Time Scarcity and the Market for News

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In progress...

Abstract. We study a model of the market for news, where readers have a general time constraint for media consumption, and where media firms are aware of readers’ preferences, observe the news items of the day, and decide on how to rank the news in order to maximize readership. We use this to study phenomena observed in the news and other media markets.
Introduction

- Readers have a constraint on how much news they can consume on any given day; which is a function of the relevance of that day’s news.
- Readers do not observe all headlines of all stories of all outlets instantly or costlessly. Instead they look at a limited number of headlines at once, from a limited number of outlets.
- They choose whether to read a story or to skip it; they may also decide to switch outlets. When they stop, they have not read all stories of the day.
- Technological advances change the speed at which readers can skip articles or switch outlets. What is their effect?
Introduction

- News suppliers are aware of the reader constraints.
- Their objective is a function of total readership.
- Their editorial board completely determines their strategy for each state of the world, which consists in ranking the news stories of the day.
- Readers are fully aware of the media outlets’ strategies, and they are sophisticated about their own preferences.
- They are temporally consistent; there is no conflict between present and future selves.
- For some topics, the more they read the more they wish to read. ("complementarity")
Despite unbiased outlets and fully sophisticated readers, in some cases the only equilibria are the ones where outlets do not give readers what they want.

In some context, the technological advances help the readers, in others they don’t.

The driving force behind our main results is the misalignment between the readers’ and the media outlets’ objectives.

Readers want to read up to a certain point and stop.

Outlets want readers to read as much as possible.
Literature


▶ media bias


▶ effects of technological innovation, e.g., targeted advertising


▶ aggregators, hyperlinks

Pariser (2011) *The Filter Bubble*
The players of the game are readers and media outlets.

The timing of the game is as follows:

Stage 0 Media outlets simultaneously choose and commit to an editorial policy (how to rank stories in any state of the world). These strategies are observed by all parties.

Stage 1 Nature draws the state of the world (a set of stories).

Stage 2 Readers choose what to read, what to skip and whether to switch from their first choice outlet to another outlet.

Stage 3 Final payoffs are realized.
The true state of the world is described by a set $S$ of stories, where

- $S = S_A \cup S_B \in S$, $\#S = N$
- $A$ and $B$ are two disjoint topics

The elements of $S$ are stories $s_n^k = (\lambda_n^k, z_n^k)$, where

- $\lambda_n^k \in [0, 1]$ measures newsworthiness
- $z_n^k \in [0, 1]$ measures content
- $n \in S_k, k \in K = \{A, B\}$.

There is a common prior $\pi$ on $S \subset \Omega = ([0, 1] \times [0, 1])^N$. 
There are two media firms $i \in I = \{1, 2\}$.

Given realization $S \in \mathcal{S}$, outlet $i$’s strategy $\sigma^i = \sigma^i(S) \in \mathcal{P}_N$ is a total (strict) ranking of the stories in $S$, where

- $\sigma^i = (\sigma^i_1, \sigma^i_2, \ldots, \sigma^i_N)$
- $\sigma = (\sigma^i, \sigma^{-i})$
- overall, in Bayesian game, $\sigma^i : S \rightarrow \mathcal{P}_N$ (editorial policy)
- $\mathcal{P}_N$ are permutations or rankings of $N$ elements
Framework: Media Outlets – profits

Given the set of stories $S$, media outlet $i$, chooses $\sigma^i$ to maximize the profit function

$$\Pi^i(\sigma^i | \sigma^{-i}) = \sum_{k \in K} (1 + \alpha^i_k) \sum_{n \in S^i_k} \mu^{k,i}_n (\sigma^i, \sigma^{-i}) - C_F$$

where

- $\mu^{k,i}_n : (\mathcal{P}_N)^I \to [0, 1]$ is the mass of readers that outlet $i$ believes will read story $s^k_n$ from him
- $\alpha^i_k \in \mathbb{R}$ is $i$’s preference for topic $k$
- $C_F$ is a fixed cost.

