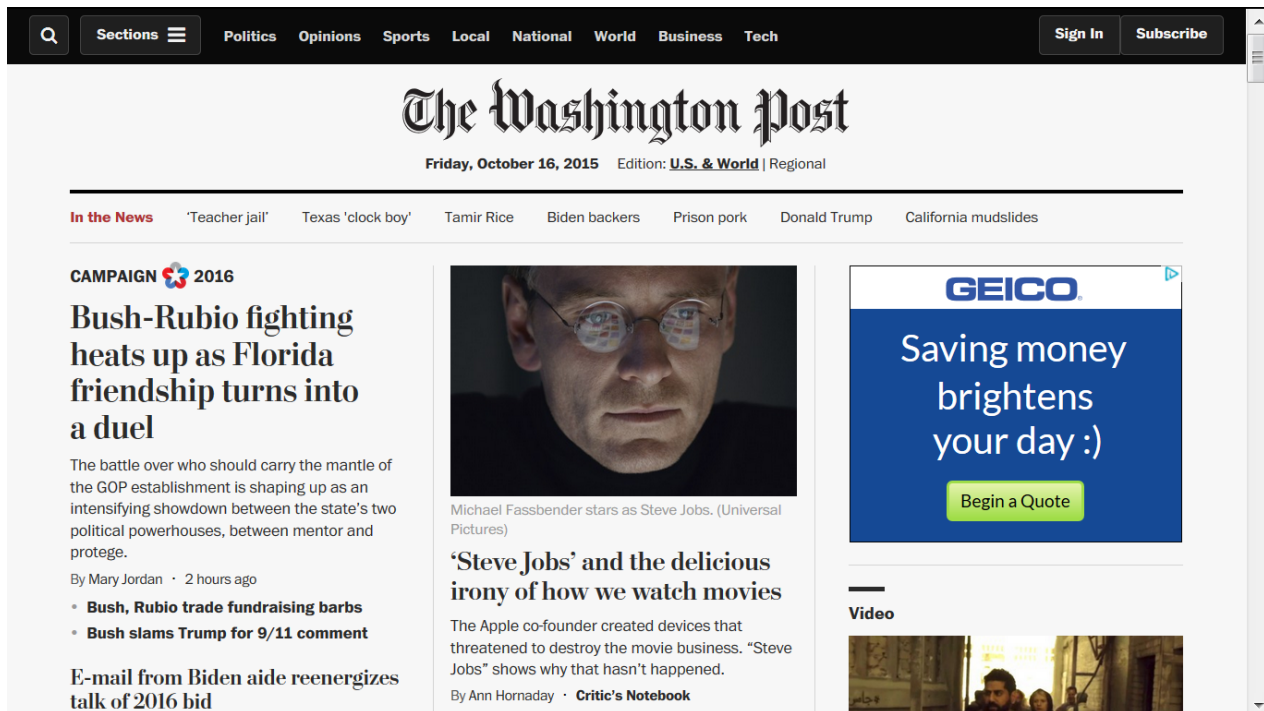


Decision Models & Analytics

Online Advertising: Display Ad Optimization

Content publishers such as The New York Times, The Washington Post and The Wall Street Journal generate revenue by using display advertisements. For example, the figure below shows the front page of The Washington Post, including a display ad paid by GEICO.



The Washington Post's website contains several different sections including Sports and National, as can be seen above. The number of views each section gets per day can be estimated by analyzing historical data. Assume that the Sports section gets six million views per day and the National section get five million views per day.

Assume four companies, GEICO, Delta, T-mobile and Capital One, wish to advertise on the Sports and National sections of the Washington Post and they contract directly with the newspaper. For each company, the contract specifies the number of times its display ads are shown in these two sections. The contracts sometimes also specify a total number of page views that can originate from any section of the newspaper. The page views promised by The Washington Post to each advertiser are summarized in Table 1 below.

Company	Sports	National	Total
GEICO	2 million	1 million	--
Delta	--	1 million	2 million
T-Mobile	1 million	1 million	3 million
Capital One	--	--	2 million

Table 1: Page Views Commitments

Assume that the contract also specifies that The Washington Post receives \$2.30 per click-through from each of the four companies. However, not every page view leads to a click. If every 1000 views leads to 5 clicks, the click-through rate is 0.5%. Newspapers use historical data and tracking technologies to determine click-through rates. Assume that the relevant click-through rates are given in the Table 2 below.

Company	Sports	National
GEICO	2.5%	0.8%
Delta	2.0%	1.0%
T-Mobile	1.0%	3.0%
Capital One	1.5%	2.0%

Figure 2: Click-through Rates

What is the optimal ad placement policy that maximizes the click-through revenues while meeting the contractual obligations?