Sweden compared with that given to consumer issues?

To answer these questions, a content analysis was undertaken of 1399 articles in the general and agricultural press between 1994 and 2018, examining the topics that dominated in both types of the

press in that period and how the tone of reporting shifted over time. To understand the attention given to farmers and farmers' issues in the general press, we compared the reporting in the general press and agricultural press of topics concerning farmers versus consumers and particularly reports about food and feed.

Sweden is one of very few European countries where farmers are unable to purchase animal fodder based on imported GM soy, which is generally expected to be cheaper for farmers than conventionally produced fodder (Eriksson et al., 2018). This issue has been a topic of debate in Sweden's farming community on a number of occasions over the years. Focusing the analysis on coverage relating to GM feed was intended to provide some insight into the extent to which the debate in the Swedish media was dominated by specific regional features (such as GMO in animal feed), compared with topics that have been reported as common in the European debate on GMO overall, and the extent to which farmers' concerns also attracted attention in the general media discourse. To provide a better understanding of how the debate on these topics shifted over time, attention was paid to what are referred to as breakpoints in the debate, that is, instances where the intensity and focus of the debate clearly shifted. The expectation was that these shifts would be influenced by events in the broader political and economic landscape, as well as intertextually by the influence of related discourses (Carvalho, 2008; Fairclough, 1995; Hess et al., 2012).

2. Swedish public and media debate on GMO

Sweden has a comparatively large biotech sector and is one of only a handful of EU member states never to have voted against GMO applications (Mühlböck & Tosun, 2018). Kurzer and Cooper (2007) show how Sweden is unique in the significant discrepancy between its voting behavior in the EU and the fact that Swedish citizens are more negative about GMO than the average European citizen. The 1996 Eurobarometer showed that Swedes were more skeptical than the average EU citizen, but that they also were comparatively knowledgeable about the technology (Gaskell et al., 2000). The 2010 Eurobarometer on biotechnology indicated that Swedes continued to be more skeptical about GMO overall than the average EU citizen (Eurobarometer, 2010). A 2018 Swedish study of 1074 Swedish citizens (Stockholm Consumer Cooperative Society, 2018) indicated that Swedish people were less negative about GMO now than in the past, but that slightly more than half of the Swedes are still concerned about the environmental effects of GMO, and just under half are concerned about the dominance of a few multinational companies in relation to what is grown and its negative effects on health. In summary, the key areas indicated in research as explanations for this skepticism of GMO among Swedes are, in no particular order, ethical aspects, concerns about risk to health and the environment, unnaturalness, lack of perceived usefulness, and skepticism about multinational companies (Fischer et al., 2020).

We identified two studies on the Swedish media debate concerning GMO (Bauer et al., 2001; Olofsson, 2002). Olofsson (2002) reports on one of the earlier studies about the media debate on biotechnology. She performed a quantitative content analysis of the media discourse on gene technology between 1973 and 1994 in the Swedish independent liberal daily newspaper *Dagens Nyheter* and identified four waves of attention directed at the technology during which the themes in the debate shifted. In the late 1970s, attention was centered on risk and safety aspects, but this shifted to a focus on ethics in the early 1980s, and then to regulation in the late 1980s. Finally, towards the 1990s, there were increasing reports on actual applications of the technology. Olofsson (2002) also shows that the debate intensified, with increasingly more articles on the topic throughout her study period.

Bauer et al. (2001) compared the press coverage of biotechnology in the elite mass media (i.e. media addressing an elite audience in the public sphere) between 1992–1996 and 1997–1999 in 15 countries, including Sweden. The authors identify the period 1996–1997 as a “watershed,” as indicated by the steep rise in coverage on the topic overall and an increase in the variety of topics being reported. This finding is also supported by others (Fischer et al., 2020; Marks et al., 2007). The

authors conclude that in the 1990s, food and agricultural applications of biotechnology for the first time featured more prominently in reporting than biomedical applications. This shift was particularly dramatic in Sweden, where there was initially a relatively high number of articles about medical biotechnology before this number dropped significantly, following the wider trend of attention shifting towards food and agriculture. The authors also conclude that overall reporting became more homogenous between countries over the period studied. Little is known, however, about how the Swedish media reported on GMO after the 1990s.

3. Conceptual framework

In deciding what to report and what to repeat, the media are important in shaping public debate with their influence over the topics being included, disseminated and kept in the headlines (Carvalho, 2010; Dearing et al., 1996; Galata & Liu, 2017; Gaskell et al., 2000). Research shows that although the media generally shift their focus quite rapidly, certain issues also live on (Rogers et al., 1991). There is a form of continuity through a change in which articles build on other articles intertextually and issues are reinterpreted and developed (Carvalho, 2008). Rogers et al. (1991) show how particular issues manage to continue to feature as the media shifts its attention elsewhere, and are reshaped as news by being connected to new topics currently regarded as news, that is, they are framed differently. For example, Cook et al. (2006) show how the British media reframed the GM debate in 2003 by discursively connecting it with the invasion of Iraq, as such keeping the GM issue in the headlines. As discussed in the introduction to this article, the role of GMO for poor smallholders in the Global South is one such issue that seems to have been able to persist throughout the 20 years of debate on GMO, and also continue with the emerging discourse on CRISPR (Gates, 2018).

Understanding how articles build on each other intertextually or how issues are reframed as news as a debate moves to focus on new issues requires longitudinal studies, however, in relation to media discourses these remain rare (Carvalho, 2008). Studies of changes in media discourses over time frequently look at periods where there is a shift in intensity and topics. Rogers et al. (1991) describe such shifts as “cycles,” while Olofsson (2002) and Geiß (2011) talk about “waves” of media attention in which attention fluctuates and peaks are associated with particular issues being framed together with other news events that vary over time within the wider discourse. While Olofsson (2002) identifies waves based on a visual interpretation of the shifting intensity in reporting, Geiß (2011) draws on a statistical model to identify spikes in the attention given to a particular issue. In this paper, we instead draw on Hess et al. (2012) to statistically identify the points in time when the shift from one regime (or cycle or wave) to the next occurs (the methodology for doing so is described in Section “Breakpoint analysis”). These are referred to as breakpoints. The period between two breakpoints is a regime during which a topic is reported in a particular way (similar to what Olofsson (2002) calls waves or Rogers et al. (1991) calls cycles). A breakpoint marks a shift in the reporting for which there may be various explanations, for example, waning interest in the topic, another issue taking over media attention, or a societal event that leads to a shift in coverage of the particular topic. Our framing of regimes separated by breakpoints resembles how Carvalho (2008) talks about critical discourse moments as “periods that involve specific happenings, which may challenge the ‘established’ discursive positions”. She further writes that such moments might be defined by several factors such as “political activity, scientific findings or other socially relevant events” (Carvalho, 2008, p. 166).

4. Material and methods

Newspaper articles were retrieved from the Retriever Research Database through a search of titles and introductory paragraphs. The search period was set as 1 January 1994 to 2 January 2018. The end date represents the date on which the search was performed. The starting date was based on previous research that indicated 1995 to be the year when the public debate on GMO exploded

Table 1. Publications included in the analysis.