For most of the talk assume $\alpha^i_k = 0$, no bias; and $C_F = 0$. 
There is continuum of readers of mass 1, where
- $M_k \in [0, 1]$ readers first access outlet $k$, $k = 1, 2$
- $M_1 + M_2 = 1$.

In each period $t \in \{1, \ldots, T\}$ each reader can choose to
- $RD$ read a story
- $SK$ skip a story
- $SW$ switch to a not previously accessed outlet
- $ST$ stop reading altogether and terminate the game.

The reader’s action in period $t$ is $a_t \in \{RD, SK, SW, ST\}$. 
At any period $t$, the reader has history $H_{t-1}$ of all the stories he has previously read or seen the headlines to.

For any action $a_t$ taken in period $t$, given that he is observing headline $\sigma_n^i$,

- $\{a_t, \sigma_n^i\}$ is appended to his history
- $H_t = \{\{a_t, \sigma_n^i\}, H_{t-1}\}$
- $H_0 = \emptyset$ for the reader’s history at period 1.
Framework: Readers – cursor

The history $H_t$ given by $H_{t-1}$ and the currently chosen action together with the following determines the position of the reader’s cursor after period $t$,

**RD** when a reader chooses to read a story he observes the next story of the outlet’s ranking; given strategy $\sigma^i = (\sigma^i_1, \ldots, \sigma^i_N)$, if at time $t$ he reads story $\sigma^i_n$, then the next observes $\sigma^i_{n+1}$, where $\sigma^i_n = \emptyset$ for $n > N$, $i \in I$;

**SK** when a reader skips to another story he observes $\sigma^i_{n+1}$; if he skips to an outlet he previously opened, then given his history $H_{t-1}$, he observes the last unread story in his history; if he skips to a story that he previously skipped, in either outlet, then his next observation remains $\sigma^i_{n+1}$;

**SW** when a reader switches from outlet $i$ to a so far unopened outlet $-i$ he observes the first headline of outlet $-i$, $\sigma^{-i}_1$.

Given this, the actions **RD**, **SW**, and **ST** are all well-defined. **SK** can be of two types: *forward and backward*. 
Framework: Readers – time costs

The physical length of time of any period $t$ depends on the action $a_t$ chosen by the reader in that period.

The variable that keeps track of **physical time** is $\tau_t \in \mathbb{R}$, which measures the time spent reading, skipping, switching by the end of period $t$.

- $\tau_0 = 0$
- $\tau_t = \tau_{t-1} + \nu_{a_t}, \ a_t \in \{RD, SK, SW, ST\}$
- $\nu_{SK}, \nu_{RD}, \nu_{SW} \geq 0$.

The variables $\nu_{SK}, \nu_{RD}, \nu_{SW}$ keep track of the **time costs** of media consumption.
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- **Topics**: UK, Europe, World, Sports, Business, etc.
- $t =$ time **period**, $\tau_1 =$ **physical time** at beginning of $t$
- $H_0 =$ **history** at beginning of $t$, $a_1 =$ **action** taken in $t$
- **Cursor** / **Story Read** / **Skipped** / **Not Accessed**
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- $t = 1, \tau_1 = 0$
- $H_0 = \emptyset$
- $a_1 = RD$

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$t = 2, \quad \tau_2 = \nu_{RD}$

$H_1 = \{RD[\sigma_1^{BBC}]\}$

$a_2 = SK$

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$\triangleright \quad t = 3, \quad \tau_3 = \nu_{RD} + \nu_{SK}$

$\triangleright \quad H_2 = \{ RD[\sigma_1^{BBC}], \ SK[\sigma_2^{BBC}] \}$

$\triangleright \quad a_3 = \ SK$

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- $t = 4$, $\tau_4 = \nu_{RD} + 2\nu_{SK}$
- $H_3 = \{ RD[\sigma_{1}^{BBC}], SK[\sigma_{2}^{BBC}], SK[\sigma_{3}^{BBC}] \}$
- $a_4 = SW$

