

The Attention Economy of Search and Web Advertisement

Alexander White

Harvard Department of Economics
(joint with Kamal Jain, Microsoft Research)

September 15, 2010

Paris

People Surf the Web

A screenshot of a Bing search results page for the query "detroit red wings". The page shows search results for tickets, schedules, and news. A sidebar on the left contains navigation links for "DETROIT RED WINGS", "Roster", "Merchandise", "Tickets", "Arena", "Wallpaper", "News", "Images", and "Videos". Below the sidebar are "RELATED SEARCHES" and "SEARCH HISTORY".

A screenshot of the Detroit Red Wings website. The header features the team name "Detroit Red Wings" and the slogan "The Beard Is Back". Below the header is a navigation menu with links for "HOME", "SCHEDULE", "STATS", "NEWS", "MULTIMEDIA", "FAN ZONE", "HISTORY", and "SHOP". The main content area includes a "STANLEY CUP SHOP" banner, a "NEXT GAME" section for a game against Pittsburgh on June 4, 2009, and a "RED WINGS TV" section. A large image of a player in a red jersey is visible on the right side.

A screenshot of a BMW website advertisement for the 2011 BMW 3 Series. The main image shows a silver BMW 3 Series driving on a road. The text reads: "34 YEARS OF IMPRESSIVE ACCOLADES. \$0 DOWN AT SIGNING UNTIL SEPTEMBER 30TH. ON ALL 2011 BMW 3 SERIES. SEE THE LEASE OFFER." Below the main image are several smaller sections: "BMW Members", "Quote On Demand", "BMWUSA on Facebook", "Trading In Your Car?", and "Ultimate Driving Accolades". The footer contains links for "Privacy Policy", "Contact Us", "Site Map", and "View Mobile Site".

People Surf the Web

Website	Search %	Bounce %	Minutes on site
BBC.co.uk	11.8	35.9	6.6
Cooks.com	56.5	28.8	2.5
Facebook.com	6.7	12.8	32.2
HuffingtonPost.com	13.9	47.3	5.7
IMDB.com	30.2	31.1	4.6
MySpace.com	16.4	31.3	9.6
Orange.fr	8.3	19.7	9.2
WebMD.com	36.5	45.0	4.2
Wikipedia.org	50.6	49.4	5.1
Yelp.com	42.1	47.8	3.8
Youtube.com	14.9	23.4	20.2

Source: Alexa.com



foire aux vins

Rechercher

Environ 417 000 résultats (0,12 secondes)

Recherche avancée

- Tout
- Actualités
- Plus

- Le Web
- Pages en français
- Pays : France
- Date indifférente
- Les plus récentes
- 2 derniers jours
- Plus d'outils

Foire aux Vins

Liens commerciaux

promosintermarche.com/foireauxvins/ Découvrez nos Bon plans Vins. Du 08 au 18/09 dans nos Magasins !

Foire aux vins 2010

www.chateaunet.com La foire aux vins la moins chère du net avec Chateaunet: Comparez !
√ Bordeaux - √ Champagne - √ Bourgogne - ► Foire aux vins !

La Foire aux vins

www.ChateauOnline.fr/foireauxvins Plus de 300 produits jusqu'à -50% Livraison offerte à partir de 220€

Recherches associées : [foire aux vins carrefour](#) [foire aux vins auchan](#)

Foire aux Vins d'Alsace du 05 au 15 août 2011

Foire aux Vins d'Alsace 62e édition de la **Foire aux Vins** de Colmar Du 07 au 16 aout 2009 - Colmar - Parc des expositions · Accueil · La Foire ...
Le Festival - Billetterie Festival - Horaires et tarifs
www.foire-colmar.com/ - En cache - Pages similaires

Guide d'achat : foire aux vins 2010 à Auchan, Carrefour, Leclerc ...

Une sélection indépendante de vins à acheter dans les **foires aux vins**.
www.guideduvin.com/foires-aux-vins

Carrefour - Foire aux vins 2010

Accédez à plus de 500 vins d'où vous voulez et quand vous le souhaitez depuis carrefour.fr ou en téléchargeant gratuitement l'application iPhone **Foire@vins** ...
foireauxvins.carrefour.fr/ - En cache - Pages similaires

Actualités correspondant à foire aux vins

[Foire aux vins / Sacré 2008...](#) - Il y a 52 minutes

Foire aux vins. Un très beau millésime arrive à bon prix en rayon... mais n'achetez pas les yeux fermés. Pour les papas amateurs de bons bordeaux, ...