Newspaper	Number of readers ^a (Printed press and web)	Available in Retriever media archive since (Printed media or web)	Media type
Dagens Nyheter	5,83,000 (2019)	1991-11-13	Daily newspaper
Svenska Dagbladet	3,60,000 (2019)	1995-01-01	Daily newspaper
Göteborgs-Posten	2,76,000 (2019)	1994-01-02	Daily newspaper
Sydsvenskan	1,72,000 (2019)	1998-10-27	Daily newspaper
Aftonbladet	5,15,000 (2019)	1994-09-01	Evening newspaper
Expressen	2,84,000 (2019)	1990-01-02	Evening newspaper
GT	96,000 (2019)	2000-01-16	Evening newspaper
Kvällsposten	93,000 (2019)	1998-10-16	Evening newspaper
Land Lantbruk	1,82,000 (2019)	2002-01-01	Agricultural press
ATL	1,25,000 (2017)	1999-11-12	Agricultural press
Jordbruksaktuellt	4595 (2019)	2004-10-18	Agricultural press

^aData from Retriever media archive: retriever.se

in Sweden (Fischer et al., 2020) and was set at one year prior to this to ensure that the start of the debate was captured.

The newspapers analyzed were selected based on their readership and press type. Compared with the two previous studies on the media debate on GMO in Sweden (Bauer et al., 2001; Olofsson, 2002), the present study broadens the empirical basis. Both Bauer et al. (2001) and Olofsson (2002) based their study on the Swedish independent liberal daily newspaper *Dagens Nyheter*, while the present study was based on the four largest daily newspapers (including *Dagens Nyheter*), and the four largest evening papers, consequently covering the vast majority of the Swedish readership (Hedström, 2016). These press types target slightly different groups of readers, with evening newspapers traditionally being directed more at the working class (Cook, 2004). Table 1 lists all the newspapers analyzed and their political orientation and readership. It should be noted that most of the largest daily and evening newspapers in Sweden class themselves as liberal. In order to capture the GMO debate within the agricultural sector, three major Swedish agricultural publications were also included: *ATL*, *Jordbruksaktuellt* and *Land Lantbruk*. Both printed and web-based articles from the selected sources were included.

The search string, developed to capture all relevant articles on GMO and farming or food, was designed in Swedish as follows: (GMO OR genmodifier* OR genteknik OR bioteknik OR genmanipul* OR “genetisk* modifier*” OR “genetisk* manipulera*” OR “GM gröd*” OR genförändr* OR CRISPR) AND (Jordbruk* OR lantbruk* OR bonde OR bönder OR mat OR livsmedel OR äta OR foder). It included variations on the word GMO (e.g. genetically modified, gene edited, biotechnology or CRISPR) combined with variations of words for farming, farmer or food.

The search resulted in 1644 articles (730 in printed publications and 914 on the internet), of which 1602 had accessible full texts. Of these, 136 duplications were removed and 1466 full-text articles were downloaded into a Word document. Another 67 articles were manually removed during the analysis because they were not about GMO. This resulted in a final number of 1399 articles for analysis.

The article background data (newspaper source, date, and title) were saved in an Excel file and all the articles were assigned a random number. A survey was then developed using the online tool Netigate to facilitate content analysis.

4.1. Content analysis

The online survey tool was designed by the first author to record topics related to GMO that were expected to appear in the texts based on background information about the European and Swedish

public debate on GMO, as described in the introduction and background sections of the present paper (see also Fischer et al., 2020). Each article was read while responding to each of the survey questions. The full survey can be found in Appendix Table A1, with topics in focus in the present paper marked in bold. The present study paid particular attention to the recorded topics of consumer issues, farmers' perspectives, mention of GMO as food or feed, and the overall tone of the article.

During a two-week trial, the first author and two research assistants coded the articles using the online survey tool. In the pilot phase, questions in the survey were discussed and adapted to ensure valid and reliable answers and consistency in the coding. Some new questions were added to the survey tool during the pilot phase in response to topics emerging from the dataset that had not been expected based on the background literature. The two research assistants then coded all the articles in a non-chronological order under the supervision of the first author.

Calculation of most reliability measures requires that for a substantial share of the dataset at least two coders have each rated the same article. This was not possible in this case given a large number of articles in the data set and the time available for the task. We, therefore, statistically tested the inter- and intra-coder reliability according to the following procedure:

Given the large number of coded articles ($N = 695$ for coder 1 and $N = 698$ for coder 2) and the completely random assignment of articles to coders, we expect the mean rating for each variable to be statistically identical between both coders unless there would be a bias in the way one or both coders coded the articles. Thus, we can interpret these means for each variable as individual ratings from each coder. For these calculated means, we proceed with the calculation of Krippendorff's alpha (calculated for ratios) and obtained a value for the alpha of 0.9597, which is sufficiently above the usually recommended critical value of 0.8.

In the next step, we tested if articles from different newspapers may have been coded in a systematically different way by one of the two coders. For example, individual coders may have been biased with respect to the overall tone on the topic in a certain newspaper or may have had a different attitude towards articles in the agricultural press in comparison to general newspapers. In order to test for the presence of potential biases regarding the coding of articles from specific newspapers, we regressed ratings from each coder, respectively, on dummies for each newspaper and then tested for equality of the obtained regression coefficients using *F*-tests. Results from this procedure are available upon request and suggest that there is no systematic bias according to which the coders have assessed the articles across newspapers.

We recorded whether or not publications mentioned "farmers' perspectives" despite having little expectation that these would feature much beyond the agricultural press. This category was included to be able to identify whether farmers' perspectives were being discussed at all in the general media. The articles were coded as discussing farmers' perspectives if they discussed farmers' opinions, producer issues, or general agricultural issues. An article was coded to discuss consumer issues if, for example, it mentioned food prices, consumers' opinions, and opportunities to choose whether or not to purchase GMO. The questions allowed for multiple responses, thus an article discussing labeling from a consumer perspective would be coded for both labeling and consumer issues.

The code "purpose of modification" was added to the survey specifically to be able to separate out references to GMO for food or feed. The reason for making this distinction was that in some periods there had been extensive debate, especially in the farming community, about whether or not Swedish farm animals should be given GM fodder.

Lastly, each article was coded for whether it gave the reader a positive (1), negative (-1), or neutral (0) impression of GMO overall. This part of the analysis was guided by the overall argument or impression given when reading the full piece, but was supported by a search for adjectives and nouns with negative or positive connotations in relation to GMO. Words in negatively coded articles included "against," "warning," "stop," "dangerous," and "complicated," whereas positively coded articles contained words such as "for," "good," and "increased harvest." During the two-week

pilot period, the two research assistants and first author coded the articles together to develop consistency in the coding between coders. Furthermore, any articles that were unclear were checked by both research assistants and the first author. Articles without a clear positive or negative tone, with an absence of positively or negatively charged words, where the message was ambiguous or where the two sides were perceived as balancing each other out, were coded as having a neutral tone. This means that there might be a slight over-classification of neutral articles. The survey data for the 1399 articles were exported to Excel for further analysis. With the aim of answering the three research questions, the daily and evening newspapers were grouped together, representing the general public discourse on GMO, and the three agricultural magazines were grouped together, representing the agricultural discourse on GMO. The content analysis focused on describing the topics dominating the debate in the general and agricultural press respectively, and changes in the respective discourses over time. Particular attention was paid to shifts over time with regard to the topics “consumer issues,” “farmers’ perspectives,” “food,” and “feed.”

