The impact of recommender system changes on production and consumption of news in social media platforms: the case of Instagram

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Abstract

This paper studies the effect of a change in the Recommender System (RS) on the market for news on a social media platform. We exploit cross-type variation in the promotion of content stemming from the announcement of Instagram change in RS that highlighted videos. Introducing a new RS increased engagement—measured by likes and comments—significantly for video content, with a 45% rise in engagement for posts with videos compared to posts with pictures. The effects persist despite initial user backlash and subsequent reevaluation of the RS. In response, news media outlets adapted by increasing the share of video posts by 5%, with improvements in media quality and reductions in video duration, though behavioral adjustments took time. At the market level, audience growth remained stable, but engagement gains were concentrated in video content. Additionally, content creators who increased video production attracted younger audiences and expanded their market share. These findings suggest that the RS change played a central role in reshaping the entire market.

1 Introduction

Recommender systems (RSs) are critical features of most online platforms. According to Gomez-Uribe and Hunt (2015) and Solsman (2018), recommender systems account for more than 80% of viewing choices on Netflix and 70% of watchtime on Youtube. Some studies confirm that RSs affect critically users' consumption decisions on online platforms, while theoretical models predict that

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RSs impact the content production, and raise competition issues.[1] Moreover, in the case of news content on social media platforms, RSs may be crucial for opinion building, specially in politics, and be a key determinant of the configuration of echo chambers. In this article, we study to what extent the change of the RS affects both content production and consumption of news in social media. We exploit the change in Instagram RS occurred during 2022 promoting content with one format over others, to analyze its impact on both consumption and production of news in social media, as well as on the the news market in a social media platform as a whole.

Our paper adds to two main strains of the literature. On one hand, to the growing literature studying RSs. Part of this literature has focused on how these systems affect consumer behavior and surplus, showing that RSs that increase the visibility of items to consumers affect positively their consumption (Aridor et al.; 2022) and induce consumers to search for more products on a platform (Donnelly et al.; 2024). Moreover, by facilitating the comparison among multiple products and their prices, RSs increase the price elasticity of consumers (Lee and Musolff; 2023). While these effects potentially increase competition among suppliers and increase efficiency, RSs also have the potential to distort competition. Some papers have shown that RSs on major platforms may be biased towards self-preferencing of the platform's own products (Farronato et al.; 2023; Lee and Musolff; 2023), or in favor of suppliers that offer more advantageous conditions to the platform (Bourreau and Gaudin; 2022; Peitz and Sobolev; 2022). Furthermore, even in the absence of deliberate biases introduced by platforms, RSs may suffer from biases inherently due to their design and architecture (Fletcher et al.; 2023). These biases may affect competition, for instance, by creating barriers to entry and increasing market concentration (Calvano et al.; 2023).

On the other hand, our paper also adds to the literature studying the increasingly prominent role of platforms (e.g., social media and news aggregators) in news consumption. RSs play an important role in driving consumers towards news articles or posts. Recent contributions have investigated the effects of platforms (and RSs more specifically) on the diversity of online consumption. Holtz et al. (2020) and Claussen et al. (2023) show that recommendation tend to decrease diversity of music or news consumption. Guess et al. (2023) find also that RS impact news consumption on social media platforms. While they do not find evidence of an effect on audience's beliefs in the short-term, Allcott et al. (2020) show that people deactivated from social media tend to lower their levels of polarization. Other studies focus on the quality of online news production. Sandrini and Somogyi (2022) show that platform can have an incentive to pay news producers to maintain them on the platform and foster news quality. De Cornière and Sarvary (2023) investigate the impact of social media platforms' content creation on third-party publishers' investment in news quality. They show that platform's content building has an overall negative impact on news

[1] See Aridor et al. (2022); Donnelly et al. (2024) for empirical papers and Calvano et al. (2023) for a theoretical model.

quality investment. Some studies document the rise of misinformation online and in particular on social media. They point out the need to reduce based on regulation or platform's self-regulation (Allcott and Gentzkow; 2017; Allcott et al.; 2019).

The goal of this paper is to extend these strains of the literature by providing an empirical analysis of the dynamic impact of RS on both sides of the market for news. For this purpose, we focus on the impact of a change of Instagram RS in 2022 that highlights posts with one format over the other: posts with videos vs. posts with pictures. The change occurs in three stages. First, an announcement is made by Instagram's CEO in May 3 indicating the need for a "new, immersive viewing experience". Second, in June 30, through a new announcement, Instagram reveals that all content in video format will be automatically turning into reels, a shorter video format. Finally, as the changes in the RS are widely rejected by many users and Influencers, Instagram decides to reevaluate the RS declaring the reevaluation in July 28.[2]

We collect data on the market for news on social media. Our data consists of more than 23,000 posts published on Instagram from February 2022 to April 2023 by a selection of 21 top French news media outlets from the ranking elaborated by the Alliance pour les Chiffres de la Presse et des Médias. To study content production, we identify the content and format of these posts, video vs. picture, as well of several of theirs characteristics. We also collect all interactions of users with these posts, which comprise more than 43,000,000 likes and 850,000 comments, to evaluate users' behavior. While abiding to privacy regulations, we abstain to collect data on individual users, except for the nickname and name. We combine these data with official records from the Institut national de la statistique et des études économiques to predict users' gender and age and to better understand changes in audience.

The contributions of this work consist of providing empirical evidence of the effects of a change in RS on the entire platform ecosystem, focusing on both sides of the market for news. To the best of our knowledge, this paper is the first to study the effects of changes in RSs on content production.

Our results show that the new Instagram RS affects not only content consumers and producers but the market of news in the platform as a whole. In terms of content consumption, we find large effects on users' engagement, likes and comments, 45% increase in engagement in posts with videos when compared to posts with pictures with respect to the same difference at the time of the announcement of the RS in May 2022. The increase is larger after more posts with videos are available, when the platform turns all videos into shorter videos/reels. But, the effects are large and persistent after users' massive complains that lead to the reevaluation of the RS. Moreover, we find that by the end of our sample period the level of engagement in posts has increased for all posts formats. This evidence suggest that the change in the RS is responsible for the new patterns of engagement.

Regarding media production, we find that news media outlets adapt produc-

[2]For more details on the changes in the RS see Section 2

tion format, with an average 5% increase in the share of posts with videos after the change of the RS. The largest effect occurs only after the reevaluation of the RS. We also observe no change in the number of videos per post produced, but reductions in duration of videos and increases in quality for all media formats. While this evidence indicates differences in the content production process due to the change in the RS, the timing suggest learning is required for the change in behavior.

Finally, we observe changes in the entire market of news in the platform. While the growth rate of new audience remains constant during the entire sample period, we find that the gains in audience are mostly related to engagement in posts with videos. Moreover, we observe shifts in the audience age, with both high producers of posts with videos and content creators that have increased their production of posts with videos engaging younger audiences and having larger market shares by the end of our sample period.

The first section below presents a detailed description of the context in which the new RS was implemented by Instagram. Then, Section 3 introduces the data collected as well of the main measurements, while Section 4 introduces preliminary facts. Section 5 explains the estimation methods followed by Section 6 with our main results. We conclude with Section 7.

2 Context

Platforms such as Instagram are motivated to change their recommender system (RS) to increase the network externalities on either side of the platform or to promote cross-side externalities. Popular platforms usually announce their RS changes publicly and evaluate short-term responses to decide which changes they prefer to keep in place. In this work, we focus on changes in the RS related to the type of format promoted (picture vs video vs reel). These changes were not implemented for a particular type of content -news, travel, food, makeup, etc.-, nor in a specific region, but widely, which for content producers and consumers is taken as given. During the period under study, we find three relevant changes in the RS, all of them related to the type of format promoted. In the following paragraphs, we review the timeline of the change in the RS.

First, on 3 May 2022, Adam Mosseri, CEO of Instagram announces that the platform will highlight content in some formats over content in other formats on users' feeds.[3] In particular, he announced a test starting that week consisting of "testing a new, immersive viewing experience" by promoting videos and larger pictures on the users' feeds.

By mid June, the Verge leaked an internal memo from April in which Tom Allison, head of Facebook, introduces an update in the strategy of Meta, and in particular the strategy of Facebook, focusing on "make Reels successful". Although Reels, that is, short videos of 15 to 90 seconds, were introduced on Instagram in 2020, there is no evidence of much use or promotion of Reels,

[3]The announcement was made through X - formerly Twitter- and it is available here (last retrieved February, 2024).

and hence the change in the company's strategy.[4] Evidence of the change in Meta's strategy appears when, in June 30, Instagram announces that all videos shorter than 15 minutes will be automatically turned into reels.[5] The change in the RS is confirmed by both an Instagram's official announcement and a new announcement from Mosseri in July.[6]

The implementation of the new RS was not well received by users. It generated significant protests among Instagram users and content creators, leading to the creation of the movement "Make Instagram Instagram again" when by the end of July the photographer Tati Bruening started a formal petition that was later shared by top Influencers like Kim Kardashian and Kylie Jenner.[7] Finally, in response to the protests, Mosseri announced on July 26 and confirmed on July 28 that the company needs to reevaluate the situation in order to warrant some predictability for content creators while accommodating to the increasing trends of users' preference of videos over pictures. In that sense, he promises to keep working on improvements for the RS so users' feeds still prioritize theirs friends' content despite of format, and a step back on the experimentation of the full-screen feed design.[8]

These three dates – May 3, June 30 and July 28 – are the key turning points in the changes of the RS. We will indicate them by red vertical lines in the figures throughout the paper. Even though we observe three successive changes in the RS, we consider them as parts of a whole, and we will address them as the change in RS during the following sections.