L'Union - [Autres articles \(2\)](#) »

[À Lens, les amateurs de vin sont désormais servis !](#) - La Voix du Nord

[Xavier Leclerc : « Les foires, c'est 20 % de nos ventes annuelles ...](#) -

La Voix du Nord - [Autres articles \(2\)](#) »

Liens commerciaux

Foire Aux Vins en Ligne

Les Meilleurs Vins au Meilleur Prix
Livraison Gratuite dès 150€ d'Achat
www.Vinotheque-Bordeaux.com/Foire

Foire : Promos sur le Vin

Grande foire aux Vins sur Cdiscount
Sélection unique à prix sacrifiés !
www.Cdiscount.com/Vin

Foire aux Vins 2010

Vins de France et du Monde en offre
Economisez jusqu'à -50%
www.chineurduvin.fr/foireauxvins

Les meilleurs vins du net

1ère livraison gratuite
avec le code COM1FRANCO
www.leverreetlafourchette.com

Déstockage vins fins

Le pro du déstockage, prix discount
Bordeaux Bourgogne vieux millésimes
www.vinfinpascher.com
Île-de-France

Achat de vin

21 vins d'exception à prix baissé !
Foire aux Vins jusqu'au 3 octobre
www.mondovino.com/foire-aux-vins

FOIRE Entrée Gratuite

Recevez Votre Invitation Gratuite !
Invitation & Inscription Gratuite
www.foiredautomne.fr/
Île-de-France



LE MONDE ACCUSE L'ÉLYSÉE

Le Monde accuse l'Elysée d'avoir sollicité le contre-espionnage pour identifier la source d'un de ses journalistes travaillant sur l'affaire Bettencourt-Woerth et va porter plainte contre X.

Accueil > Economie Région

Foire aux vins / Sacré 2008...

Publié le mardi 14 septembre 2010 à 10H36

Un très beau millésime arrive à bon prix en rayon... mais n'achetez pas les yeux fermés.

Pour les papas amateurs de bons bordeaux, le père Noël ne passe pas en décembre mais en septembre. Catalogue dans une main et chariot dans l'autre, ils parcourent depuis mardi dernier et pour trois semaines encore les foires aux vins des grandes surfaces. Ils ne rechignent devant aucun effort pour refaire ou parfaire le niveau de la cave familiale.

Le moment s'y prête car jamais pendant l'année on ne trouvera un tel choix de vins sous de mêmes toits. Surtout que toutes les grandes enseignes de distribution sont sur le pied de guerre pour proposer un catalogue

SEAT Leon

GOOD STUFF

4 500€ TTC
d'avantage client

Credit Auto
2,9%



Du 1 au 30 septembre 2010 PROFITEZ AVEC LUI



Cliquez ici !