4.2 . Breakpoint analysis

To aid this part of the analysis, we performed a statistical time series analysis to detect structural breaks in coverage of the studied topics. Time series data of small discrete events (counts) could be analyzed in different ways, out of which the simplest and most intuitive would clearly be visual inspections. This method reaches its boundaries when we deal with visually small changes where it will be difficult to ensure standardized interpretation over time or across graphs. We, therefore, propose statistical breakpoint analysis as an approach that is initially more cumbersome, but that has a major advantage that it yields reproducible results. Statistical testing for the presence of structural breaks in the media discourse followed the methodology developed in Hess et al. (2012). This approach is based on the assumption that the media discourse is composed of a time series of discrete counts of articles (y) per month (t). Each of these time series of counts of articles addresses a topic (m) related to GMO: $y_{t,m}$. Given the relatively small number of discrete counts of articles per month, it was assumed that each $y_{t,m}$ follows a Poisson distribution:

$$y_{t,m} \sim \text{Poisson}(m)$$

The Poisson distribution is the distribution of small discrete events, such as zero, one, two, or three events per month. This statistical distribution can be described by the parameter λ , which defines both the central tendency (mean) and spread (variance) of the statistical distribution function. Thus, the breakpoint indicates a point in time when the average number of articles on that topic changes. For example, prior to breakpoint k , there were on average 2.3 articles per month on topic m , and in the regime starting from breakpoint k onwards, the Poisson distribution showed an average of 0.7 articles per month. In this example, from the month of the breakpoint onwards, reduced attention appeared to be given to topic m . We would interpret such a decline in the average attention given to topic m as media attention possibly shifting to other topics or overall interest in GMO possibly also declining. In turn, an increase in the average number of articles per month following a breakpoint would be interpreted as evidence of increased attention on topic m .

A time series of media articles on topic m without an identified structural break consequently has to be interpreted as a fairly constant discourse over time, according to the constant average number of statements per time unit and a constant variance.

Following Hess et al. (2012), each of these m Poisson distributions was modeled as a Monte Carlo Markov Chain (MCMC) Poisson change-point process (Chib, 1998; Park, 2010). This is a statistical simulation technique that allows a certain number (k) of breakpoints to be specified for a time series of counts of media articles that all address a certain topic (e.g. one time series represents the count of all articles that address topic m = “consumer issues”). The simulation then splits this time series of counts of articles into $k + 1$ time regimes (separated by k breakpoints). In order to determine the optimal number of k breakpoints, models with alternative values for k are estimated

for each of the m topics and the most suitable model selected based on statistical model selection criteria (see Hess et al. (2012) for a detailed description of the statistical methodology).

It should be noted that conventional regression analyses, such as Poisson regressions, are not suitable for this type of analysis. A regression model by definition estimates regression parameters over the entire dataset, for example, the entire range of the time series. Detecting multiple break-points within a time series without prior knowledge or hypotheses about the date at which a break-point may occur is difficult, if not infeasible with conventional parametric regression models.

5. Results and discussion

The analysis indicated an initial period of intense reporting around 1996–1997, after which the intensity waned a little, with new intense periods of reporting in around 2000 and 2003–2004 (Figure 1). Olofsson (2002), who studied the Swedish debate on GMO from 1973 to 1994, found that over that time period the reporting on biotechnology increased steadily. Taken together, our analysis and that of Olofsson (2002) thus indicate that the topic experienced increase in attention for thirty years from the 1970s, after which there was a decline up to 2018 (a distinct peak in reporting in 2014 breaks the pattern, but does not change the trajectory of overall decline).

The agricultural press, for which there are only data from 2000, indicated a fairly similar pattern of shifting intensities in reporting over time as the general press. However, the pattern in the agricultural press lagged in time somewhat after the general press, suggesting that the agricultural press was largely influenced by how the debate on the topic was evolving in the general public discourse.

Figure 2 shows how the tone of reporting changed over time. This was calculated by adding up the coded tone (−1 (negative), 0 (neutral), or 1 (positive)) of all articles for the respective press type for each year. The coverage in Swedish general newspapers was intense and at its most negative in 1997. The deeply negative debate on GMO in the mid-1990s followed the trend in other European countries at that time (Bauer et al., 2001; Gaskell et al., 2000), and supports the finding of Bauer et al. (2001) that the Swedish debate, like the European debate, was particularly intense at this time. This was early on in the GMO debate and the key issues that would subsequently dominate the discourse had not yet been firmly identified. Several events took place and received attention in the wider

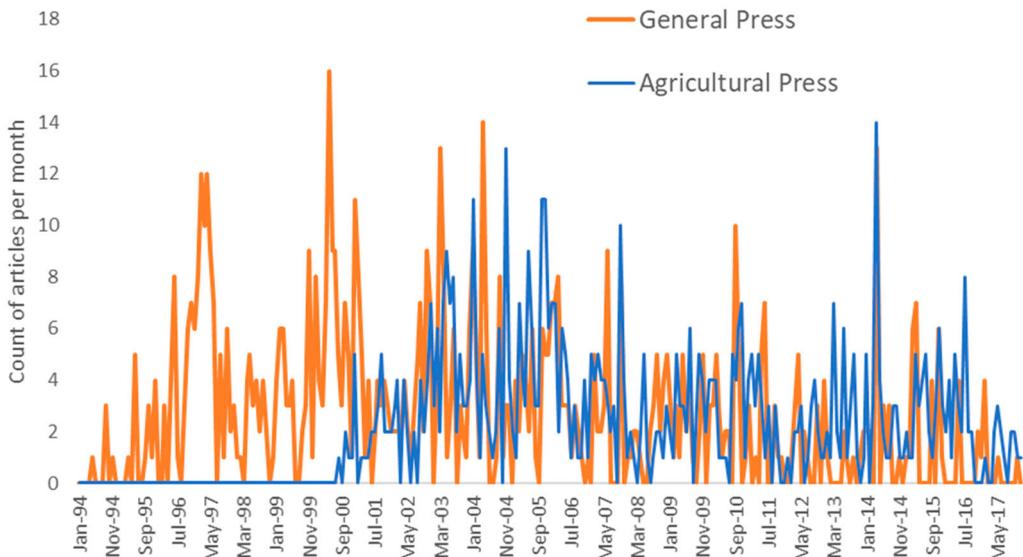


Figure 1. Frequency of reporting over time. Source: Own presentation based on dataset.

Note: Data for agricultural press was not available prior to 2000.

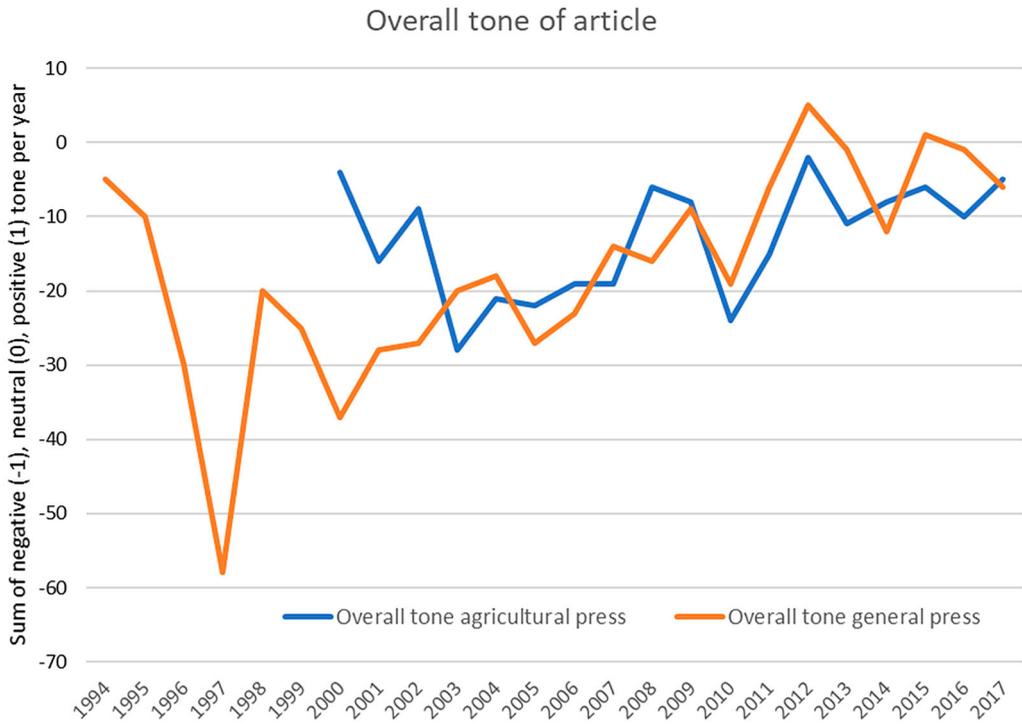


Figure 2. Tone of reporting over time. Source: Own presentation based on dataset.