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$\Rightarrow t = 5, \tau_5 = \nu_{RD} + 2\nu_{SK} + \nu_{SW}$

$H_4 = \{RD[\sigma_{1}^{BBC}], SK[\sigma_{2}^{BBC}], SK[\sigma_{3}^{BBC}], SW[\sigma_{4}^{BBC}]\}$

$\Rightarrow a_5 = RD$

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- $t = 6$, $\tau_6 = 2\nu_{RD} + 2\nu_{SK} + \nu_{SW}$
- $H_5 = \{RD[\sigma_1^{BBC}], \ldots, SW[\sigma_4^{BBC}], RD[\sigma_1^{GUA}]\}$
- $a_6 = SK$

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$t = 7$, $\tau_7 = 2\nu_{RD} + 3\nu_{SK} + \nu_{SW}$

$H_6 = \{RD[\sigma_{BBC}^1], \ldots, RD[\sigma_{GUA}^1], SK[\sigma_{GUA}^2]\}$

$a_7 = RD$

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- $t = 8$, $\tau_8 = 3\nu_{RD} + 3\nu_{SK} + \nu_{SW}$
- $H_7 = \{RD[\sigma_1^{BBC}], \ldots, SK[\sigma_2^{GUA}], RD[\sigma_3^{BBC}]\}$
- $a_8 = ST$

Legend: **Cursor** / Story Read / Skipped / Not Accessed
The agent’s utility function also depends on total newsworthiness consumed,

\[ x_t^k = \begin{cases} 
  x_{t-1}^k + \lambda(s_t^k) & \text{if } a_t = \text{RD} \\
  x_t^k & \text{otherwise}
\end{cases} \]

where \( x_0^k = 0 \). At any \( t \), given observed headline \( s_n^k \) and history \( H_{t-1} \), reader chooses \( a_t \) to maximize expected utility

\[
U_t(a_t|s_n^k, H_{t-1}, \sigma) = \sum_{k \in K} \triangle u_k(x_t^k, x_{t-1}^k) - \triangle c(\tau_t, \tau_{t-1})
\]

\[ + U_{t+1}(a_{t+1}|H_t, \sigma) \]

where

- \( \triangle u_k(x_t^k, x_{t-1}^k) = u_k(x_t^k) - u_k(x_{t-1}^k) \)
- \( \triangle c(\tau_t, \tau_{t-1}) = c(\tau_t) - c(\tau_{t-1}) \).
Framework: Readers – utility function

We consider two cases

- $u'_A(\cdot) > 0$, $u''_A(\cdot) = 0$ (linear, constant returns on $A$)
- $u'_B(\cdot) > 0$, $u''_B(\cdot) > 0$ (convex, increasing returns on $B$)

or

- $u'_A(\cdot) > 0$, $u''_A(\cdot) = 0$ ($A$ linear)
- $u'_B(\cdot) > 0$, $u''_B(\cdot) \leq 0$ (concave, decreasing returns on $B$)

If the agent chooses to stop ($ST$) at any point then his continuation utility is 0.

We also assume the agent will never read all stories in $S$,
- $c(0) = u_k(0) = 0$ and $c'(0) < u'_k(0)$ for $k \in K$
- $c(N_{\nu_{RD}}) > \sum_{k \in K} u_k \left( \sum_{s^k \in S} \lambda(s^k) \right)$, for any $S \in S$. 
Framework: Timing of the Game

The **timing** of the game is as follows:

**Stage 0** Media outlets simultaneously choose the orders \((\sigma^i(S))_{i \in I}\) for every state of the world \(S \in S\). These strategies are observed by all parties.

**Stage 1** Nature draws the set of stories \(S \in S\).

**Stage 2** In period 1, readers in mass \(M_1\) observe the first headline of firm 1, and readers in mass \(M_2 = 1 - M_1\) observe the first headline of firm 2. They choose an action \(a_t\) for every period \(t \in \{1, \ldots, T\}\).