NOUVEAU SEAT Alhambra

Reprise Argus*
4 000€ TTC

Credit Auto
2,9%

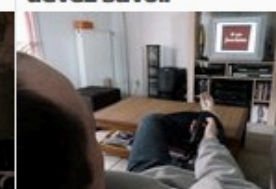
A suivre

Tchat spécial foires aux vins



< précédent - suivant >

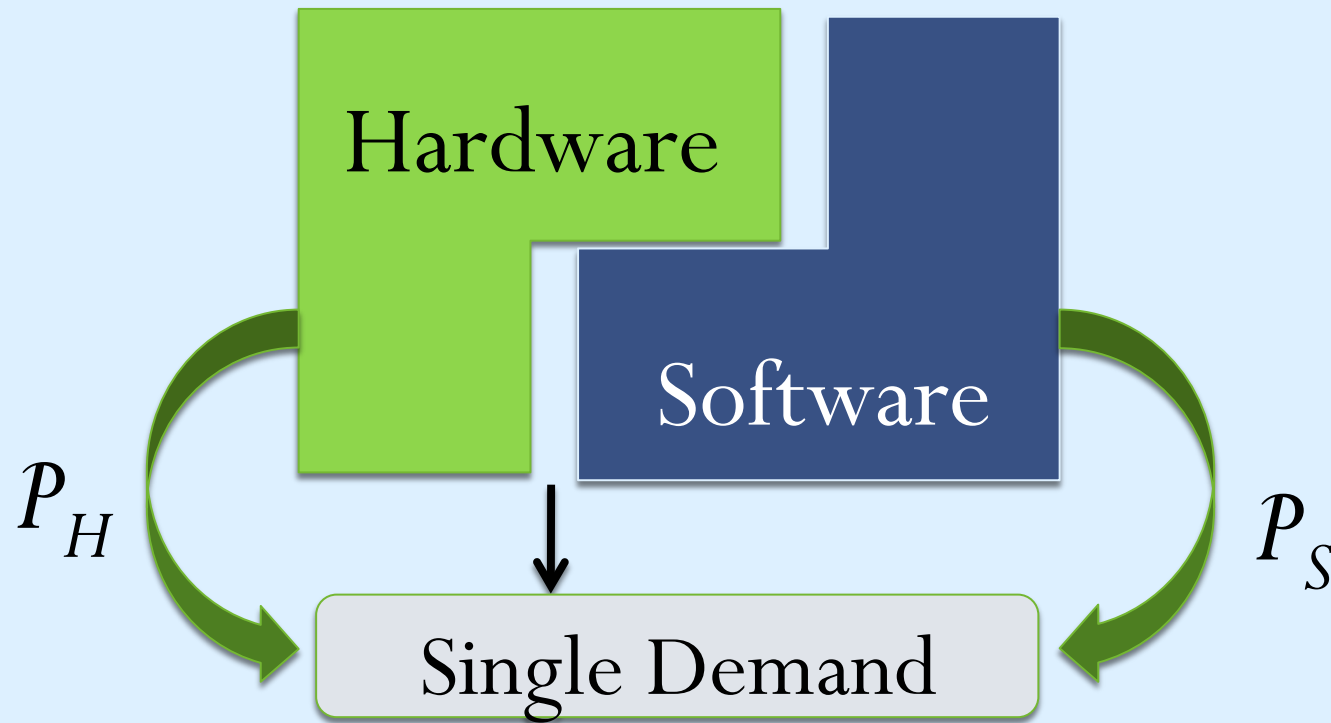
TNT : ce que vous devez savoir



Aujourd'hui, plus de trois bouteilles sur quatre sont vendues en grande surface. Même les grands châteaux doivent y passer.



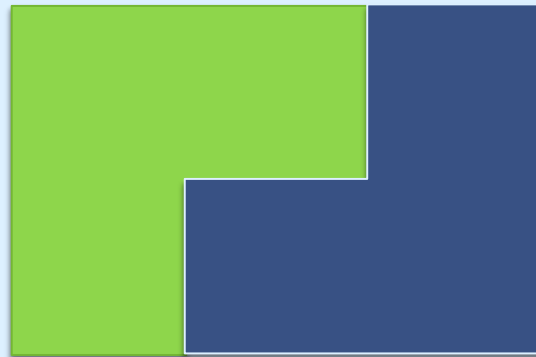
Typical Complement Sellers' Problem:



Double Marginalization: $P_H + P_S > P^*$

- Cournot 1838, ch. IX

Typical Solutions: One Price Setter



↓ $p = p^*$

Single Demand

With advertisement, however, there are two effects at play

- Different websites have different advertising technologies

A Model

A “Search Engine” (SE), a “Content Website” (CW),
and “Users”

$$U_i = \begin{cases} v_i - (\delta_{se} + \delta_{cw}), & \text{if visits both sites} \\ 0, & \text{otherwise} \end{cases}$$

$$v_i \sim [\underline{v}, \bar{v}]$$

SE and CW Profits

$$\Pi_{se} = (a_{se} - c_{se})D(\delta_{se}(a_{se}) + \delta_{cw}(a_{cw}))$$

$$\Pi_{cw} = (a_{cw} - c_{cw})D(\delta_{se}(a_{se}) + \delta_{cw}(a_{cw}))$$

A Model

Timing

1. SE and CW set advertising levels
2. Users decide whether to search and visit content site

“Industry” Optimum

$$\max_{\{a_{se}, a_{cw}\}} (a_{se} + a_{cw} - c_{se} - c_{cw})D(\delta_{se}(a_{se}) + \delta_{cw}(a_{cw}))$$

Necessary conditions at optimum:

$$a_{se}^{\Pi} + a_{cw}^{\Pi} - c_{se} - c_{cw} = \frac{D}{-D'} \cdot \frac{1}{\delta'_{se}}$$

$$a_{se}^{\Pi} + a_{cw}^{\Pi} - c_{se} - c_{cw} = \frac{D}{-D'} \cdot \frac{1}{\delta'_{cw}}$$

These imply:

$$\delta'_{se}(a_{se}^{\Pi}) = \delta'_{cw}(a_{cw}^{\Pi})$$

Equilibrium

Each site $j = se, cw$ solves:

$$\max_{a_j} (a_j - c_j) D(\delta_j(a_j) + \delta_{-j}(a_{-j}))$$

Necessary condition for each site:

$$a_j^* - c_j = \frac{D}{-D'} \cdot \frac{1}{\delta_j'}$$

Two Distortions

Equilibrium

$$a_{se}^* + a_{cw}^* - c_{se} - c_{cw} = \frac{D}{-D'} \cdot \left(\frac{1}{\delta'_{se}} + \frac{1}{\delta'_{cw}} \right)$$

- Double Marginalization
- “Mis-marginalization”

Industry Optimum

$$a_{se}^{\Pi} + a_{cw}^{\Pi} - c_{se} - c_{cw} = \frac{D}{-D'} \cdot \frac{1}{\delta'_{se}}$$

$$\delta'_{se} = \delta'_{cw}$$

Comparison

Until Now

- One Search Engine
- One Content Website



Let's Compare With

- One Search Engine
- Perfectly Competitive
Content Websites



Comparison

Until Now

- One Search Engine
- One Content Website

Key point

Adding competition can reduce both

- Industry profits
- Total welfare

Example

Advertising Technologies: $\delta_{se}(a_{se}) = a_{se}^2$

$$\delta_{cw}(a_{cw}) = \frac{a_{cw}^2}{\gamma}$$

Zero Marginal Costs

Users' Valuations: $v_i \sim U[0, \bar{v}]$

Case 1: One SE, One CW

Choosing Advertising Levels—SE and CW solve:

$$\max_{a_{se}} a_{se} \left[1 - \frac{a_{se}^2 + \left(\frac{a_{cw}}{\gamma} \right)^2}{\bar{v}} \right] \quad \max_{a_{cw}} a_{cw} \left[1 - \frac{a_{se}^2 + \left(\frac{a_{cw}}{\gamma} \right)^2}{\bar{v}} \right]$$