European public debate around this period. In 1994, the first GMO, the “Flavr Savr” tomato modified for longer shelf life, was launched on the US food market. In 1996 major UK food retailers started selling tomato paste for which this technology had been used. It was initially popular, but soon received a lot of negative coverage, for example, through NGO-driven consumer awareness campaigns (Bruening & Lyons, 2000). In 1996, the suspected (and subsequently confirmed) connection between the first human death from a variant of Creutzfeldt–Jakob Disease (CJD) in the UK in 1995 and earlier outbreaks of BSE in cows was made public (Ansell, 2006). This led to a long and heated public debate and widespread public distrust in the governance of food safety in the UK that spilled over to other EU countries. In the same year, Greenpeace launched highly publicized campaigns to block the import of GMO soya to the EU, and consumer awareness campaigns were run in which consumers were encouraged to report GMO products in stores (Krenzler & MacGregor, 2000). The most common issue discussed in the studied articles from 1996 was GMO food and labeling of the GMO content in food products. In 1997, significant attention was paid to the risks of eating GMO food, indicating that the Greenpeace campaign was also having an impact on the debate in the Swedish media. Examples of typical headlines during the year include “Do you dare to eat the genetically manipulated food”, “Greenpeace wants to stop genetically manipulated food”, and “The life-threatening soy”. The tone was contentious and overall negative to GMO, with frequent use of the term “manipulated” and its clearly negative connotations. This term disappeared almost completely from Swedish media reporting in later years. However, while other studies have suggested that these events were formative of the longer-term negative debate on GMO in the EU (Marris, 2001; Stephan, 2012), our analysis shows that from 1997 the Swedish debate steadily becomes less negative over time (Figure 2). Towards the end of the period studied, the reporting was close to neutral in overall tone. This is an interesting finding given the fact that most media studies on GMO in Europe have focused on the early years when reporting was heated and negative (Bauer et al., 2001; Herrick, 2005; Stephan, 2012).

Figure 3 displays the frequency of reporting on a selection of the topics studied. The dominant topics reported on were related to trade and regulation (including issues of coexistence and labelling), consumer issues, and food. In line with the general tendency in Europe as reported in other studies (Cook et al., 2006; Gaskell et al., 2000; Herrick, 2005), there was a substantial focus on consumer issues and on food, particularly in the general press. This may be related to the formative impact on the discourse of the initial widespread distrust in food safety authorities resulting from the British scandal with the initially refuted and later confirmed connection between the human deaths to a new variant of CJD and BSE in cows in the 1990s (Ansell, 2006). Other early formative influence on the media focus on consumer issues and food are the highly publicized campaigns against GMO in food in the 1990s (Krenzler & MacGregor, 2000). Regulation, trade, and coexistence have been ongoing issues of importance in the EU, due to the centrality of the governance of trade within the union as well as between the EU and other global markets (Krenzler & MacGregor, 2000; Stephan, 2012).

In 1997, the only GMO to be legally grown in the EU was Monsanto's insect-resistant Bt maize (MON810). The authorization of this maize led some EU countries to voice intense resistance, declaring that they would ban GMOs from their territories (Carson & Lee, 2005; Krenzler & MacGregor, 2000). As a result of this intense debate, in 1999 the EU instated a de facto moratorium on further acceptance of GMO products, which lasted until 2004 when legislation was in place. The moratorium led to a long-lasting trade dispute between Europe and the US in particular (Krenzler & MacGregor, 2000; Pollack & Shaffer, 2000). This clearly received attention in the Swedish press, with headlines such as "The US and EU in food war" and "EU quarrel about gene-food". The topic of coexistence (legislation that allows farmers growing GMO and those not growing GMO to coexist), introduced in the EU in 2002, has been intensely debated in the EU (Binimelis, 2008). This spilled over into the Swedish press, as indicated by the many times it was mentioned (Figure 3).

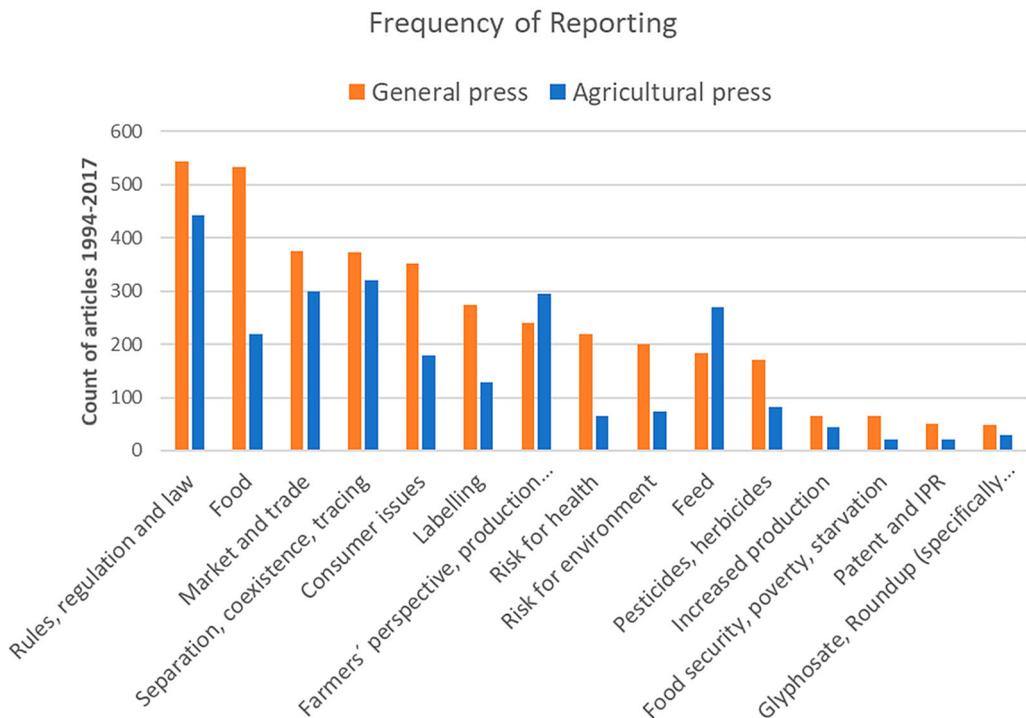


Figure 3. Frequency of reporting on key topics. Source: Own presentation based on dataset.

The topic of coexistence should be seen as fairly characteristic of the EU debate on GMO, with comparatively little attention being paid to it in contexts outside the EU (Fischer & Eriksson, 2016).

As expected, farmers' perspectives were more commonly reported in the agricultural press (Figure 3). However, it is notable that they were also quite commonly given coverage in the general press. This contrasts with the very limited attention given to European farmers in the academic debate on GMO (Doxzen & Henderson, 2020; Fischer & Hess, 2021). In contrast, and rather surprisingly, the topics of food security, poverty and starvation were only given very limited coverage in both press types (Figure 3). These topics have been central in academic debates on GMO and equally important to how both scientists and companies have justified the relevance of their new products and inventions (Glover, 2010; Herrick, 2008; Paarlberg, 2010; Whitty et al., 2013; Zerbe, 2004). The very limited reporting on the topic in the Swedish press indicates that Swedish reporting has focused on issues closer to home. Indeed, an examination of the geographic regions featuring in the study sample indicates that the overwhelming majority of articles reported on events in Sweden or the EU, and that apart from the US (approximately 5%), other regions were barely mentioned at all (Appendix Table A1).