**Stage 3** Final payoffs are realized.

The solution concept is **perfect Bayesian equilibrium**.
The agent is **dynamically consistent**: if, ex-ante, he intends to take a specific action at a future given history, then he does not change his mind if he reaches that node.

**Lemma**

*Suppose that at time $t$, the agent’s period $t$ utility maximization choice consists of taking action $a_{t'}$ at future history $H_{t'}$, where $t' > t$. Then, at time $t'$ and history $H_{t'}$, the agent period $t'$ maximization choice is action $a_{t'}$.***
The agent takes plan of action that maximizes expected utility of total ex-post news read, $u_k(x_T^k)$, on each topic, $k \in K$, minus the total ex-post cost incurred, $c(\tau_T)$. 

**Lemma**

Let $P_0$ be the agent’s ex-ante plan of action, and let $p_0(H_T|P_0, \sigma)$ be the agent’s ex-ante probability of reaching terminal history $H_T$. The agent takes plan of action that maximizes $U_0(P_0|\sigma) = \sum_{k \in K} p_0(H_T|P_0, \sigma)[u_k(x_T^k) - c(\tau_T)]$. 
Results: Two Examples – common features

We will consider two (families) of examples with the following features in common.

Two topics $K = \{A, B\}$

Two media firms $I = \{1, 2\}$ with unbiased and topic-neutral profit function

$\alpha^i_k = 0$ and $\beta^i_k = 0$, $k \in K$.

Mass one of readers with utility functions for quantity of news consumed on topics $A$ and $B$ respectively

$u_A(x) = x$ and $u_B(x) = 2x^2$

and with cost function of time spent on the media

$c(\tau) = 4\tau^3$.

Note: linearity of $u_A$ means marginal utility of reading stories on $A$ is constant; on topic $B$ it is increasing.
Example 1: Beneficial Technology – set-up

Two states of the world, $S = \{S_1, S_2\}$, with probabilities $p$ and $1 - p$ for states $S_1$ and $S_2$ respectively, where

$$S_1 = \{(1, z_1^A), (0.75, z_2^A), (0.5, z_1^B), (0.4, z_2^B)\}$$
$$S_2 = \{(1, z_1^A), (0.75, z_2^A), (0.5, z_1^B), (0.5, z_2^B)\}$$

for some $z_n^k \in [0, 1]$, for $n \in I$ and $k \in K$.

Assume $C_F = 0$, $\nu_{RD} = \frac{1}{4}$, $\nu_{SW}, \nu_{SK} > 0$.

Reader-optimal outcome is to read both stories from topic $A$ and none from topic $B$ in state $S_1$, and to read both from topic $B$ and none from topic $A$ in state $S_2$. 
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for some $z_n^k \in [0, 1]$, for $n \in I$ and $k \in K$.

Assume $C_F = 0$, $\nu_{RD} = \frac{1}{4}$, $\nu_{SW}$, $\nu_{SK} > 0$.

**Reader-optimal outcome** is to read both stories from topic $A$ and none from topic $B$ in state $S_1$, and to read both from topic $B$ and none from topic $A$ in state $S_2$. 
Example 1.1: Consumer Efficient Equilibrium

Suppose the firms choose the consumer-optimal ranking of stories $\sigma_i = \sigma^*$, $i \in I$, given by

$$\sigma^* = \begin{cases} 
\{(1, z_1^A), (0.75, z_2^A), (0.5, z_1^B), (0.4, z_2^B)\} & \text{if } S_1 \text{ occurs} \\
\{(0.5, z_1^B), (0.5, z_2^B), (1, z_1^A), (0.75, z_2^A)\} & \text{if } S_2 \text{ occurs.}
\end{cases}$$

The readers know the strategies and have no incentive to switch outlets from the one they have bookmarked, regardless of the strategy of the other firm. They always read the first two stories and stop.