(Same Users)



Case 2: One SE, Competitive CWs

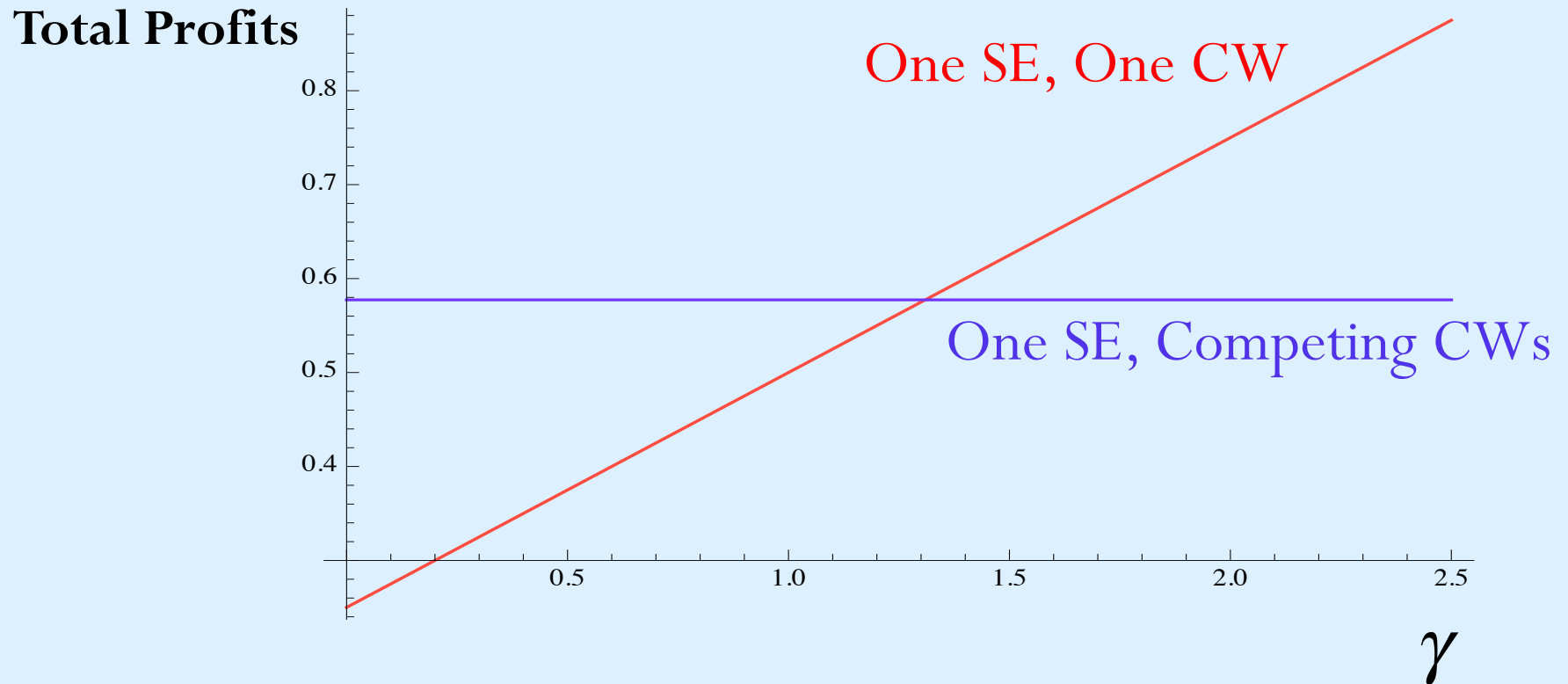
Here, only search engine sets positive advertising

Choosing Advertising Levels—SE solves:

$$\max_{a_{se}} a_{se} \left[1 - \frac{a_{se}^2 + \left(\frac{0}{\gamma}\right)^2}{\bar{v}} \right]$$

Tradeoff:

