SELL/BUY BUNDLING

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This note examines bundling where a firm sells content or a service and, in the process, buys the customer's attention or data. For example, Google bundles search with ads. This kind of sell/buy bundle is prevalent in the digital economy. We develop a framework to address the question: When will the firm require customers to take a sell/buy bundle rather than allow them to buy the content without selling their attention? Under our assumptions, if the average customer's value of content is large relative to the value of the ad and customer attention costs are relatively low, the profit-maximizing strategy for the firm is to price so that all customers take the bundle. We end by considering other reasons for sell/buy bundling that fall outside our economic model.

I. INTRODUCTION

Newspapers and online platforms provide content to readers, and, in return, readers give their attention to advertisements. Sometimes, as in the case of newspapers, there is a net positive price charged to readers for the two transactions. Other times, as with Facebook or Google, the net price is zero.

The case of customers giving up data is similar. The firm provides content or a service and, in return, the customer provides personal data. In this note, we focus on bundles where the customer is selling their attention, but the results do not depend on the label we attach to what the customer is providing.

The sale of content supported by ads is a form of bundling, but not one that has been studied in that context. In a typical case of bundling, a firm sells two goods A and B as an AB bundle. A classic example is the combination of Word, Excel, and PowerPoint into a Microsoft Office Suite bundle. Here, we look at a different type of bundle, where the bundle is a combination of selling A to the customer while buying B from the customer. We call these sell/buy bundles. As Gillian Tett has pointed out, the common case where the net bundle price is zero can also be thought of as a barter transaction since no money changes hands.[2]

The question we address is when does the firm require the customer to take a sell/buy bundle rather than allow the customer to buy the content without selling their attention. In some situations, it would be hard for the firm to provide a buy-only option. For network television to offer an ad-free version of the news would require additional content to be created for the twelve minutes per hour devoted to ads. But for digital content, removing the ads is a simple process. Examples of such unbundled services include Hulu+, Slate+, and YouTube Premium. In 2016, *The New York Times* considered launching a premium online version without ads.[3] This would have allowed readers to buy the content without selling their attention. Similarly, one could imagine a premium-priced or subscription version of Facebook or Google where the content is provided without ads.

The bundling of content with ads has received attention as part of the larger debate around the power of Big Tech. Paul Romer has proposed a tax on targeted digital ads in order to "restore and protect this digital commons."[4] As Romer recognizes (and even encourages), firms could avoid this tax by offering an ad-free subscription service at a premium price. His motivation for the tax is to move content providers away from an ad-supported model that keeps users on the platform via "filter bubbles" and addictive provocations, and towards a subscription-based revenue model. In the search-engine space, a new entry, neeva.com, offers a subscription model that aims to "surface high-authority websites, and not the ones that are chasing after clicks."[5] But for companies such as Facebook, Google, *The New York Times*, and *The Wall Street Journal*, no such premium subscription options presently exist.

In this note, we extend the traditional analysis of bundling to allow the firm to bundle a sale with a purchase. Our goal is to provide a framework for studying sell/buy bundles and to connect the framework to the traditional bundling literature. This type of bundling is prevalent in the digital economy and not well studied.

The sell/buy bundling employed by newspapers and online content providers is different from traditional bundling in one important way: it is a case of one-way bundling. For example, the customer can buy Hulu content on their own (no ads via Hulu+) or the customer can buy Hulu at a lower price and sell their attention (the bundle). But it is not possible for the customer to sell their attention without also buying content. The choice for the firm is between selling A alone or selling A and buying B as a package. There is no option for the firm to buy just B.

2 See https://hbr.org/2021/07/the-data-economy-is-a-barter-economy.

3 http://www.mandmglobal.com/new-york-times-considers-ad-free-premium-digital-subscription-model/.

4 https://www.nytimes.com/2019/05/06/opinion/tax-facebook-google.html.

5 https://www.cnbc.com/2021/05/16/sridhar-ramaswamy-ex-google-building-ads-free-search-engine-neeva-.html.