If the switching cost $\nu_{SW}$ and the skipping cost $\nu_{SK}$ are sufficiently small, and if profits are such that both firms choose to operate, then the consumer-optimal ranking is always an equilibrium. This result is general.
Example 1.2: Inefficient Equilibrium – wrong stories read

Assume the **switching cost** $\nu_{SW}$ is prohibitively **high**, so that both firm 1 and firm 2 have a monopoly over their measure of readers, $M_1$ and $M_2 = 1 - M_1$, respectively.

We can focus on the reader’s choices within the same outlet.

Suppose one of the firms chooses the following ranking

\[
\hat{\sigma} = \begin{cases} 
\{(0.5, z_1^B), (0.4, z_2^B), (1, z_1^A), (0.75, z_2^A)\} & \text{if } S_1 \text{ occurs} \\
\{(0.5, z_1^B), (0.5, z_2^B), (1, z_1^A), (0.75, z_2^A)\} & \text{if } S_2 \text{ occurs.} 
\end{cases}
\]

Knowing this, the reader considers just two plans of action

(i) read the first two stories, regardless of the state
(ii) skip the first, after which he learns the true state.

There is $\overline{\nu}_{SK} \in [0, \nu_{RD}]$ such that for $\nu_{SK} > \overline{\nu}_{SK}$, the agent always chooses (i), and for $\nu_{SK} < \overline{\nu}_{SK}$, he always chooses (ii).
Example 1.2: Inefficient Equilibrium – wrong stories read

Recall: **Switching cost** $\nu_{SW}$ is prohibitively **high**.

**Large skipping costs:** If $\nu_{SK} > \overline{\nu}_{SK}$, the reader always chooses (i), leading to final history:

$$\hat{\sigma} = \begin{cases} 
(0.5, z^B_1), (0.4, z^B_2), (1, z^A_1), (0.75, z^A_2) & \text{if } S_1 \text{ occurs} \\
(0.5, z^B_1), (0.5, z^B_2), (1, z^A_1), (0.75, z^A_2) & \text{if } S_2 \text{ occurs.}
\end{cases}$$

**Small skipping costs:** If $\nu_{SK} < \overline{\nu}_{SK}$, the reader always chooses (ii), leading to final history:

$$\hat{\sigma} = \begin{cases} 
(0.5, z^B_1), (0.4, z^B_2), (1, z^A_1), (0.75, z^A_2) & \text{if } S_1 \text{ occurs} \\
(0.5, z^B_1), (0.5, z^B_2), (1, z^A_1), (0.75, z^A_2) & \text{if } S_2 \text{ occurs.}
\end{cases}$$

Firm 1 has no incentive not to give the agent the stories in order he wishes to read, but it also has no disincentive not to.
Example 1.3: Inefficient Equilibrium – too many stories

Maintain: **Switching cost** $\nu_{SW}$ is prohibitively high.

Consider another ranking, $\tilde{\sigma} = \begin{cases} 
\{(0.4, z_1^B), (1, z_1^A), (0.5, z_2^B), (0.75, z_2^B)\} & \text{if } S_1 \text{ occurs} \\
\{(0.5, z_1^B), (1, z_1^A), (0.5, z_2^B), (0.75, z_2^B)\} & \text{if } S_2 \text{ occurs.} 
\end{cases}$

**Large skipping cost:** If $\nu_{SK} > \tilde{\nu}_{SK}$, the agent chooses to always read the first three stories, regardless of the true state.

If firm 1 chooses $\tilde{\sigma}$, total readership is $3M_1$ rather than $2M_1$ in both states and its profit is higher than before.

The driving force here is a misalignment of readers’ and outlets’ objectives: the media want as much readership as possible; readers do not want to read too much.
Example 1.3: Inefficient Equilibrium – too many stories

Maintain: **Switching cost** $\nu_{SW}$ is prohibitively **high**.