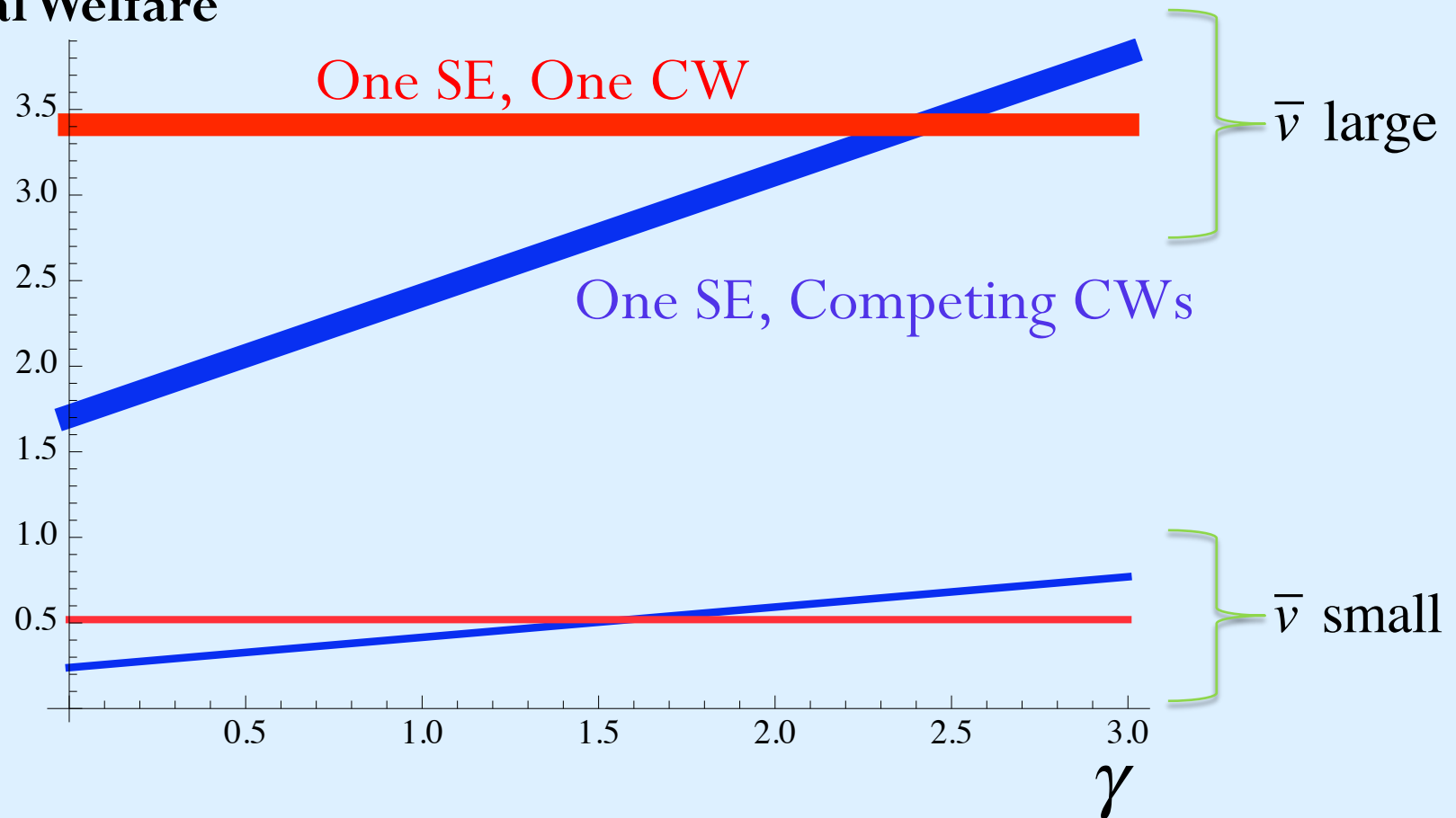
Double Marginalization versus Mis-marginalization



Tradeoff:

Double Marginalization versus Mis-marginalization

Total Welfare



Proposition

- a) Starting from the Nash Equilibrium outcome with a single SE and a single CW, if the CW advertising level, a_{cw} , is exogenously decreased, and the SE responds optimally, then total industry profits increase
- b) Starting from an outcome featuring competitive CW advertising ($a_{cw} = c_{cw}$), then total industry profits increase if and only if