Though it is plausible that the decision of Instagram to implement the change in the RS to favor content with videos over content with only pictures is the result of a global trend of audience preferring video content over picture content, this does not seem to be consistent with the Instagram audience itself. First, the platform was originally focus on sharing images only. Second, once in place, the audience was against the change to the point of petition "To make Instagram Instagram again". Finally, in the case of the audience of news media content in the platform, and specifically for French news media content, we do not observe an increasing trend in the engagement on posts with videos prior to changes. Hence, we consider the change in the RS as quasi-exogenous for both french news media outlets and users of the platform. Moreover, we consider the timing of the announcement of such a change to be completely exogenous.

[4]Details of Instagram Reels' introduction can be found here, while the article and the memo can be found here.

[5]TechCrunch reports the changes in the following article (last retrieved: February, 2024)

[6]See the official Instagram announcement and Alan Mosseri's announcement

[7]See BBC reporting the online protest here (last retrieved: February 2024) and Le Monde reportinghere

[8]See Alan Mosseri's announcement and a more detail explanation during his interview with Casey Newton (last retrieved: February, 2024).

3 Data

To understand the effects of the change in a RS in a the market of news in a social media platform, ideally, we would collect content produced by all news media outlets that also produce content in the platform and all interactions of users of the platform that follow or engage with such content, as well as characteristics of news media outlets and users and their behavior outside their common interaction. For example, we would ideally follow users through time, observing who they are -gender, age, and their socioeconomic characteristics-, which type of content they interact with in the platform -news and other topics - and how those interactions are -likes, views, comments, direct messages to other users, etc. We would also ideally follow news media outlets as content creators in the platform and their behavior outside of the platform - how much subscriptions do they sell, how many adds, total revenue, number of news produced, etc.

In this paper, we use data obtained by extracting content from Instagram posts of 20 french news media outlets. The extraction was possible because news media outlets have public accounts, which allowed us to adhere to the platform guidelines regarding content data extraction. Due to capacity constraints, we choose to focus on the top newspapers from the ranking of the most popular French newspapers and magazines elaborated by the Alliance pour les Chiffres de la Presse et des Médias (ACPM). [9]

We collect the content of 23,283 posts published by news media outlets during the period between February 2022 and April 2023. For each post, we extract the text and hashtags present in the post, the exact time when the post was published, and identify the format of the post: video(s), picture(s), or both. Additionally, for each of the 23,283 posts we also extract the likes, comments, and views associated with it. These comprise more than 44 million interactions. For each of these users' interaction, we can identify the user name and nickname. In the case of comments, we also extract the content of those comments and the time stamp.

Note that, in compliance with privacy regulations, we refrain from extracting exhaustive details about audience behavior, focusing solely on interactions with public news media outlets' accounts. Consequently, we observe a number of selected and limited interactions between the audience and the aforementioned content, while respecting users' privacy and not actively monitoring interactions with other accounts or content. This may lead to selection bias when estimating the overall effects of a RS change on the ecosystem of Instagram.

In order to better characterize the audience of these news' content, we predict the age and gender of users from their first name. We identify the first name from the full name of the user and use the *Ranking of first names in France since 1900*, an interactive tool available through Institut national de la statistique et des études économiques (INSEE) website.[10] Names are assigned to the average

[9] See Classement Diffusion Presse Quotidienne Nationale 2020-2021 and Classement Diffusion Presse Magazine 2020-2021 from the Internet Archive - Wayback Machine

[10] For further details on data collection see INSEE website

of birth years and to the gender according to the highest occurrence.[11] Of the more than 5 million unique first names, it is possible to assign 52,23%. Figure A.1 in Appendix A shows the distribution of content creators by audience average age and share of women.[12] We find that content creators that are traditionally characterized for female audiences, such as Femme Actuelle, Marie Claire, or Elle, in fact, have a larger female audience, while content creators that are traditionally characterized for male audience, such as Auto Plus or Onze Mondial, also have a larger male audience. Established news media outlets, such as L'Humanite, Le Figaro, or Le Monde, have a balanced audience in terms of gender.

Table 1: Content creation by news media outlet

News media outlet	Number of posts	Posts with video (%)	Posts without video (%)	Average number of hashtags	Average length of post
Le Figaro	2,813	28	72	0.7	677.9
Le Monde	2,105	18	82	3.5	1,252.6
Les Echos	1,979	19	81	1.2	698.5
Liberation	1,898	9	91	6.2	1,108.5
Point de Vue	1,694	9	91	27.8	706.3
Marie-Claire	1,674	30	70	5.3	732.2
Elle	1,065	40	60	6.9	481.6
Madame Figaro	1,102	59	41	3.1	692.2
Public	1,084	36	64	4.1	177.0
Onze Mondial	1,085	7	93	7.7	206.1
Gala	1,045	31	69	3.4	429.7
Paris Match	1,001	26	74	3.3	438.3
Femme Actuelle	885	41	59	5.1	499.0
Voici	834	87	13	0.3	162.8
Valeurs Actuelles	808	27	73	3.8	241.3
Midi-Olympique	717	10	90	0.1	218.6
L'Humanité	521	26	74	3.1	502.1
Auto Plus Magazine	476	10	90	6.9	404.1
Psychologies	276	6	94	6.2	1,079.1
SoFoot	221	19	81	0.2	508.6
All	23,283	26	74	5.3	625.4

To characterize content creation, Table 1 presents the details of the posts collected by news media outlet. We observe that the top content creators like

[11] We restrict the years to those that involve ages between 13 and 70, given that the platform does not allow underage usage and that only 2% of users are older than 70.

[12] Share of women considers as the total audience only those users that are classified by gender. The underlying assumption here is that the classification of gender audience is independent of the news media outlet.

"Le Figaro", "Le Monde" and "Les Echos" publish on average more than 5 posts per day. During the entire period, the majority of the content created includes only pictures, which is aligned with the original purpose of the platform. We also observe a large variance with respect to the average number of hashtags included in the posts, as well as the number of characters in the content of the posts.

Table 2: Engagement by news media outlet

News media outlet	Number of posts	Number of likes	Number of comments	Average length of comments	Average engagement
Le Monde	2,186	10,090,047	79,736	103.6	4,670.0
Gala	1,085	3,927,696	39,450	45.6	3,653.8
Point de Vue	1,729	4,878,033	23,095	60.9	2,811.4
Le Figaro	2,862	6,598,382	169,036	84.1	2,321.9
Libération	1,938	4,372,944	57,771	63.2	2,281.6
Onze Mondial	1,092	2,226,802	25,491	56.8	2,056.7
Paris Match	1,025	1,922,679	42,457	54.5	1,914.0
Valeurs Actuelles	830	1,531,363	52,278	84.7	1,906.6
Elle	1,131	1,793,438	105,884	51.0	1,672.6
Public	1,111	1,483,460	18,654	49.3	1,207.0
Marie-Claire	1,706	2,067,871	145,718	58.9	1,249.8
Midi Olympique	733	835,799	2,535	61.2	1,141.5
Madame Figaro	1,122	1,004,006	57,356	51.3	869.6
SoFoot	231	176,946	3,090	59.3	779.4
Femme Actuelle	912	590,118	13,966	73.1	643.9
Psychologies	281	83,649	2,990	103.5	308.3
Voici	861	255,256	10,675	54.3	299.5
L'Humanité	535	155,285	1,931	119.1	293.3
Les Echos	2,027	584,075	13,624	112.3	291.0
Auto Plus Magazine	488	38,428	6,105	71.3	91.1
All	23,283	43,356,924	854,590	72.5	1,898.9

To understand content consumption, we define **engagement** as the sum of the number of likes and comments. We exclude the number of views from the engagement measure, as only some posts with videos have a number of views greater than zero. We also notice that the number of likes already represents well engagement in posts with videos, as the number of views and the number of likes are highly correlated.[13] Table 2 presents the details of the engagement by news media outlet. The news media outlets with largest engagement are "Le Monde", "Santé Plus Magazine" and "Gala" with more than 3500 users' interactions per post. Moreover, most of this engagement is disproportionally generated by

[13]See Figure D.1 in the Appendix D.