Moving on to the breakpoint analysis (Figures 4–7), this paper focuses on a presentation and discussion of the topics of food, feed, consumer issues, and farmers' perspectives. Results for other GMO-related topics are available from the authors upon request. It was expected that there would be substantial overlaps in reporting of food and consumer issues because overall consumer issues concern food while reporting on food might be broader than merely concerning consumers. This was confirmed in the analysis of the general press, where the pattern of coverage of consumer issues and food was similar with respect to the occurrence of breakpoints. However, in the agricultural press, the coverage of these two topics was considerably less intense and much more stable over time, as indicated by the overall absence of structural breaks. Based on the number of breakpoints, the coverage of food and consumer issues in the agricultural press was always more stable than that in the general press, which can be interpreted as an indication that new issues related to these topics generated less resonance in the agricultural media.

Similarly, the topics of farmers' perspectives and feed were expected to align somewhat, with feed to farm animals being an issue that overall concerns farmers more than consumers (although it has recently turned into a consumer issue as well, as indicated in the wider European debates on the labeling of food products from animals that have been fed GMO (Castellari et al., 2018)). This was confirmed by our analysis: the structure of breakpoints in the topics "feed" and "farmers' perspectives" revealed similar patterns for each of these topics, both in the agricultural and general press. This paper examines only a few regimes and breakpoints in detail to indicate the core findings.

First, looking at the overall tendencies, vibrant reporting on both food and consumer issues could be observed in the general media in the early years of the study period (Figures 4a and 5a). Until the end of 1998, there were several shifts in the pattern of reporting, suggesting that new ideas were being injected into the discourse and that these topics were attracting significant attention. It also indicates that the Swedish debate was following the wider European debate at the time, which was contentious and intense and focused on consumer issues around labeling, food, and health risks (Bauer et al., 2001; Gaskell et al., 2000). However, after 1998 the discourse remained fairly stable until mid-2004 to early 2005, when it moved into a new regime with a lower intensity of reporting, which lasted until mid-2010 to mid-2011 when reporting on these topics overall declined even more in intensity. In 2004, the EU lifted the moratorium that had been in place since 1999, meaning that in theory, it was possible again to allow new GMOs into the EU. Looking at the newspaper headlines from that time, it is clear that from around 2004 there was a shift in focus and intensity away from consumer issues towards GMO in farming (e.g. "Genetically modified rapeseed grown in Skåne", "EU ministers in disagreement about GMO maize"). This was perhaps generated by wider expectations that the lifting of the moratorium would imply authorization of more GMOs for growing and import into the EU, with a particular

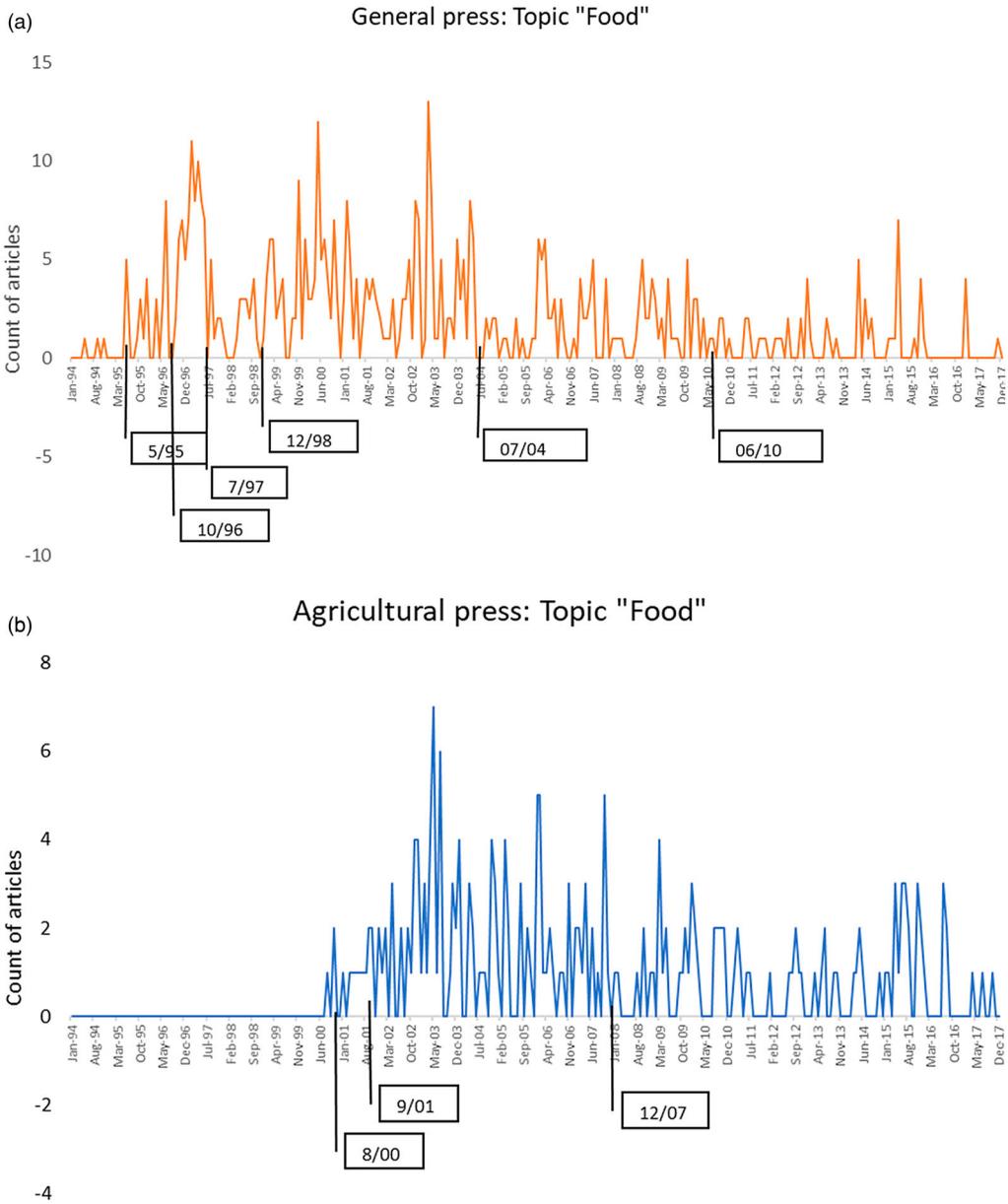


Figure 4. Intensity of reporting over time in the general press on food, indicating breakpoints in the debate. Source: Own presentation based on results. Intensity of reporting over time in the agricultural press on food, indicating breakpoints in the debate. Source: Own presentation based on results.

impact on farmers. We now know that this did not happen because as yet there are no new GMOs on the EU market after the one variety of Bt maize was allowed in 1997. This might have led to the reduced intensity in reporting after 2004.