$$\delta'_{cw}(c_{cw}) < \delta'_{se}(a_{se}^*(\delta_{cw}(c_{cw})))$$

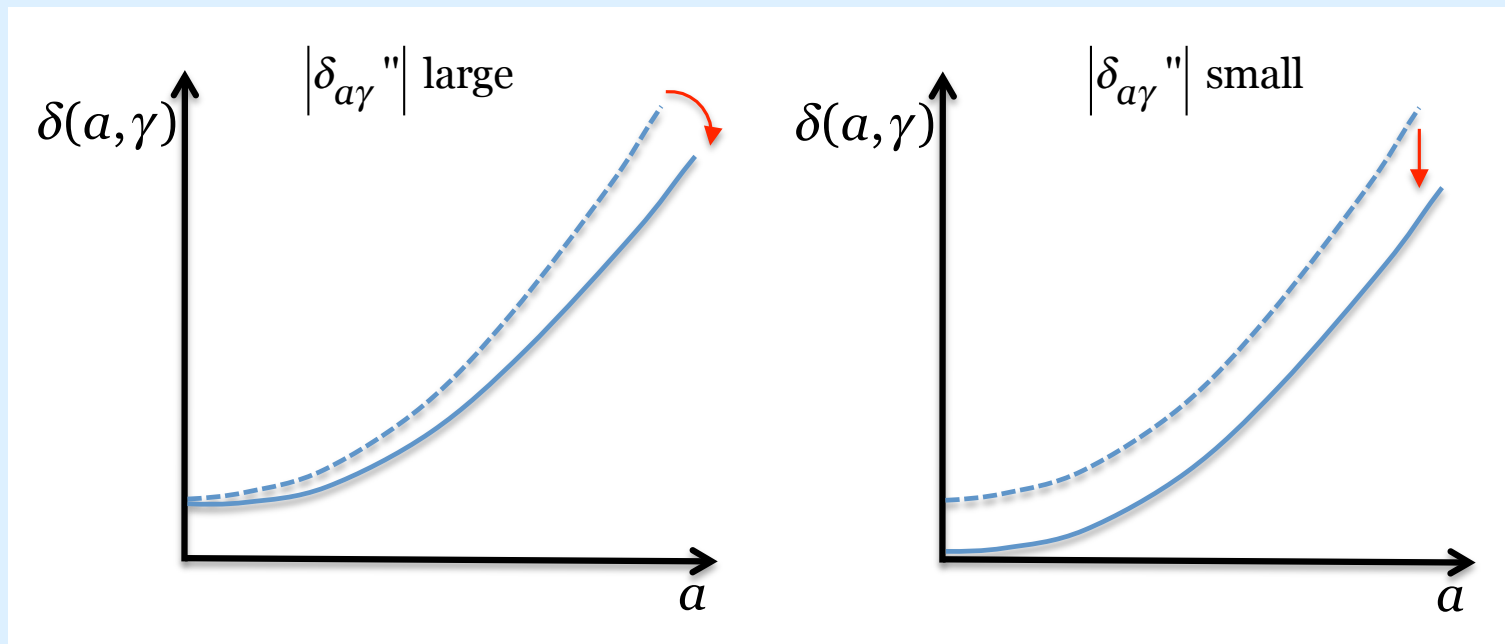
What Can We Take from This?

- When complementary websites advertise differently, there are (at least) *two* sources of economic distortion:
 - *Level* of distraction
 - *Payoff* from distracting
- Empirically, payoff from showing ads seems to be highly variable:
In 2007, the CPM paid by advertisers varied from less than \$1 to more than \$100 (source: Evans '08)
- When evaluating conduct of firms in this industry, both of these issues should be taken into account
- Potential benefits of allowing sites to share information about users?

In the Paper

General, price theoretic treatment of the problem

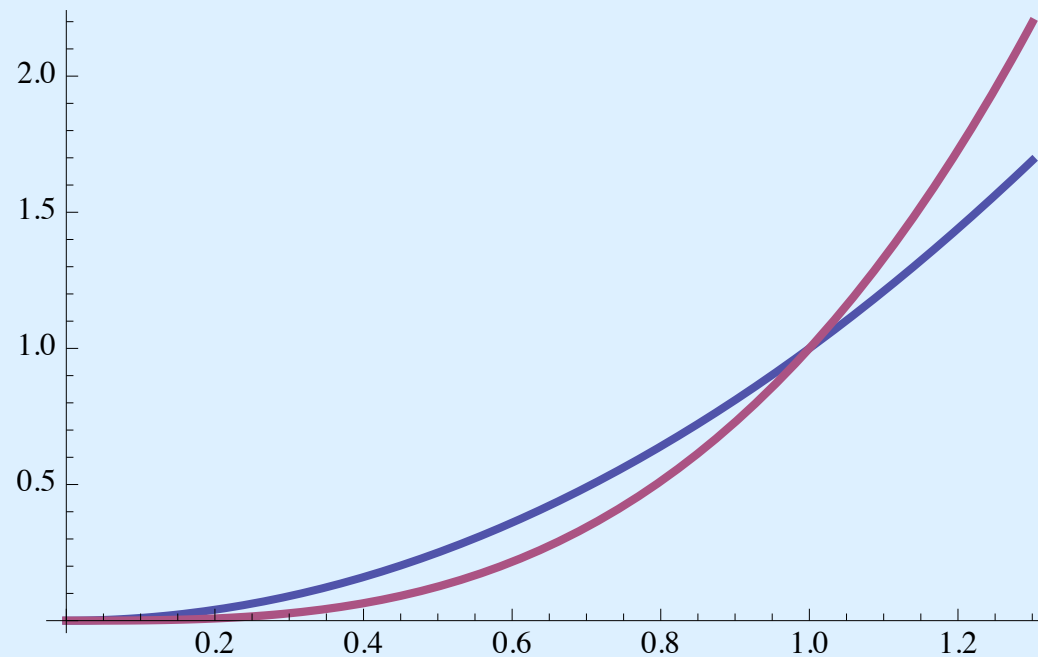
- Start off with one site, examine different advertising technologies