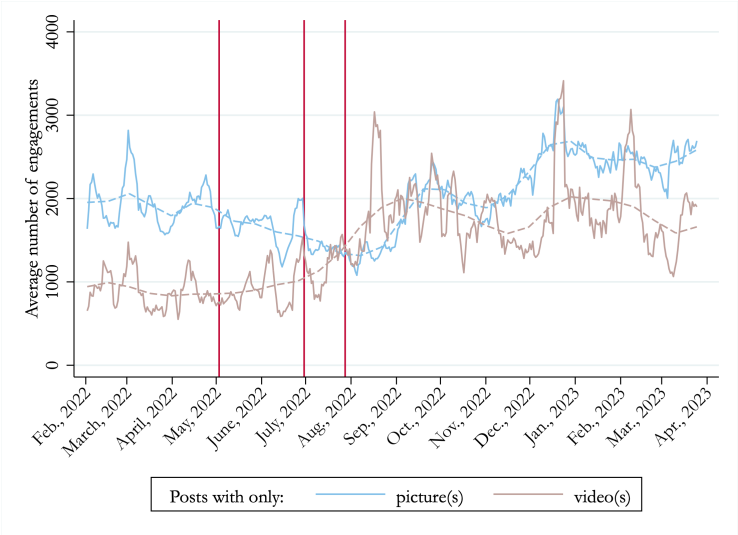
likes, with only a few cases of more than 5% of the engagement generated by comments. Finally, we also observe that while audience of some news media outlets like "Le Monde" make a lots of comments and those comments are long, the audience of other news media outlets like "L'Humanite" make longer but fewer posts.

4 Facts

In this section, we document the trends in audience and content production during the implementation of the new recommender system (RS). We indicate the the change in the RS with red vertical lines in the figures. The first week of May 2022 refers to the announcement of the change in RS, the last week of June 2022 refers to the transformation of videos to shorter videos, or Reels, and the last week of July refers to the revision of the RS.

As the change in the RS directly affects what type of format -picture vs video- users see on their feed, we first focus on users' consumption through our measure of engagement. Figure 1 presents the 7-day moving average of engagement of posts by post format. We observe that at the beginning of our sample period posts with only pictures have twice the engagement that posts with only videos. While at the end of the period posts with only pictures still have a higher engagement than post with only videos, the ratio in average engagement has reduced to 1.67.

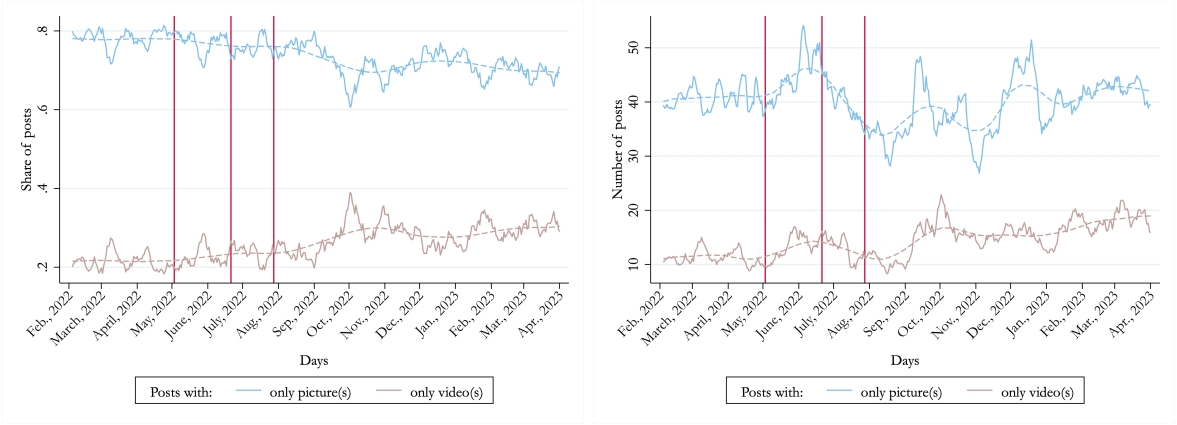
Figure 1: Evolution of the engagement by post format



This figure presents the 5 day moving averages of the number of engagement for posts with different formats: with only pictures or with only videos

These changes in average engagement of posts with different formats can be a solely response to the change of the RS or a response of the change of content produced. Figure 2a presents the share of daily posts by format, while Figure 2b presents the number of daily posts by format. Since posts with only pictures are less costly to produce than posts with videos, and the platform originally focus on promoting content with pictures, at the beginning of our sample period post with pictures represent 80% of the posts created. However, by the end of the period we observe an increase in the share of posts with videos from 20 to 30%. In order to understand if the change of format in content production is due to substitution effect, we turn our attention to Figure 2b. While there is some substitution of content production of posts with pictures by post with videos during the period mid June - December, we observe that by the end of our sample the number of posts with pictures recovers to initial levels while the number of posts with videos has almost doubled.

Figure 2: Evolution of content production by type



(a) Daily share of posts including only picture(s) or video(s)

(b) Daily number of posts including only picture(s) or video(s)

These figures present the 5 day moving averages of the share of posts created and number of posts created for posts with different formats: with only pictures or with only videos

5 Methodology

Recommender systems (RS) act as filter of information for the users. In the case of Instagram, they promote some content over other content to increase users' participation in the platform. The new RS introduced in May 2022 by Instagram aimed to highlight more videos/reels formats to better match current user preferences. In other words, posts with videos appeared more frequently in the user feeds, and therefore became more visible and better ranked. Therefore,

we anticipate to see effects of the change in the RS first on the audience of the news, that is on the consumption side, rather on the content generation, that is the producer side. By focusing on news posts we anticipate high levels of engagement, since it is expected that users engage more with more interesting news. Hence, we expect that the deployment of the new RS has some impact first on the audience and engagement of all posts in general, but especially on those of news content. In order to quantify the effects of a change in the recommender system (RS) on news media consumption we focus on the effects on engagement, number of likes and comments, to such content. We estimate an Event Study - Difference-in-Differences model.

We estimate the following equations:

$$Y_{it} = \alpha + \beta \text{video}_i + \sum_{k \neq -1} \delta_k D_{ik} \times \text{video}_i + \gamma X_i + \phi_t + \epsilon_{it} \tag{1}$$

$$Y_{it} = \alpha + \beta \text{video}_i + \psi T_t \times \text{video}_i + \gamma X_i + \phi_t + \epsilon_{it} \tag{2}$$

where D_{ik} is a dummy variable equal to one for post i at time k with $k = -1$ being the time in which the change of the RS was announced while video_i is a dummy variable indicating if the post contains a video. In the difference-in-differences specification, the variable T_t is a dummy variable that takes value 1 after the the change of the RS was announced. The outcome variable, Y_{it}, is the logarithm of the number of engagements of post i at time t, where engagement is measured as the sum of likes and comments related to the post i. We control for a set of post's characteristics, X_i, as the day of publication, the length of the post, the number of hashtags(#), the number of tags (@). In both cases, we include post and time fixed effects. The parameters of interest are δ_k for $k \geq 0$ as well as ψ. Both reflect the differences in engagement from posts with videos and posts without videos after the announcement of the change in algorithm. While δ_k presents the differences for each period, ψ presents the average differences for the entire after period.

The main assumption here is that there is no difference in engagement trends between posts with videos and posts without videos before the announcement of the algorithm. We have visual evidence of the validity of parallel trends in Figure 1. However, we further test this assumption by evaluating whether the coefficients of δ_k for $k < -1$ are statistically different from 0. Additionally, we are assuming that content created before and after the change of the RS is similar in unobservables while we control for differences in observables.

Notice that while the treatment, the change in RS, is intended to highlight posts with videos, it does so in detriment to posts without videos. In that sense, all posts published on the platform are subject to the treatment. We consider that posts with videos are going to be affected in the opposite direction as posts without videos, hence we could be overestimating the effect of the change in the RS over posts with videos. However, since our interest is to evaluate the effects of the RS change in the platform ecosystem as a whole, such effects are comprised of the sum of the effects on posts with videos with respect to untreated

posts and the effects on posts without videos with respect to untreated posts. In conclusion, we assume that the observed effects are the result of this sum. We present the results in section 6.1.

To evaluate the effects of changes in the RS on content creation, we restructure our data into a panel, where we follow the behavior of each news media outlet through time. We estimate an Event-Study model and a simple before-and-after model, characterized by the following equations:

$$Y_{nt} = \alpha + \sum_{k \neq -1} \pi_k \mathbb{1}(t = k) + \gamma X_n + \phi_t + \lambda_n + \nu_{nt} \tag{3}$$

$$Y_{nt} = \alpha + \rho New\_RS_t + \gamma X_n + \phi_t + \lambda_n + \nu_{nt} \tag{4}$$

where $\mathbb{1}$ is a dummy variable that takes the value 1 for each time period t relative to the change of the RS is announced and New_RS_t is a dummy variable that takes value 1 after the change of the RS is announced. The outcome variable, Y_{nt}, is the share of posts with videos with respect to the total number of posts created by the news media outlet n at time t. We control for a set of content creator's characteristics, X_n, as the number of post with pictures they created on the same day, the average engagement of their posts with picture in the last Z days, the average engagement of their posts with videos in the last Y days, the length of the post, the number of hashtags(#) and the number of tags (@). We also include content creators and time-fixed effects. The parameters of interest is π_k for $k \neq -1$ and ρ, which reflects the effect of the RS changing on the share of content created with video at different time points and the accumulated effect respectively.