Looking instead at how the agricultural media reported on food and consumer issues (Figures 4b and 5b), it is clear that consumer issues were more of a background issue in the agricultural press, without significant shifts in reporting (as indicated by only one breakpoint in the reporting on the topic and the lower average count of articles per month). Consumer issues could thus be interpreted as being fairly unimportant in shaping the discourse on GMO in the agricultural press, whereas the

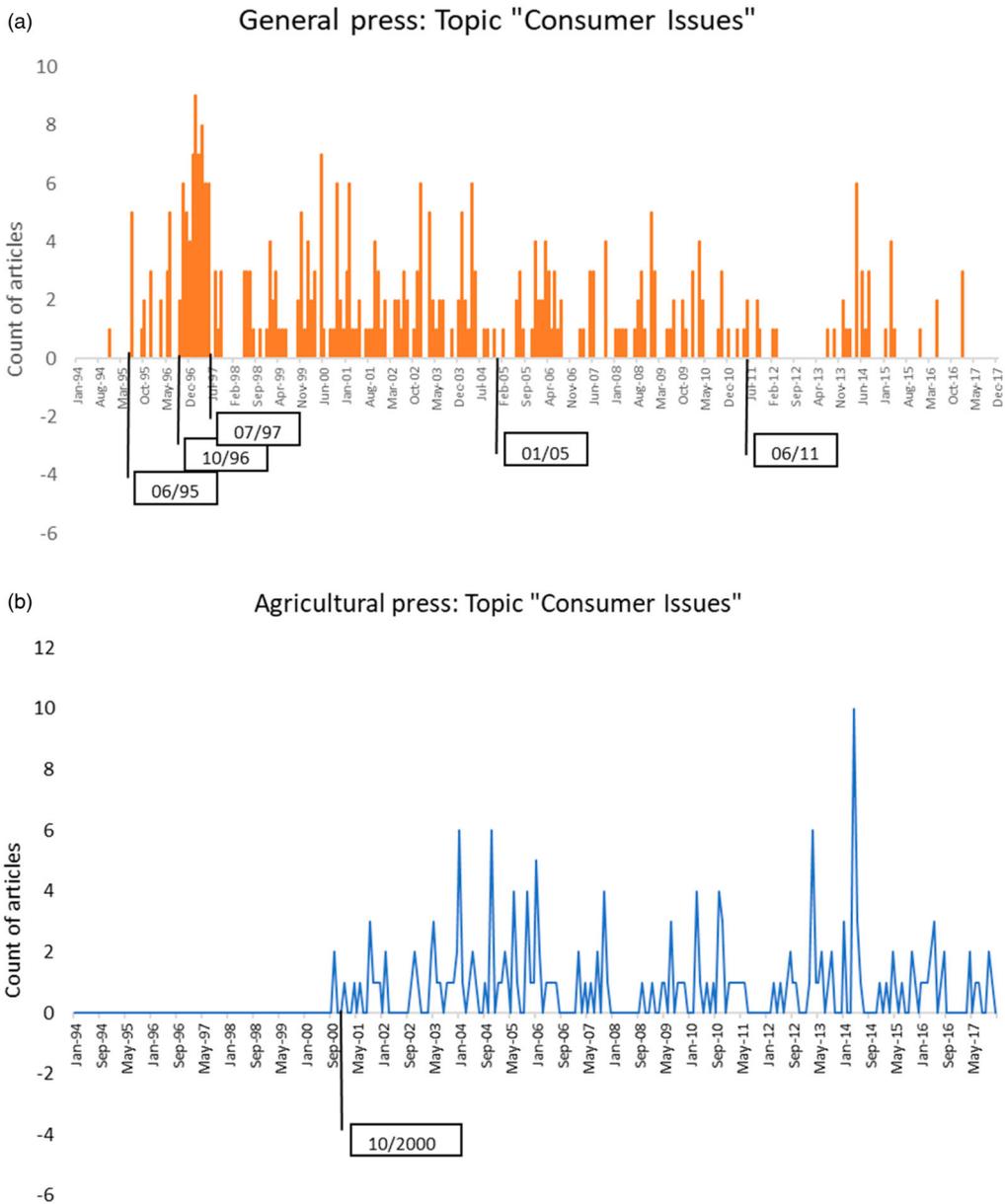


Figure 5. Intensity of reporting over time in the agricultural press on food, indicating breakpoints in the debate. Source: Own presentation based on results. Intensity of reporting over time in the agricultural press on consumer issues, indicating breakpoints in the debate. Source: Own presentation based on results.

issue of food received somewhat more attention in the agricultural press during the early years (Figure 4b).

Turning to feed and farmers' perspectives (Figures 6 and 7), some interesting trends became apparent. Overall, in both the agricultural and general press, it can be observed that these topics shifted into several new regimes of reporting over time, with more frequent shifts early and late in the period, whereas in both press types we can see a decade of comparatively stable and less intense reporting between roughly 2001 and 2011. An in-depth reading of articles published during the early years of the study period indicated that reporting mainly concerned allowing GMO fodder

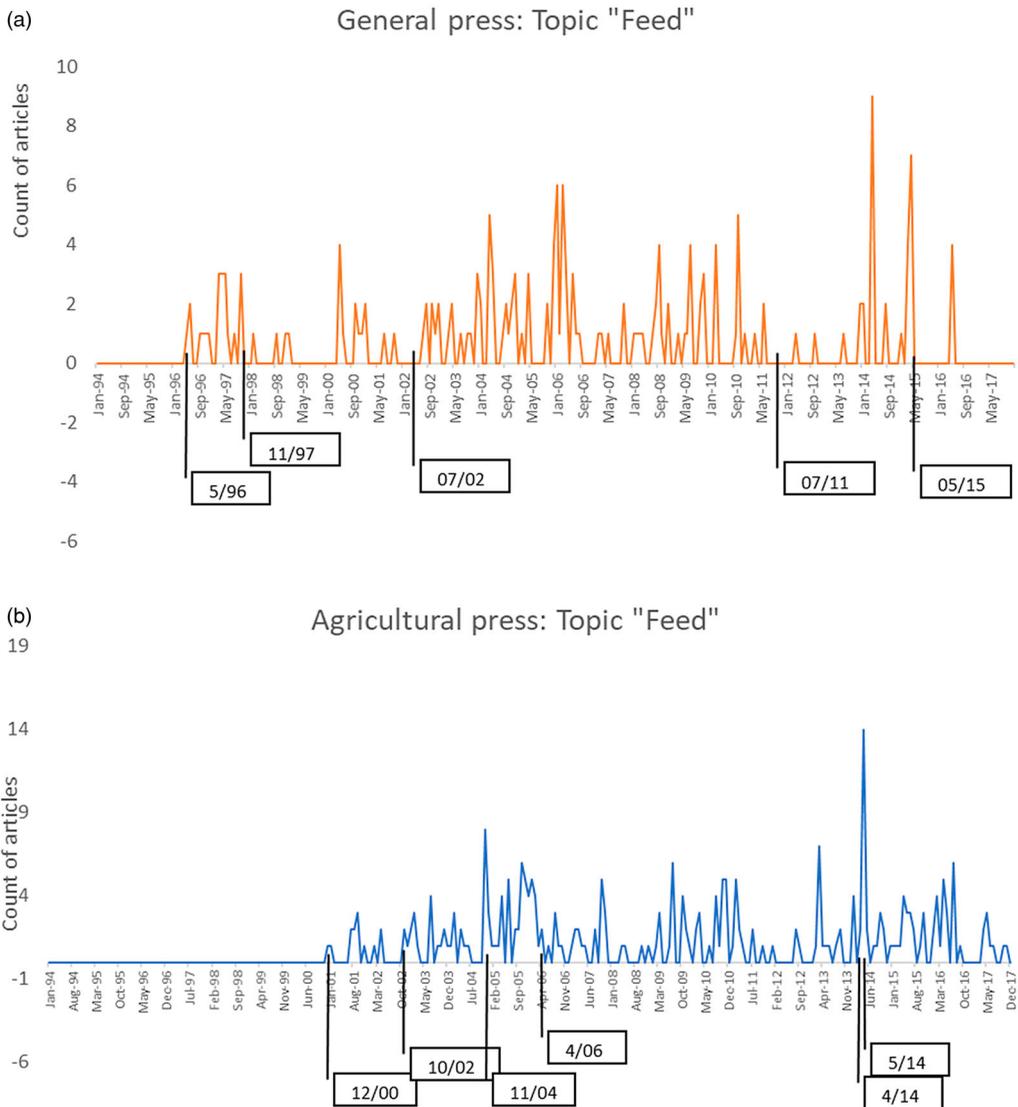


Figure 6. Intensity of reporting over time in the general press on consumer issues, indicating breakpoints in the debate. Source: Own presentation based on results. Intensity of reporting over time in the agricultural press on feed, indicating breakpoints in the debate. Source: Own presentation based on results.