Consider another ranking,

\[ \tilde{\sigma} = \begin{cases} 
\{(0.4, z_1^B), (1, z_1^A), (0.5, z_2^B), (0.75, z_2^B)\} & \text{if } S_1 \text{ occurs} \\
\{(0.5, z_1^B), (1, z_1^A), (0.5, z_2^B), (0.75, z_2^B)\} & \text{if } S_2 \text{ occurs.} 
\end{cases} \]

**Large skipping cost:** If $\nu_{SK} > \tilde{\nu}_{SK}$, the agent chooses to always read the first three stories, regardless of the true state.

If firm 1 chooses $\tilde{\sigma}$, total readership is $3M_1$ rather than $2M_1$ in both states and its profit is higher than before.

The driving force here is a **misalignment** of readers’ and outlets’ objectives: the media want as much readership as possible; readers do not want to read too much.
Example 1.4: Consumer Efficient Equilibrium Again

**Small switching cost:** If $\nu_{SW} < \tilde{\nu}_{SW}$, then the equilibrium above cannot be sustained.

If firms do not deviate from $\tilde{\sigma}$, then their profit is $\Pi_1 = 3M_1$ and $\Pi_2 = 3(1 - M_1)$, respectively.

If firm 1 deviates to the consumer efficient ranking $\sigma^*$, then it will seize the entire market but obtain less readership per individual, and make profit $\Pi_1 = 2$, which it will do for measure of readers $M_1 < 2/3$. Similarly, firm 2 will deviate for a measure of readers $M_1 > 1/3$.

**Lowering** the technological cost of switching from one outlet to another leads to a welfare improvement for readers.
Example 1.5: Story Endowment

So far initial endowment of stories $x^k_0, k \in K$, was zero. In general stories develop over time and so complementarities can play a role over time as well.

This can be modeled by allowing for positive initial endowments, $x^k_0 \geq 0, k \in K$.

- A positive initial endowment on topic $A$, $x^A_0 > 0$ leaves reader preferences unchanged.
- A positive initial endowment on topic $B$, $x^B_0 > 0$ can affect readers’ preferences: more demand for topic $B$.
- Further strategic effect for news sources.
Example 2: Non-Beneficial Technology – set-up

One state of the world,
\[ S = \{(1, z^A_1), (0.5, z^A_2), (0.456, z^B_1), (0.455, z^B_2), (0.454, z^B_3)\} \].
Cost of reading \( \nu_{RD} = 0.3 \).

Reader prefers to read only \((1, z^A_1)\); his second preferred outcome is \((0.456, z^B_1), (0.455, z^B_2), (0.454, z^B_3)\).

Media firms prefer readers to read the three stories from topic \( B \) rather than only one from topic \( A \).

For large skipping cost \( \nu_{SK} \) and for large switching cost \( \nu_{SW} \), it can achieve this with ranking

\[ \hat{\sigma} = \{(0.456, z^B_1), (0.455, z^B_2), (0.454, z^B_3), (1, z^A_1), (0.5, z^A_2)\} \].

Each firm has a strict incentive to set \( \sigma_i = \hat{\sigma}, \ i \in I \), and for high enough values of \( \nu_{SK} \) and \( \nu_{SW} \) this forms an equilibrium.
Example 2: Non-Beneficial Technology – set-up

One state of the world,
\[ S = \{(1, z_1^A), (0.5, z_2^A), (0.456, z_1^B), (0.455, z_2^B), (0.454, z_3^B)\} \].

Cost of reading \( \nu_{RD} = 0.3 \).

Reader prefers to read only \((1, z_1^A)\); his second preferred outcome is \((0.456, z_1^B), (0.455, z_2^B), (0.454, z_3^B)\).

Media firms prefer readers to read the three stories from topic B rather than only one from topic A.

For large skipping cost \( \nu_{SK} \) and for large switching cost \( \nu_{SW} \), it can achieve this with ranking
\[ \hat{\sigma} = \{(0.456, z_1^B), (0.455, z_2^B), (0.454, z_3^B), (1, z_1^A), (0.5, z_2^A)\} \].