The main assumption here is also parallel trends, which we can visually evaluate in Figure 2a, as well as through the estimates of π_k for the pre-period. Additionally, since the decision to change the RS is made by the platform, without considering any specific content creator, and in particular without considering French news media outlets, the assumption of no anticipation holds. As no other changes were announced by the platform during this period, we can assume that there are no other confounding events. Finally, as all content creators are exposed to the change of the RS, this analysis only reflects a before-and-after approach, assuming that content created after the change in RS is similar in unobservables to content created prior. We present the results in section 6.2.

6 Effects on the market for news in social media platform

To better understand the effects of changing the Recommender System (RS) on the market for news in the platform ecosystem, we first analyze the impacts on each side of the market and then on the market as a whole.

We anticipate more immediate effects on content consumption, as the new RS is directly focusing on which format of posts users see on their feeds (Aridor

et al.; 2022; Donnelly et al.; 2024). As posts with videos get more recommendations than posts with pictures, we expect an increase in engagement in the first ones. It could also be the case that posts with pictures get less engagement as they get less exposure; if that were the case, we would see an increase in the effect of engagement of post with videos with respect to posts with picture.

Although content creators could infer that posts with videos will get more exposure due to the changing of the RS, it is more costly for them to produce posts with videos, and it is uncertain if those posts will, in fact, receive more engagement just because they get more exposure. In this sense, we may expect a delay in the response of content creators to the change in the RS.

Finally, we are also interested in the effects of changing the RS on the market as a whole, that is, in terms of the characteristics of the audience and the distribution of the market share. The decision to change the RS was made by Instagram with the objective of capturing social media users from competing platforms such as TikTok. These users tend to be younger and prefer video format over pictures. In order to see any effects, not only the strategy of Instagram needs to be successful, these new users should also engage in news media content. If that were the case, we may expect that more visibility of new content in video format and new users with different characteristics (gender, age) and preferences affect the market share distribution.

We evaluate these hypothesis in the next subsections. Subsection 6.1 we explore effects on users' content consumption, in subsection 6.2 we investigate effects on news media outlets as content creators, and in subsection 6.3 we analyze effects for the market as a whole.

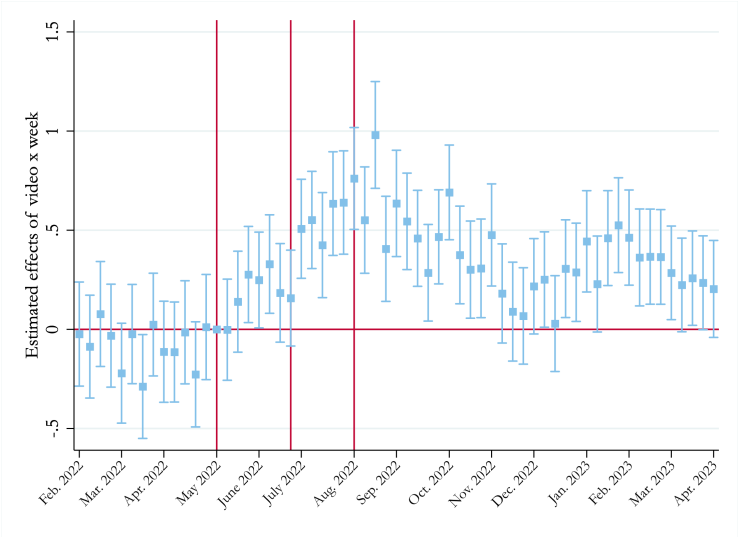
6.1 Content consumption

We present the results of estimating equations 1 and 2 in Figure3 and Table 3 respectively. Figure 3 shows the event study coefficients of δ_k from 1, which measure the differential weekly effect of posting a video vs a picture on users' engagement with respect to the time of the initial announcement of the change of the Recommender System (RS). Table 3 presents the results of the estimation of Equation 2, focusing on ψ, which measures the differential total effect of posting videos vs posting pictures with respect to the time of the initial announcement. In both cases we indicate the three main events related to the change of the RS: the first announcement of the change in RS in the first week of May 2022, the turning from videos to Reels in the last week of June, and the revision of the RS in the last week of July. In the case of Figure 3 we indicate the three main events with three red vertical lines in the figure. In the case of Table 3 we split the effect in three and present the results in columns (3) and (4). Although we signal the three main events in both cases, we consider the initial announcement as the baseline period for the comparisons, since the users could not have anticipated the following changes without the initial announcement.

First, in Figure 3, we observe that in most of the pre-period, from beginning of February 2022 to end of April 2022, these differences in engagement are not statistically different from zero. The absence of differences in engagement from

posts containing videos to posts containing pictures leads us to conclude that the parallel trends assumption holds. This result is consistent with what we previously observed about engagement by post type in Figure 1.

Figure 3: Effects of changing the recommender system in engagement of news content: Event-study estimates



This figure presents the estimates of δ_k from the event study specification from Equation 1. These estimates reflect the difference in the logarithm of engagement, measured as number of likes and number of comments, from posts with videos and posts without videos in each week with respect to the same difference in the first week of May 2022 when controlling for observable characteristics. The variable post with video is a dummy variable that takes value 1 if the post contains a video and 0 otherwise. The variable After is a dummy variable that takes value 1 if the post has been published after May 3 and 0 otherwise.

During the period of early implementation, since the initial announcement of the change in algorithm at the beginning of May to the turning from videos to Reels at the end of June, we observe some moderate and positive effects with a 30% increase in the engagement level in the second week of June with respect to first week of May. This result is consistent with an incomplete implementation of the new RS, which, while intended to promote reels, did not have much content to promote.

After the turning from videos to reels, we observe positive and significant differences in engagement of posts with videos compared to the engagement of posts with pictures. On average, during this period, the effect of the algorithm change is of a 60% increase in the engagement level of posts with videos over posts with pictures with respect to the same difference in the baseline period.

We note that the effects remain positive and significant after announcing the reevaluation of the RS due to users' complaints, from the beginning of August

to the end of October, with an average 40% increase in the engagement level of posts with video over posts without videos with respect to the same difference during the first week of May. However, these effects dissipate by November, indicating that they are short-term effects.

Table 3: Effects of changing the recommender system (RS) in engagement of news content: Difference-in-differences estimates

Endog. var.: log(engagement)	(1)	(2)	(3)	(4)
Post with video	-1.12***	-0.75***	-1.11***	-0.74***
	(0.34)	(0.12)	(0.34)	(0.12)
After announcement (May-...)	0.02	-0.16**		
	(0.11)	(0.07)		
Announcement (May-June)			-0.14*	-0.23***
			(0.07)	(0.06)
Reel change (July)			-0.38***	-0.49***
			(0.09)	(0.05)
Reevaluation of RS (August-...)			0.11	-0.09
			(0.14)	(0.09)
Video × After announcement (May-...)	0.50**	0.45***		
	(0.18)	(0.11)		
Video × Announcement (May-June)			0.27**	0.29***
			(0.11)	(0.10)
Video × Reel change (July)			0.61***	0.61***
			(0.11)	(0.09)
Video × Reevaluation of RS (August-...)			0.50**	0.43***
			(0.20)	(0.11)
Constant	6.97***	7.38***	6.97***	7.41***
	(0.24)	(0.28)	(0.24)	(0.30)
Post characteristics	No	Yes	No	Yes
Newspaper FE	No	Yes	No	Yes
Publication day FE	No	Yes	No	Yes
Observations	23,283	23,283	23,283	23,283
Adjusted R^2	0.059	0.588	0.071	0.594

Standard errors clustered at newspaper level are in parentheses. * p<.1, ** p<.05 and *** p<.01. This table presents the estimates of ψ from the difference-in-differences specification from Equation 2. These estimates reflect the difference in the logarithm of engagement, measured as number of likes and number of comments, from posts with videos and posts without videos after the announcement of the change in the RS with respect to the same difference in the first week of May 2022. The variable post with video is a dummy variable that takes value 1 if the post contains a video and 0 otherwise. The variable After is a dummy variable that takes value 1 if the post has been published after May 3 and 0 otherwise. Columns (3) and (4) decompose the main effects by stage of change in the RS. Columns (2) and (4) include controls for observable characteristics of posts.

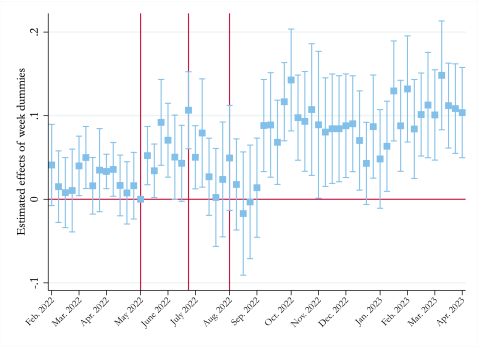
Table 3 presents the results of the difference-differences estimation of the effect of the change in the RS on engagement. We present four specifications, while columns (1) and (2) present the traditional difference-in-differences coefficients, columns (3) and (4) decompose the effect according to the different stages of implementation of the change. Moreover, columns (1) and (3) do not control for characteristics of the post, only by content creator and time fixed effects, while columns (2) and (4) include them as additional controls.