in the EU or not, with different opinion pieces and reported incidents of traces of GMO being found in fodder imports. In later years, the fodder debate shifted to a specific Swedish discourse about whether or not fodder containing GMO allowed elsewhere in the EU should be allowed into the country. This debate intensified from 2014 onwards. Unlike many other EU countries, the Swedish fodder market remains free of GMOs (Eriksson et al., 2018). Due to the country's comparatively small fodder market, importers have judged the costs of separating GMO fodder from non-GMO fodder to be too high. However, GMO fodder is typically estimated to be somewhat cheaper for farmers than conventionally produced fodder, and the issue of whether or not to allow GMO fodder has received regular coverage in the press. In April 2014, the Federation of Swedish Farmers (LRF) and large dairy companies publicly announced that they were considering dropping their (voluntarily adopted) GMO-free policy for fodder. This was an important trigger for the increased

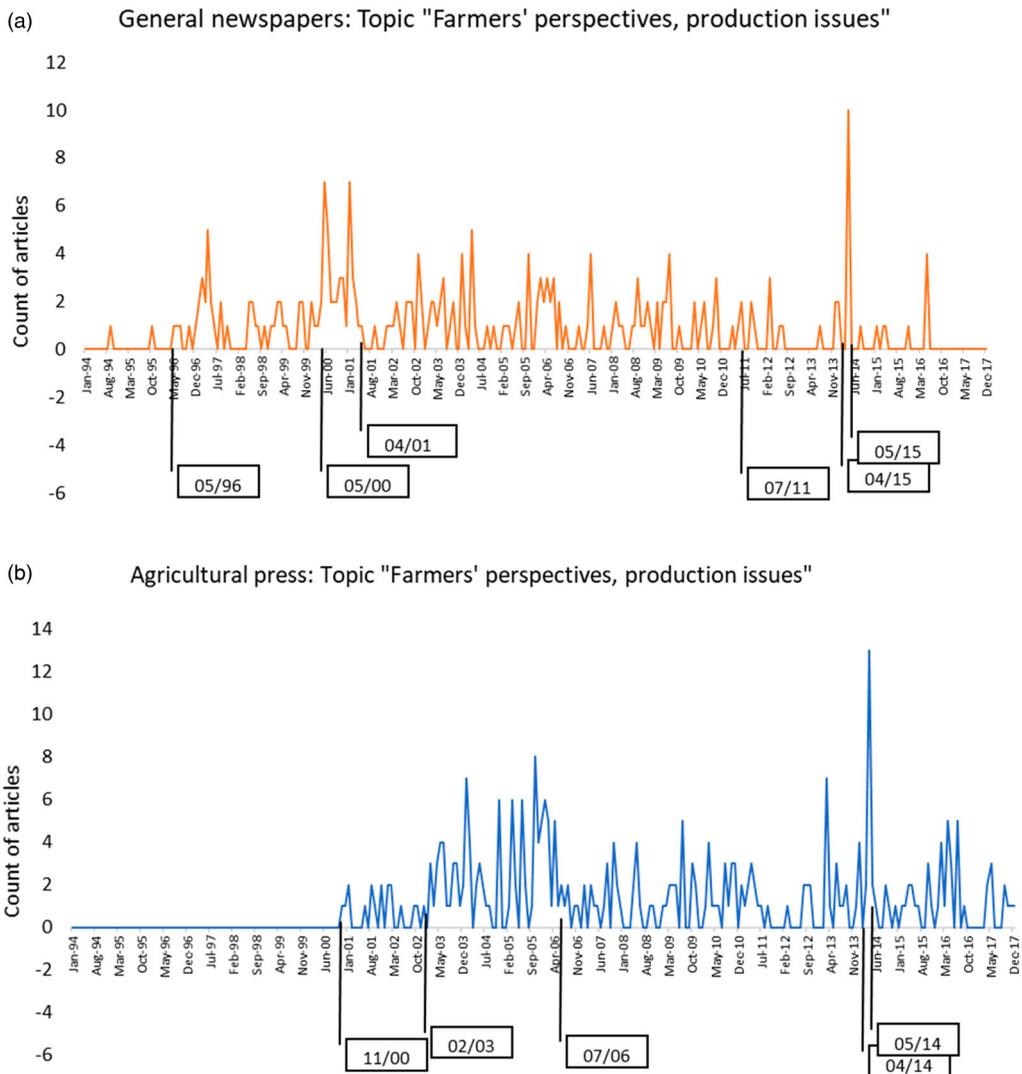


Figure 7. Intensity of reporting over time in the agricultural press on consumer issues, indicating breakpoints in the debate. Source: Own presentation based on results. Intensity of reporting over time in the agricultural press on farmers' perspectives, indicating breakpoints in the debate. Source: Own presentation based on results.

intensity in the debate in the agricultural press that year, as can be seen in [Figures 6b](#) and [7b](#), with graphs on both feed and farmers' perspectives displaying separate regimes between April and May 2014 ([Figures 6b](#) and [7b](#)). Ultimately both the LRF and dairy producers changed course and continued using only GMO-free fodder, and media attention subsequently waned. While also reporting on the fodder debate, the general newspapers appeared to be influenced less by the announcements made by the agricultural and dairy organizations. Instead, a debate article produced by Timbro, a free-market think tank, and the investment bank Carnegie arguing for GMO in fodder imports to be allowed so as to reduce prices paid by consumers, seems to have been an important trigger for the breakpoint in 2015 ([Figures 6a](#) and [7a](#)). Timbro is well-known in Sweden and engages in and attracts media attention for its reports and debate articles on a wide range of free-market topics.

Overall, this study shows that the agricultural press followed the general press in its intensity and style of reporting on GMO, with some time lag, suggesting that the agricultural press was largely

influenced by the general discourse on GMO. As expected, the agricultural press reported more frequently on topics of particular concern to farmers. However, the study also shows that issues of interest to Swedish farmers were given substantial coverage in the general media as well, especially towards the end of the study period.

6. Conclusions

This study has described how the debate on GMO in food and agriculture shifted over time in the Swedish agricultural and general press.

We can firstly conclude that, particularly during the early years covered by this study, the debate on GMO in the Swedish media was clearly influenced by topics that were also receiving significant attention at a European level, including the British BSE scandal, Greenpeace's consumer awareness campaigns, the EU moratorium and the trade war with the US.

Overall, it was found that the Swedish debate centered on issues that potentially had a direct impact on events in Sweden. The attention paid to Europe can thus be largely explained by Sweden being part of the EU, with a common market and common regulation on GMO. What happened in the rest of Europe, therefore, affected Sweden, while what was going on in other countries was largely ignored in the debate. In particular, it is noticeable that the topic of food security in the Global South was almost completely absent from the debate in the Swedish media. As outlined in the introduction to this article, again in relation to CRISPR, major global players are focusing on the usefulness of the technology for resolving issues of food security in the Global South. Our study shows that such claims might, in fact, have a limited impact on local discourses in the Global North, where food security in distant countries is an abstract topic of limited direct relevance to citizens.