In the Paper

General, price theoretic treatment of the problem

- Start off with one site, examine different advertising technologies



In the Paper

General, price theoretic treatment of the problem

- Start off with one site, examine different advertising technologies
- Analyze problem with arbitrary number of sites
 - **Two fundamental distortions**
 - **Double marginalization**
 - **Mis-marginalization**

In the Paper

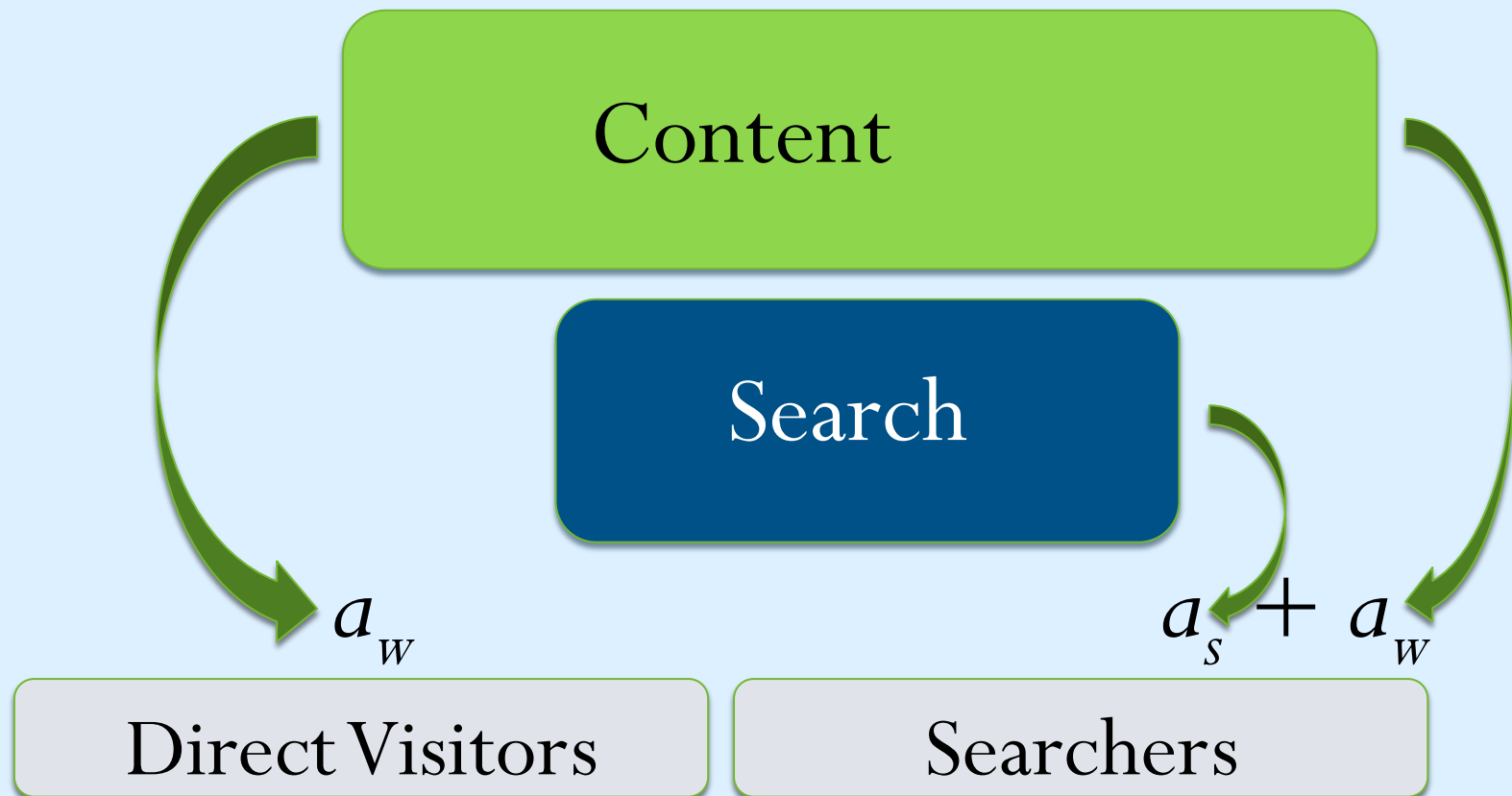
General, price theoretic treatment of the problem

- Start off with one site, examine different advertising technologies
- Analyze problem with arbitrary number of sites
 - Two fundamental distortions
 - Double marginalization
 - Mis-marginalization
- Salop model: 1 search engine, n content websites
 - Study effects of differentiation, incentives for entry
 - Surprising result: In equilibrium, users benefit from **more differentiation/ less entry** by content websites

Future Work

- Relate to ongoing work on general framework of platform competition (with Glen Weyl)
- Integrate constraints on transferability of utility between platforms and consumers
- Better understand relation to Cournot with asymmetric costs