We observe that in general posts with video have 75% less engagement than posts with pictures. Moreover, we notice that after the announcement of the change in the RS the average engagement of all posts declines by 16%, and that when we decompose the effect, the largest decline occurs after the turning of videos into reels and before the reevaluation of the RS with a decline of 49% with respect to the pre-period. Finally, we observe that the effect of the change in the RS is positive and statistically significant. On average, after the announcement of the change in the RS there is 45% more engagement in posts with video than posts with pictures compared with the same difference before the change. This result is in line with the positive effect of an item's prominence on RS on its consumption show in other contexts by empirical studies (Aridor et al.; 2022; Donnelly et al.; 2024). Furthermore, this difference becomes larger after the turning of videos into reels and before the reevaluation of the RS with an increase of 61% with respect to the pre-period, and remains high after with an increase of 43%.

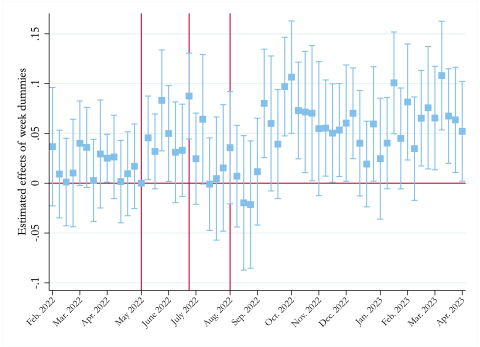
6.2 Content creation

We present the results of estimating equations 3 and 4 in Figure 4 and Table 4 respectively. Figure 4 shows the event study coefficients of π_k from Equation 3, which measure the differential weekly effect on the share of posts with videos with respect to the time of the initial announcement of the change of the Recommender System (RS). Table 4 presents the results of the estimation of Equation 4, focusing on ρ, which measures the differential total effect on the share of posts with videos with respect to the time of the initial announcement. In both cases, we again signal the three main events related to the change of the RS: the first announcement of the change in RS in the first week of May 2022, the turning from videos to Reels in the last week of June, and the reevaluation of the RS in the last week of July. In the case of Figure 4 we indicate the three main events with three red vertical lines in the figure. In the case of Table 4 we split the effect in three and present the results in columns (3) and (4). Although we signal the three main events in both cases, we consider the initial announcement as the baseline period for the comparisons, since the content creators could not have anticipated the following changes without the initial announcement.

Figure 4: Effects of changing the recommender system in daily share of posts with video: Event-study estimates



(a) Lag of 1 day on average characteristics of content created



(b) Lag of 7 days on average characteristics of content created

These figures present the estimates of π_k from the event study specification from Equation 3. These estimates reflect the difference in share of content produced with video, measured as number of posts with videos divided of total number of posts, with respect to the the first week of May 2022 when controlling for observable characteristics with lag of 1 day and lag of 7 days respectively.

In Figure 4, we first confirm that, from beginning of February 2022 to end of April 2022, in most of the pre-period these differences in share of posts with videos are not statistically different from zero. Hence, we conclude that the parallel trends assumption holds, consistent with our observation from Figure 2a. Moreover, the assumption holds regarding whether we include controls for previous engagement in posts with videos and posts with pictures with lags of 1 or 7 days.

During the periods of early implementation and turning videos to Reels, since the initial announcement of the change in algorithm at the beginning of May to the reevaluation of the RS at the beginning of August, we do not observe many effects, with the exception of a few weeks. Only in the last week of May and the second week of June we observe an small increase 8-10% in the share of posts with videos with respect to first week of May. This result is consistent with content creators being unsure of the gains in exposure of posts with videos due to an incomplete implementation of the new RS and with producing videos being more costly than producing pictures.

After the reevaluation of the RS due to massive protests of users, we observe positive and significant increases in the share of posts with videos compared to this share in the first week of May. While these effects appear at the beginning of September, they seem somewhat persistent during the remaining of the post period. On average, during this period, the effect of the RS change is of a 6% increase in the share of posts with videos with respect to the same share in the baseline period.

Table 4: Effects of changing the recommender system (RS) in share of posts with videos: Before-and-after estimates

Endog. var.: share of posts with videos	(1)	(2)	(3)	(4)
After announcement (May-...)	0.06***	0.05***		
	(0.02)	(0.02)		
Announcement (May-June)			0.02	0.04***
			(0.02)	(0.01)
Reel change (July)			0.02	0.01
			(0.03)	(0.02)
Reevaluation of RS (Aug-...)			0.08***	0.06***
			(0.02)	(0.02)
Constant	0.04***	0.02***	0.04***	0.02***
	(0.02)	(0.03)	(0.02)	(0.03)
Post characteristics: Lag (days): 1	No	Yes	No	Yes
Media quality	No	Yes	No	Yes
Publication day FE	No	Yes	No	Yes
Observations	7157	7157	7157	7157
R^2	0.010	0.219	0.017	0.221
Adjusted-R^2	0.010	0.216	0.017	0.219

Robust standard errors are in parentheses. * p<.1, ** p<.05 and *** p<.01. This table presents the estimates of ρ from the before and after specification from Equation 4. These estimates reflect the change in the share of posts with videos, measured as number of posts with videos over total number of posts, after the announcement of the change in the RS with respect to the same share in the first week of May 2022. The variable After is a dummy variable that takes value 1 if the post has been published after May 3 and 0 otherwise. Columns (3) and (4) decompose the main effects by stage of change in the RS. Columns (2) and (4) include controls for observable characteristics of content by content creator with a lag of 1 day.

Table 4 presents the results of the before-and-after estimation of the effect of the change in the RS on the share of posts with videos created. We present four specifications, while columns (1) and (2) present the traditional before-and-after coefficients, columns (3) and (4) decompose the effect according to the different stages of implementation of the change. Moreover, columns (1) and (3) do not control for characteristics of the content created by the news media outlet, only by content creator and time fixed effects, while columns (2) and (4) include them as additional controls with a lag of 1 day for average engagement of posts with videos and average engagement of posts with pictures.[14]

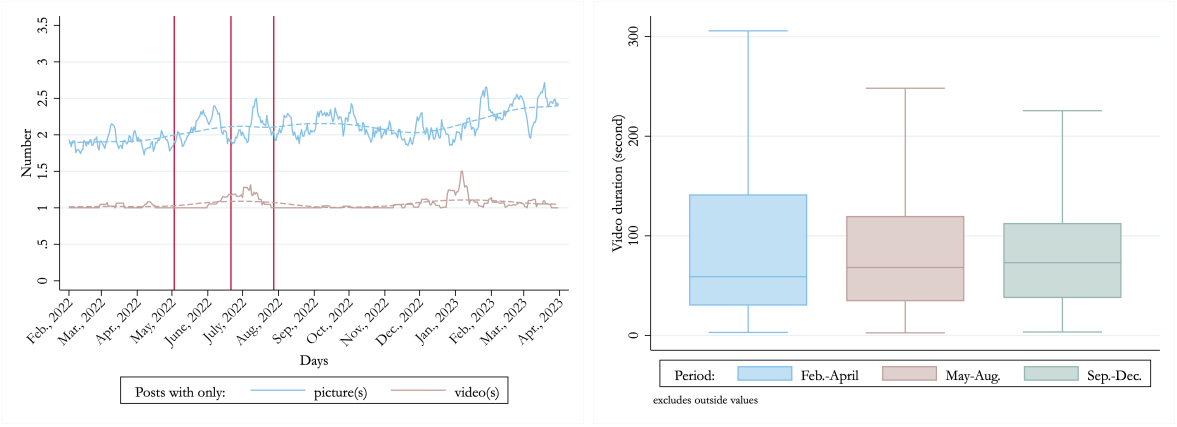
We observe that after the announcement of the change in the RS the share of posts with videos increases by 5%, and that when we decompose the effect, the largest increase occurs after the reevaluation of the RS with an increase of 6%

[14]See Table C.3 in Appendix C for a similar panel regression using 7-day lagged variables.

with respect to the pre-period. This result is consistent with the production of video content requiring an initial sunk cost that content creators were hesitant to make.

In that sense, we explore whether there are other changes in content creation in addition to the format. First, we investigate the evolution of the intensive margin of production, measured by the number of pictures and number of videos per post. Since content creators are unsure regarding the impact of their content with the new RS, they may reduce the number of pictures produced to increase the production of videos and compensate the cost difference. Second, we inspect possible changes in the duration of video content. As video content production is costlier than picture content production, we may expect that newspapers relying on more video content production shortened the video duration in order to decrease the production cost. Finally, we study the evolution of media quality for both videos and pictures.

Figure 5: Evolution of content production



(a) Intensive margin by format: Daily number of pictures and videos

(b) Video duration by sub-period

These figures present the evolution of content production. Figure 5a shows the daily number of pictures and videos indicating the changes in the RS with the vertical red lines, while Figure 5b presents the distribution of video duration before, during and after the change of the RS.

In Figure 5a, we explore the intensive margin of content production by looking at the number of pictures and videos. We observe an increase of the number of pictures used in posts starting at the mid May until the end of October. This trend seem to indicate that content creators may have misinterpret the change in the RS or believe it could be offset by adding more pictures to posts with pictures. Moreover, the trend of number of videos seem to indicate an increase after the turning of videos into reels, which may be just mechanical due to content creators persisting on the production of long videos. Yet, the effects are short term. Hence, content producers turned to create more content

with videos, but creating the minimum number of videos required for a posts with video after the change in the RS. However, these production changes took effect after the reevaluation of the RS, as if content creators needed longer time to adapt to the change in the RS or to the shift of engagement.