Each firm has a strict incentive to set \( \sigma_i = \hat{\sigma}, i \in I \), and for high enough values of \( \nu_{SK} \) and \( \nu_{SW} \) this forms an equilibrium.
Example 2.1: Inefficient Equilibrium – too many stories

**Small switching cost:** Suppose $\nu_{SW} = 0$, then readers have no cost of switching from one outlet to another. A firm can only profitably deviate by capturing the other firm’s market share, which it could only do by placing $(1, z_1^A)$ first.

Firm 1 will not deviate from strategy $\sigma_1 = \hat{\sigma}$ if $M_1 > 1/3$. Similarly, firm 2 will not deviate from strategy $\sigma_2 = \hat{\sigma}$ if $M_1 < 2/3$ (or $M_2 = 1 - M_1 > 1/3$).

Therefore, for $M_1 \in (1/3, 2/3)$ neither firm will deviate from strategy $\hat{\sigma}$, and the **consumer-efficient equilibrium**, obtained with large switching costs, **does not exist**.

Taking the other firm’s market does not compensate for loss of readership of providing readers with their preferred ranking.
Example 2.2: Subsidized Intervention

Maintain **small switching cost** and assume $M_1 \in (1/3, 2/3)$.

If a social planner wanted to subsidize a media firm to maximize reader welfare, the least expensive method would be to **subsidize** the firm with the smaller measure of agents.

If $M_2 = 1 - M_1 < M_1$, then the subsidy goes to firm 2. For a large enough subsidy, firm 2 would have to set $\sigma_2 = \sigma^*$, where

$$\sigma^* = \{(1, z_1^A), (0.5, z_2^A), (0.456, z_1^B), (0.455, z_2^B), (0.454, z_3^B)\}.$$  

In this case, firm 1 best responds by also setting $\sigma_2 = \sigma^*$, and both firms would keep their market share.

In this case, subsidizing only one firm by forcing it to maximize reader welfare also forces the other firm to do the same.
Example 2.3: Inefficient Equilibrium – political implications

Readers now make **political decisions**, e.g., they vote over an issue on which reading the topic $A$ story would influence them.

Assume that if content $z_1^A = 1$, they vote for one candidate, and if content $z_1^A = 0$, they would vote for another.

There are two states of the world,

$S_1 = \{(1, 1^A), (0.5, z_2^A), (0.456, z_1^B), (0.455, z_2^B), (0.454, z_3^B)\}$

$S_2 = \{(1, 0^A), (0.5, z_2^A), (0.456, z_1^B), (0.455, z_2^B), (0.454, z_3^B)\}$.

Since media outlets are unbiased towards content, for high enough $\nu_{SK}$, they rank stories as in $\hat{\sigma}$, for both states. (Recall $\hat{\sigma} = \{(0.456, z_1^B), (0.455, z_2^B), (0.454, z_3^B), (1, z_1^A), (0.5, z_2^A)\}$.)

All readers would strictly prefer to acquire information and vote according to their posterior. Instead, they will always remain uninformed, and vote according to their prior.
Example 2.4: Heterogenous Readers – anti-coordination

So far, profit-maximizing firms coordinate on stories in equilibrium. This is a consequence reader homogeneity. Extending the model to heterogeneous readers, e.g. in switching costs, can lead to anti-coordination.

Suppose firm 1 has two types of readers: with high switching cost $\nu_{SW,i}$, and with low switching cost $\nu_{SW,ii}$.

If $M_{1,i} > 1/2$ is measure of first type and $M_{1,ii} = 1/3$ of second type. (Switching costs of remaining agents not relevant.)

- Firm 1 has incentive to play $\hat{\sigma}$, while firm 2 plays the consumer-efficient strategy $\sigma^*$.
- $M_{1,i}$ readers will read three stories on topic B offered by firm 2, while $1 - M_{1,i}$ read only first story on topic A.
Conclusion

We developed a framework to study explicitly the possibilities and limitations of different media and media technologies.

We got some partial hints and characterizations but hope to get a more complete picture.

In particular we hope to add a political dimension to the model and contrast the findings with empirical evidence or stylized facts of media supply and demand in practice.