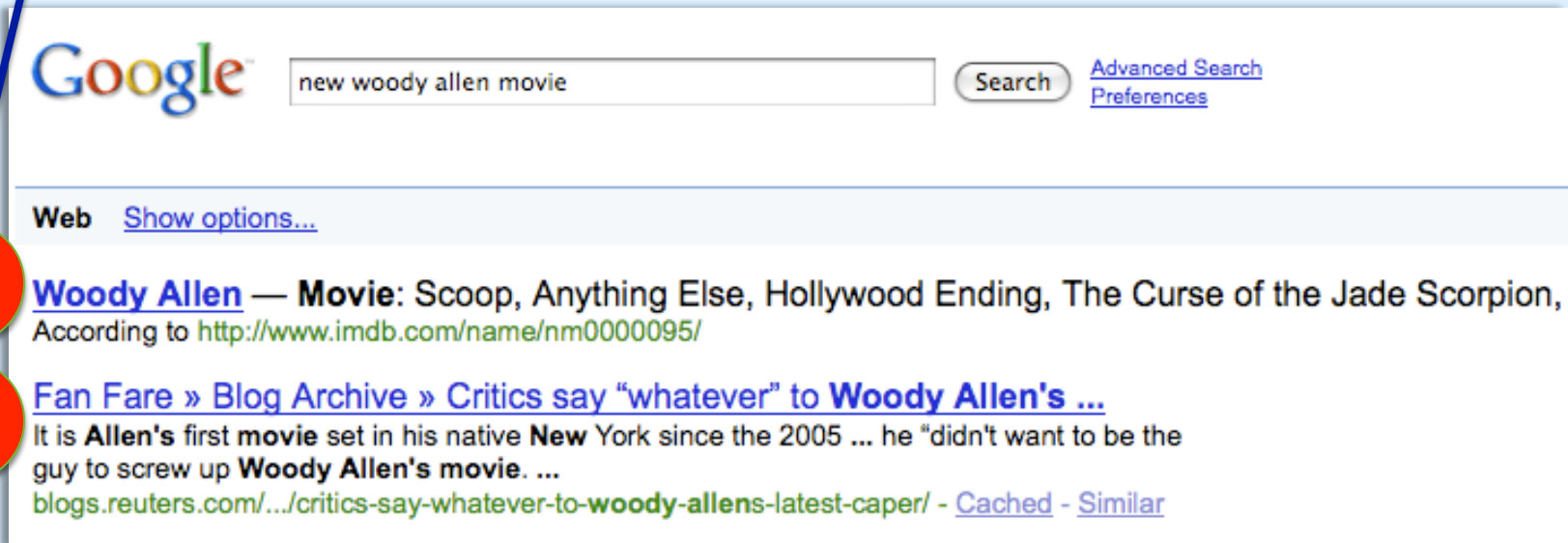
Partial Complementarity



Searcher benefit direct visitors, and direct visitors harm searchers

Unreliable Content Sites

$$\lambda v_i - a_s^2 - a_{w,1}^2$$



The screenshot shows a Google search interface. The search bar contains the text "new woody allen movie". To the right of the search bar are buttons for "Search", "Advanced Search", and "Preferences". Below the search bar, there is a "Web" tab and a "Show options..." link. Two search results are visible:

- 1** [Woody Allen](#) — **Movie:** Scoop, Anything Else, Hollywood Ending, The Curse of the Jade Scorpion, According to <http://www.imdb.com/name/nm0000095/>
- 2** [Fan Fare » Blog Archive » Critics say "whatever" to Woody Allen's ...](#)
It is **Allen's** first **movie** set in his native **New** York since the 2005 ... he "didn't want to be the guy to screw up **Woody Allen's** movie. ... blogs.reuters.com/.../critics-say-whatever-to-woody-allens-latest-caper/ - [Cached](#) - [Similar](#)

$$(1 - \lambda)\lambda v_i - a_s^2 - a_{w,1}^2 - a_{w,2}^2$$

Related Literature

- Surveys:
 - Evans (RNE '08), (JEP '09)
- Link Structure:
 - Katona & Sarvary (Marketing Science '08)
 - Dellarocas, Katona & Rand
- Search Engine as a Platform
 - Athey-Ellison
 - Gomes
 - White
- Advertising on Platforms:
 - Anderson & Coate (RES '05)
 - Choi (IEP '06)
 - Crampes, Hartichbalet & Jullien (JIE '09)
- Competition Among Complement Producers:
 - Casadesus-Masanell, Nalebuff & Yoffie
 - Cheng & Nahm (RJE '07)
 - Weyl-Fabinger

Conclusion

1. Multiple websites are often complements
2. They use very different methods to turn user attention into revenue

Each of these leads to a separate coordination problem

1. Double Marginalization: too much nuisance
2. Mis-marginalization: inefficient nuisance

For websites, there is a tradeoff between solving one and solving the other