Regarding video duration, in Figure 5b, we can observe that while there is an increase in the median duration, the entire distribution seems to shrink. News media outlets tend to adhere to what was expected by Instagram with the change of the RS: providing shorter videos to attract a younger audience.

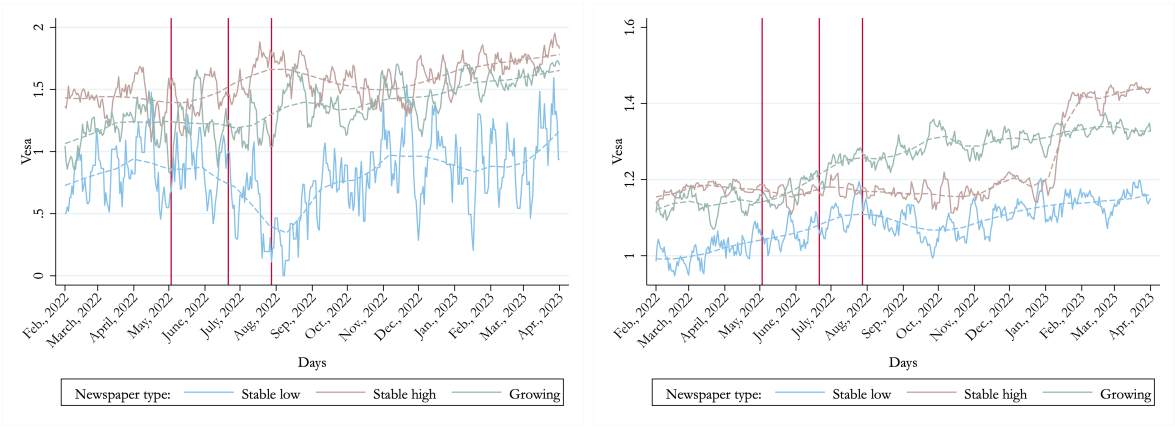
Finally, to study the evolution of quality by content format. We measure quality for different formats following display resolution standard defined by the Video Electronics Standards Association (VESA) measured in millions of pixels. We convert the different quality measures to millions of pixels following VESA scales.[15] Moreover, we classify content creators on three categories, based on their share of posts with videos created.[16] We classify news media outlets in the following way: 1) Content creators that still rely heavily on pictures; their proportion of video use is about 10% and does not evolve during the studied period (Feb., 2022- April, 2023). These news media outlets are considered as "low video creators" and they appear in the category "Stable low". 2) Content creators that use video regularly in their posts before the RS change and after the RS change. For this category, the proportion of posts with video remains around 50% throughout the period studied. all along the period of this study. We consider them as "high video creators" and they appear in the category "Stable high". 3) The last category includes content creators that increase significantly their content with video in their posts after the RS change announcement. They have on average 18% of posts with video before the change and increase this to 34% towards the end of 2022. These content creators appear in the category "Growing".

In Figure 6 we observe that content creators in the three categories have increased the quality for both formats. However, their behavior has not been consistently similar. While content creators in the group "Stable low" had slowly increase the quality of pictures in their posts, they declined the quality of videos after the announcement of the change in the RS, which slowly recovers and moderately increases after the reevaluation of the RS. In contrasts, content creators in the group "Stable high" consistently increase the quality of the videos they create, while maintaining the quality of their pictures until January 2023. Ultimately, content creators that increase the production of content with videos also increase the quality of both videos and pictures. While they increase the quality of pictures after the announcement of the change in the RS, they only increase the quality of videos after the turning of videos into reels. This behavior is consistent with content creators being uncertain about the actual effects of the change of the RS and requiring time for learning and adapting to new technology.

[15] See `https://en.wikipedia.org/wiki/Display_resolution_standards` for a description of VESA standards.

[16] See Table C.1 in Appendix C.

Figure 6: Evolution of content quality by format



(a) VESA quality for video format

(b) VESA quality for picture format

These figures present the evolution of content quality for three groups of content creators: content creators that produce a low share of videos during the entire period "Stable low", content creators that produce a high share of videos during the entire period "Stable high", and content creators that increase the production of posts with videos "Growing". Figure 6a shows the evolution of quality of videos in terms of millions of pixels, measured standarized by VESA. Figure 6b shows the evolution of quality of pictures in terms of millions of pixels, measured standarized by VESA.

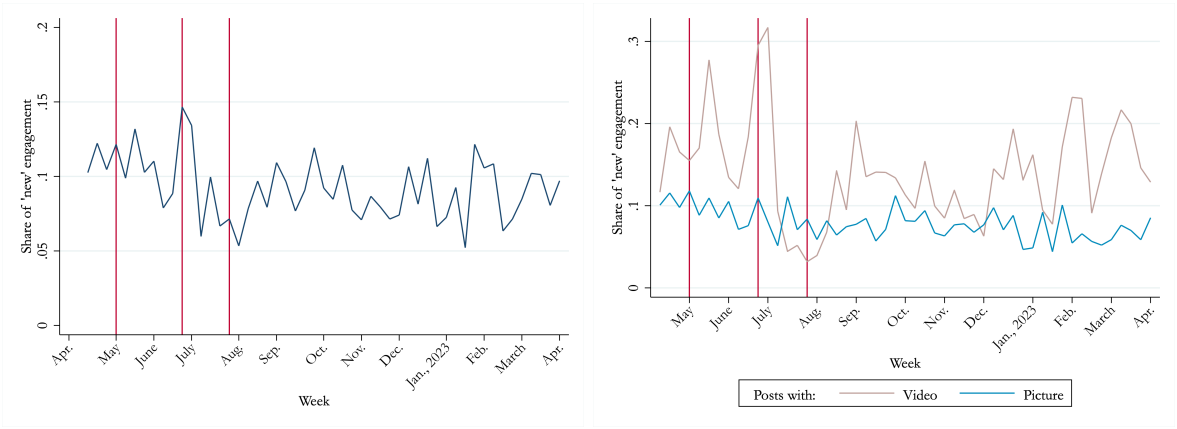
6.3 Market evolution

In the last subsections we have observed changes in the behavior of users and content creators after the change of the RS. We have seen users engaging more in posts with videos than in posts with pictures, and content creators increasing the production of posts with videos, both in the extensive and intensive margin, as well as reducing the duration of videos and increasing the quality of all formats of media. In this section we explore changes for the market of news content as a whole in terms of the characteristics of the audience and the distribution of the market share.

Regarding the characteristics of the audience, we first explore if there is an expansion in the number of users that engage with news media content. It is important to note that due to privacy regulations we only collect minimum information of users through their interactions with the public accounts of our content creators. Hence, we explore the evolution of the audience by looking at users who engage for the first time with a content produced by the news media outlets in our dataset, which we define as 'new engagement'. The daily share of new engagement is relatively steady as shown in Figure 7a at roughly 8%, but it reaches a peak at 14% about the end of June, following the turning from video to reels. Figure 7b shows that this global increase predominantly results from 'new engagement' made with post with video. The timing of this trend seems to

be in line with the literature on RS impact on item consumption (Aridor et al.; 2022; Donnelly et al.; 2024). More highlighted items – here posts with video – attract audience for the first time, who can thus generate 'new engagement'.[17]

Figure 7: New engagement



(a) Weekly new engagement

(b) Weekly new engagement by post type

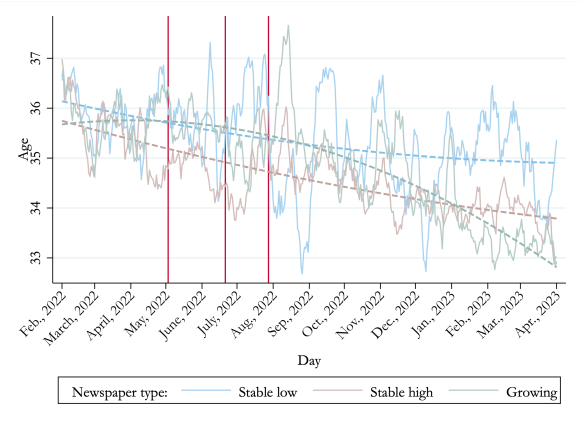
These figures presents the evolution engagement due to new users. Figure 7a shows the aggregate share of of new users, while Figure 7b shows the share of engagement of new users by content format.

As for the audience's age, we again focus on audience by content creators according to their behavior. We identify three groups of content creators: content creators that produce a low share of videos during the entire period "Stable low", content creators that produce a high share of videos during the entire period "Stable high", and content creators that increase the production of posts with videos "Growing". The three groups of content creators have similar audience age before RS change, but we observe significant changes after July 2022. By the end of our sample period, "Stable high" and "Growing" content creators have a clearly younger audience compared to those – "Stable low" – that seldom rely on video in their posts. This results is consistent with the fact that younger audience are more attracted by video. This figure provides suggestive evidence that Instagram managed to capture a younger audience with the change of the RS.