Secondly, while most studies on the media discourse on GMO, including the two studies reporting on Sweden (Bauer et al., 2001; Olofsson, 2002), examined the first 10 years after the introduction of GMO, our study spanning more than 20 years shows that over time the debate steadily became less negative, while nevertheless remaining more negative than positive.

The study identified a number of breakpoints where the debate shifted in intensity and content. For an empirical modeling of the discourse on GMO our study can be considered only a first step in the analysis of the structure of breakpoints. In this study, we interpreted identified breakpoints through a qualitative analysis, engaging with secondary literature to explain the breaks and identify factors of potential impact on the shift in discourse. Future research could test for explanatory factors for the occurrence of these breakpoints in a multivariate way, for example, in terms of regression models.

The breakpoint analysis overall indicated that after a vibrant period of debate on consumer issues and food in the mid to late 1990s, there was a long period of stability, with the studied topics receiving less coverage. A revival of the debate can be seen towards the end of the study period, but this revival is largely related to the topics of farmers' perspectives and feed and can be explained by the particular Swedish debate on GMO fodder. However, the attention given to consumers and food waned over time. Overall, the intensity of the debate in the mid to late 1990s, as indicated by the frequency of breakpoints, was not repeated during the study period. Future studies will be able to reveal whether the same intensity of the public debate is repeated following the emergence of CRISPR.

The shift in attention in the general debate from food and consumers to feed and farmers during the study period indicates that issues of importance to farmers were given more attention than expected in the Swedish media debate, particularly more recently. The relative centrality of Swedish farmers' perspectives in the Swedish media debate and its formative impact on the discourse in later years suggest that the lack of academic attention given to farmers and their perspectives in studies of the GMO debate is unfortunate, as it could have resulted in gaps in understanding of the public discourse on GMO. Our study has made some contributions to filling this gap.

Note

1. This technique can be seen as an advancement of older techniques of genetic modification involving the alteration of an organism's genetic structure by adding, deleting, changing or replacing individual nucleotides or sequences of DNA.

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Appendix

Table A1. Survey used for coding of articles.

Survey question	Response alternatives (words combined in brackets were grouped as one alternative as they were considered to have roughly the same meaning)	Comments on response type and interpretation
Article ID number	The randomised code assigned to each individual article	
Date of publication	Year-month-date	
Headline of article	Free text	
Newspaper source	ATL, Jordbruksaktuellt, Dagens Nyheter, Land Lantbruk, Svenska Dagbladet, Aftonbladet, Expressen, GT, Kvällsposten	Only one response
Author of article	Media, researcher, private R&D biotech, environmental organisation, agricultural organisation, consumer organisation, other private actors in the food chain (food or feed producer), other (free text)	Multiple responses. In all cases where an article did not have an author, "media" was noted as the response.
Term for GMO	[GMO, genteknik, genetiskt modifierad, genmodifierad, GM], gen, [genetiskt manipulerad, genmanipulerad], [genändrad, genförändrad, genetiskt förändrad], transgen(a), genredigerad, [CRISP, CRISPR/CAS], [bioteknik, biotekniskt modifierad, modifierad med bioteknik, biotech], other (free text)	Multiple responses. All terms for GMO were listed, based on discussion with key informants. Terms that mean essentially the same thing were coded together, noted with brackets here. GMO terms are written here in their original Swedish so as not to confuse this key part of the analysis.
Geographical markers	Sweden, [EU, Europe, European countries], USA, Brazil, Argentina, Canada, India, China, Africa, other geographical marker	Multiple responses. Named European or African countries were coded as Europe or Africa because these geographical areas were of particular interest in this study. Reference to continents was coded as "other geographical marker".
Purpose of GMO	Food, feed , other (medicine, fuel, etc.), not defined	Multiple responses. Food is interpreted to include drinks for human consumption as well.
Type of organism	Maize, soy, rape seed, cotton, other plant (including other specific plants, or "plants" in general), animal, other (anything else), not defined	Multiple responses. "Animal" was coded only when the animal was modified, not when the animal was eating GMO feed. Unidentified plants were coded as "other plant".
Type of modification	Changed for production benefits (including insect resistance, herbicide tolerance, drought resistance, salt resistance, increased harvest, etc.), insect resistance (e.g. Bt), herbicide tolerance (e.g. Roundup Ready, glyphosate tolerance), changed for human health, vitamin enriched (e.g. golden rice, vitamin A enriched, iron enriched, changed oil composition), other modification (e.g. produce fuel, medicine, etc.), not defined	Multiple responses.
Subject position	Media, [researcher, research institute], [private R&D research, biotech, seed producer], [Farmer, farmer organisation], organic farmer, [small farmer, poor, starving people], [the public, people, citizens], [consumers, consumer organisation, costumers], [government, parliament, state agency, municipality], other actors in the food supply chain (stores, grocery stores, food producer, fodder producer), EU, environmental organisation, NGO other, Other	Multiple responses. Actor or role talked about in the third person
Issues of interest 1 out of 2 –	[scientific proof, scientific advancement, technical development, proven, research support], [pesticide, plant protection],	Multiple responses. However, for each issue, the article can only be coded as "not mentioned in

(Continued)

Table A1. Continued.

Survey question	Response alternatives (words combined in brackets were grouped as one alternative as they were considered to have roughly the same meaning)	Comments on response type and interpretation
Issues of interest 2 out of 2	<p>[glyphosate, roundup, glufosinate-ammonium], [farmer's perspective, producer issues, agricultural issues], [consumers issues, food prices, consumers resistance, options in the store etc.], labelling, [quarantined, co-existence, tracing GMO in food/nature, contamination, GMO-free], increased production, [food security, poverty, starvation], risk (in general), environmental risk, health risk, economical risk, [market, trade between countries, competition, profit, export, import, commercial opportunities], [rules, laws, conventions, regulations, permission, prohibition], [patent, intellectual property rights, the possibility to use your own seeds, property rights over natural resources, use GMO seeds several years, terminator technology, terminator genes]</p> <p>[GMO good, GMO good without specifying how, GMO good in other than environmental, health or economic terms, lack of proof that GMO is bad, GMO free is bad], [GMO bad, GMO bad without specifying how, GMO bad in other than environmental, health, or economic terms, "against GMO", "no to GMO", GMO free is good], [GMO good for the environment, GMO has no negative effect on the environment, GMO decreases use of pesticides, GMO safe for the environment, GMO free is bad for the environment], [GMO bad for the environment, GMO increases use of pesticides, more monoculture from GMO, negative risk with GMO spreading, GMO free is good for the environment], [GMO good for health, GMO has no negative effect on health, GMO inventions good for health, GMO free is bad for the health], [GMO bad for health, there might be health risks with GMO, unsure if there are health risks, cancer, allergy, GMO free is good for health], [GMO good for the economy, GMO has no negative effect, GMO free is bad for the economy], [GMO is bad for the economy, GMO has no positive economic effect, GMO free is good for the economy]</p>	<p>text", "mentioned in text" or "main focus in text".</p> <p>Multiple responses. However, for each issue, the article can only be coded as "not mentioned in text", "mentioned in text" or "main focus in text".</p>
GMO tone	Positive, negative, neutral	<p>The tone of the article was coded as positive, negative or neutral. The analysis was guided by overall impression as well as how adjectives and nouns were used in relation to GMO with negative or positive connotations, creating an overall impression. Words in negatively coded articles included "against," "warning," "stop," "dangerous," and "complicated" whereas positive coded articles contained words such as "for," "good," "increased harvest," and "approved." Articles without positive or negative words or where the two sides were perceived as balancing out the argument, or ambiguous cases, were coded as having a neutral tone.</p>

Note: The whole survey used for coding articles, translated from Swedish to English is shown in the table. The survey questions used in the present article marked in bold.