Finally, we show the evolution of engagement market share in Figure 9 for the three groups of content creators. We measure the market share for each group as the engagement of the group over the total engagement in each period. Content creators in the categories "Stable high" and "Growing", that is content creators that by the end of the sample period have a high share of posts with

[17]See Figure in Appendix D to observe a strong correlation between views (i.e. audience) and engagement (here 'likes') for a subsample of posts.

Figure 8: Evolution of average audience's age



This figure present the evolution of the average audience's age weighted by the engagement of the post for three groups of content creators: content creators that produce a low share of videos during the entire period "Stable low", content creators that produce a high share of videos during the entire period "Stable high", and content creators that increase the production of posts with videos "Growing".

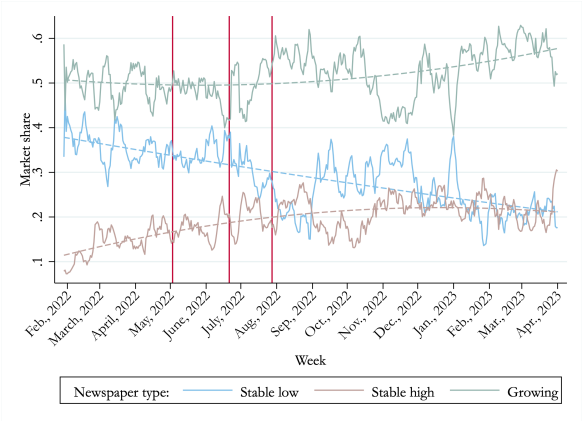
video, show each an increase of 10 percentage points in their market share over the period studied. This growth came at the expense of the last category "Stable low", which has seen its market share halved over the period. For "Stable high" newspaper the growth is relatively steady from the beginning to November, and reach a plateau hereafter. This trend can already illustrate an increasing preference for posts with video among Instagram users. Regarding "Stable high" newspapers, the growth starts after the implementation of the new RS, i.e. once they started to increase their use of video with posts. The market share of content creators in the category "Stable low", those which produced lower shares of posts with video during the sample period, decreases from 40% to 20%. These changes could be explained by the RS better highlighting of posts with video combined with the increasing production of posts with videos by other newspapers.

These results are consistent with theoretical predictions on RS impact on competition (Calvano et al.; 2023). In our case, market shares evolve significantly at the benefit of content creators that take advantage of the RS change. A rise of content production induced by video generation may be considered here as increasing possibly in entry barrier.

7 Conclusion

Recommender systems (RSs) are critical features of online platforms as they are an important driver of users' consumption choices (Aridor et al.; 2022; Donnelly

Figure 9: Market share evolution



This figure presents the evolution of the market share for three groups of content creators: content creators that produce a low share of videos during the entire period "Stable low", content creators that produce a high share of videos during the entire period "Stable high", and content creators that increase the production of posts with videos "Growing". The market share is measured as the engagement of each group over the total engagement at each point in time

et al.; 2024). Such systems could therefore impact the other side of the platform, namely producer side, as predicted by theoretical papers (Calvano et al.; 2023). In the market for news context, this paper evaluates empirically the interaction between RSs and consumption and production sides of a social media platform.

In 2022, the new RS highlights content of one format over the others, featuring posts with videos to accommodate to the strategy of the group Meta. The change in the RS is implemented by the platform in three moments through different announcements: May 3, June 30 and July 28. First, by promoting a "more immersive viewing experience", second, by turning videos into shorter videos/reels, and finally by reevaluating the RS after massive complains.

Exploiting a dataset comprised of Instagram posts published by top French news media outlets between February 2022 and April 2023, and the users interactions with the content, we are able to identify effects of the change in the RS for the market of news in a social media platform. The richness of these data, which includes more than 23,000 posts and more than 44 millions of engagements –likes and comments– from followers, grant us the means to explore the behavior of both content producers and content consumers.

We find that the change of the RS have a large effect on content consumption, with a 45% average increase in engagement in posts with videos when compared to posts with pictures with respect to the same difference at the time of the announcement in May 2022. The increase in engagement peaks after the turning of videos into reels, which allowed more posts with videos to be available to be highlighted by the new RS. However, the effects of changing the RS on

engagement are persistent after the reevaluation of the RS and accompanied with increases in engagement for posts of both formats by the end of our sample period. The size and timing of the effect of these effects seems to suggest that the new RS algorithm is at the basis of the shift in engagement behaviors.

News media outlets adjusts consequently the production of content accordingly. We find an average increase in the share of posts with videos of 5% after the change of the RS. The effect is strongest only after the reevaluation of the RS, but is not accompanied by an increase in the number of videos per post created. Moreover, we observe a reduction on video duration and an increase in quality of both videos and pictures produced. The evidence seems to suggest that content creators adapt their production to the new RS, but this change in behavior requires some learning and takes longer time. Finally, we find that the market of news on Instagram has gained new audience, mostly due to engagement in posts with videos, but the growth rate of new audience doesn't seem to have accelerated after the change of the RS. Content creators that were high producers of posts with videos and those that have incorporated video posts as part their content production have younger audiences and larger market shares by the end of our sample period.

This article highlights that platforms and their different sides can be all critically impacted by a change in their RS. Any change in RS should be thus carefully considered by a platform. Starting probably by considerations on the consumption of content, the platform should anticipate new RS consequences on both sides and assess if they are in line with the interest of their audience. Content producers should be aware that any change in the RS could potentially affect dramatically their activity on the platform. Content creators should, therefore, try to anticipate how RS changes will generate audience shifts in order to adapt their content or even consider to switch to another platforms. Additional research is needed regarding both consumers and producers' responses to changes in RSs to better identify the welfare improvement changes that platforms can implement.

References

Allcott, H., Braghieri, L., Eichmeyer, S. and Gentzkow, M. (2020). The welfare effects of social media, *American Economic Review* **110**(3): 629–76.
URL: *https://www.aeaweb.org/articles?id=10.1257/aer.20190658*

Allcott, H. and Gentzkow, M. (2017). Social media and fake news in the 2016 election, *Journal of economic perspectives* **31**(2): 211–236.

Allcott, H., Gentzkow, M. and Yu, C. (2019). Trends in the diffusion of misinformation on social media, *Research & politics* **6**(2): 2053168019848554.

Aridor, G., Gonçalves, D., Kluver, D., Kong, R. and Konstan, J. (2022). The economics of recommender systems: Evidence from a field experiment on movielens, *CESifo Working Paper No. 10129* .

Bourreau, M. and Gaudin, G. (2022). Streaming platform and strategic recommendation bias, *Journal of Economics & Management Strategy* **31**(1): 25–47.

Calvano, E., Calzolari, G., Denicolò, V. and Pastorello, S. (2023). Artificial intelligence, algorithmic recommendations and competition, *SSRN Working Paper n°4448010* .

Claussen, J., Peukert, C. and Sen, A. (2023). The editor vs. the algorithm: Targeting, data and externalities in online news, *Management Science* (forthcoming).

De Cornière, A. and Sarvary, M. (2023). Social media news: content bundling and news quality, *Management Science* **69**(1): 162–178.

Donnelly, R., Kanodia, A. and Morozov, I. (2024). Welfare effects of personalized rankings, *Marketing Science* **43**(1): 92 – 113.

Farronato, C., Fradkin, A. and MacKay, A. (2023). Self-preferencing at amazon: Evidence from search rankings, *AEA Papers and Proceedings* **113**: 239–43.

Fletcher, A., Ormosi, P. L. and Savani, R. (2023). Recommender Systems and Supplier Competition on Platforms, *Journal of Competition, Law & Economics* **19**(3): 397–426.

Gomez-Uribe, C. A. and Hunt, N. (2015). The netflix recommender system: Algorithms, business value, and innovation, *ACM Transactions on Management Information Systems (TMIS)* **6**(4): 1–19.

Guess, A. M., Malhotra, N., Pan, J., Barberá, P., Allcott, H., Brown, T., Crespo-Tenorio, A., Dimmery, D., Freelon, D., Gentzkow, M., González-Bailón, S., Kennedy, E., Kim, Y. M., Lazer, D., Moehler, D., Nyhan, B., Rivera, C. V., Settle, J., Thomas, D. R., Thorson, E., Tromble, R., Wilkins, A., Wojcieszak, M., Xiong, B., de Jonge, C. K., Franco, A., Mason, W., Stroud, N. J. and Tucker, J. A. (2023). How do social media feed algorithms affect attitudes and behavior in an election campaign?, *Science* **381**(6656): 398–404.
URL: *https://www.science.org/doi/abs/10.1126/science.abp9364*

Holtz, D., Carterette, B. A., Chandar, P., Nazari, Z., Cramer, H. and Aral, S. (2020). The engagement-diversity connection: Evidence from a field experiment on spotify, *CoRR* **abs/2003.08203**.

Lee, K. H. and Musolff, L. (2023). Entry into two-sided markets shaped by platform-guided search, *Working paper* .

Peitz, M. and Sobolev, A. (2022). Inflated Recommendations, *Crc tr 224 discussion paper series*.

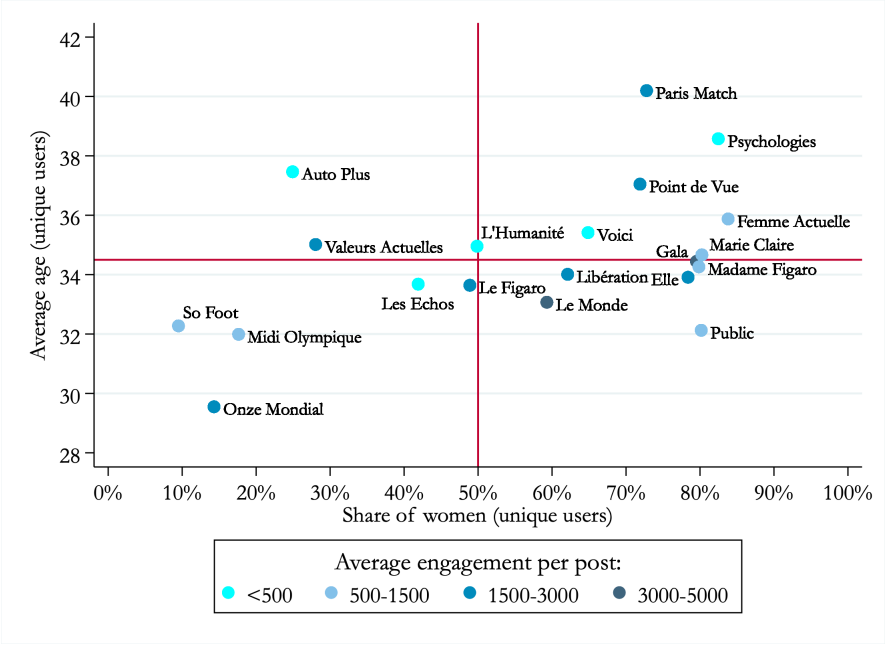
Sandrini, L. and Somogyi, R. (2022). News Media Bargaining Codes, *Working Papers 22-06*, NET Institute.

Solsman, Joan, E. (2018). YouTube's AI is the puppet master over most of what you watch, *Technical report*.

Appendix

Appendix A Newspapers descriptive statistics

Figure A.1: Newspaper audience: gender and age



Appendix B Breakdown of engagement: average number of likes and comments

Figure B.1: Average number of likes by post type

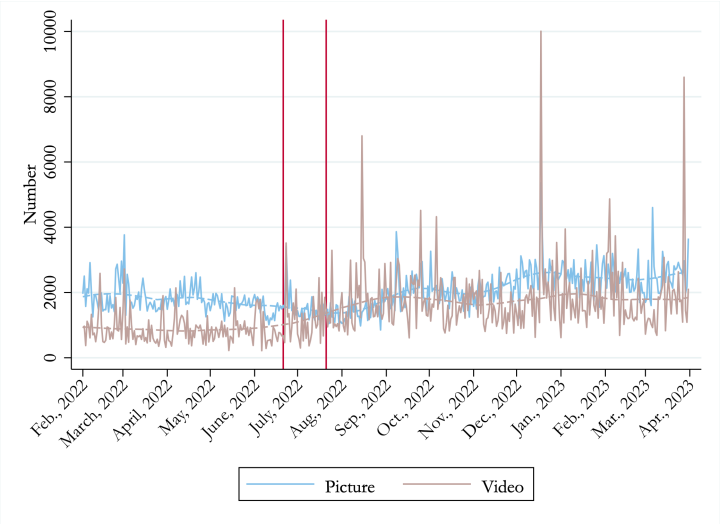
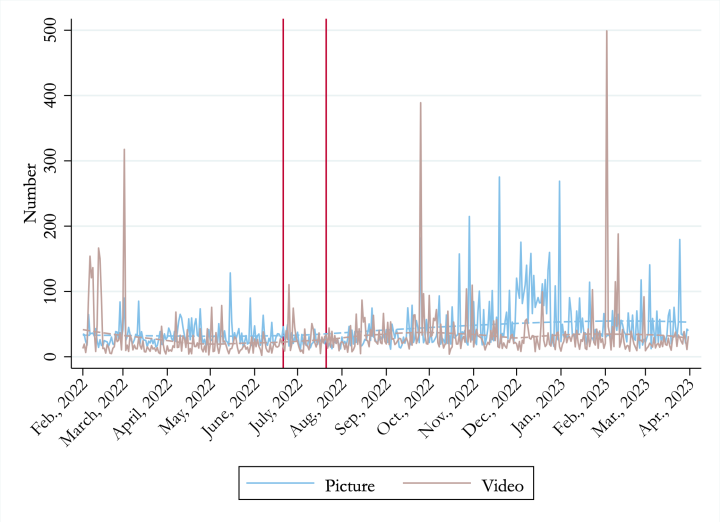


Figure B.2: Average number of comments by post type



Appendix C Supply side

Table C.1: Share of post with video by newspaper type and period

	Share of post with video			Newspapers
	Feb.-Apr.	May-Aug.	Aug.-Mar.	
Stable low	0.09	0.09	0.07	Auto Plus, Libération, Midi-Olympique, Onze Mondial, Point de Vue, Psychologies, So Foot
Stable high	0.50	0.53	0.49	L'Humanité, Le Figaro, Femme Actuelle, Madame Figaro, Voici
Growing	0.18	0.20	0.34	Elle, Gala, Les Echos, Le Monde, Marie-Claire, Paris Match, Public, Valeurs Actuelles
All	0.23	0.25	0.31	

Table C.2: Panel regression: descriptive statistics

	Before May	After May	t-test
Share video/day	0.22	0.29	0.07***
No. of post w/ pict.	2.33	2.42	0.09*
Engagement	4,981.3	6,283.2	1,301.9***
No. arobase	2.76	2.79	0.03
No. hashtag	16.96	16.69	-0.27
Content length	774.3	739.6	-34.8**
Quality (vesa)	1.44	1.70	0.026***

Table C.3: Panel regression: 7-day lagged variables

Endog. var.: share of posts with videos	(1)	(2)	(3)	(4)
After announcement (May-...)	0.03***	0.06***		
	(0.01)	(0.02)		
Announcement (May-June)			0.03***	0.02
			(0.01)	(0.02)
Reel change (July)			0.01	0.02
			(0.02)	(0.03)
Reevaluation of RS (Aug-...)			0.04***	0.08***
			(0.01)	(0.02)
Constant	0.38***	0.23***	0.38***	0.23***
	(0.04)	(0.02)	(0.04)	(0.02)
Post characteristics	Yes	No	Yes	No
Media quality	Yes	No	Yes	No
Observations	7157	7157	7157	7157
R^2	0.227	0.010	0.228	0.017
Adjusted-R^2	0.226	0.010	0.226	0.017

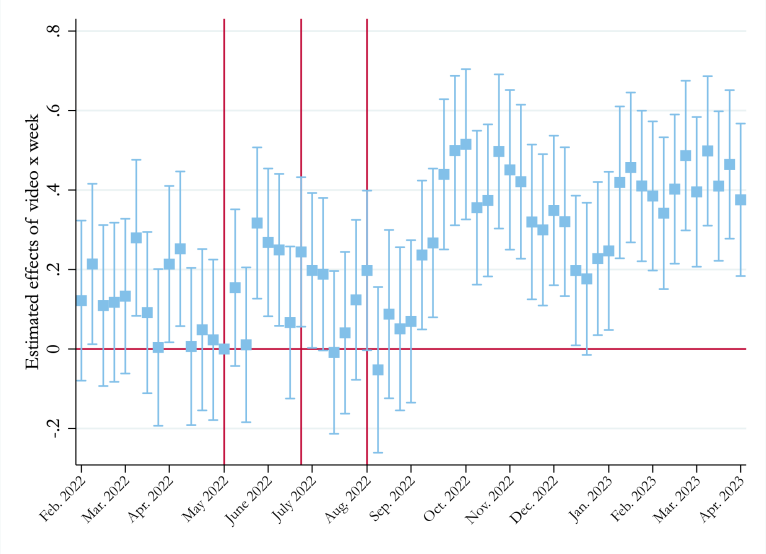
* p<.1, ** p<.05 and *** p<.01

Table C.4: Pooled Probit: results

Endog. var.: video (1/0)	Probit	
No. of eng. post w/ video (7 days)	0.05***	(8.46)
No. of eng. post w/ picture (7 days)	-0.07***	(-6.22)
No. of caracters	-0.00***	(-43.67)
No. of arobase(s)	0.08***	(14.59)
No. of hashtag(s)	0.00	(0.10)
Sunday	ref.	
Monday	0.10**	(2.46)
Tuesday	0.15***	(3.65)
Wednesday	0.12***	(2.81)
Thursday	0.21***	(5.25)
Friday	0.24***	(5.95)
Saturday	0.10**	(2.26)
Constant	0.39**	(2.43)
Weekly dummies	Yes	
Newspaper FE	Yes	
Pseudo-R^2	0.25	
Correct predictions (%)	80.2	

Robust standard errors are in parenthesis. * p<.1, ** p<.05 and *** p<.01

Figure C.1: Supply side Probit model: Weekly dummies



Appendix D Number of views and likes

Figure D.1: Numbers of view and like