II. THE BASIC MODEL

In our model, the firm is a monopolist in terms of selling good A and a monopsonist in terms of buying good B from customers who have bought A. We do not assume that the firm is, in general, a monopsonist in terms of buying attention from the customer, only that it is a monopsonist in buying attention while the customer is consuming its A product. For example, for people online at Facebook this is the only firm to which they can sell their attention while exploring Facebook content.

We assume that price discrimination is not possible. The firm has to offer a common price to all customers when selling content and a common price to all customers when paying for their attention. In the case of a sell/buy bundle, the firm offers a single net price (possibly negative) for simultaneously selling its content and buying the customer's attention.

We first consider the case where the customers' value of content and cost of attention are independent. Let the customer's value of content be uniformly distributed over $[0,M]$ and the cost of attention be uniformly distributed over $[0,1]$. Setting the maximum cost of attention to be 1 is a normalization; M is then the ratio of the maximum value of content to the maximum cost of attention. Intuition suggests that $M > 1$, but we consider all possible values of M. Varying M will illustrate how the optimal bundle strategy changes when the average value of content is larger or smaller than the average cost of attention. Initially, we assume the value to the advertiser of any customer's attention is 1, so that it is efficient for all customers to see ads. In Section 4, we relax this assumption.

We begin with the case of a pure bundle. The firm only sells A in conjunction with buying B. The mathematics will be simpler if we adjust the bundle price to include a payment of 1 to the customer for their attention. A bundle price of p implies a net customer price of $p - 1$. (The firm collects $p - 1$ from the customer and 1 from the advertiser for p in total.) A customer with content value v and cost of attention c will buy the bundle provided:

$$v - c \geq p - 1 \text{ or } v + (1 - c) \geq p.$$

We can interpret $1 - c$ as the customer's net gain from selling attention where the 1 comes from the adjusted bundle price. In Figure 1 below, we put the value v on the vertical axis and $1 - c$ on the horizontal axis.

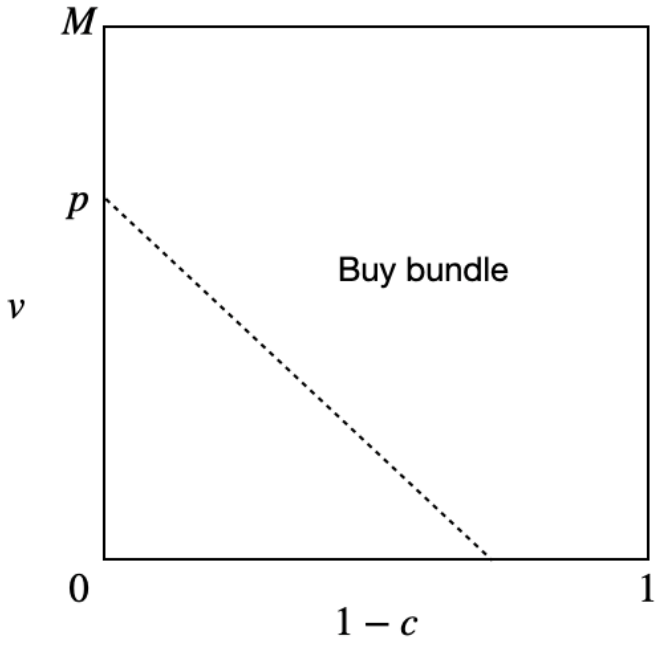

Figure 1

The customers willing to purchase content and sell their attention for a bundle offered at a price of $p - 1$ are all those lying in the upper-right region of the rectangle. This picture looks like the traditional pure-bundle pricing problem. As drawn, $M = 1$, and the profit-maximizing bundle price is $p = \sqrt{(2/3)} \approx 0.82$. Customers are offered a bundle of the content with ads for a net payment of $0.82 - 1 = -0.18$. By comparison, a bundle price of 1 corresponds to a zero-payment trade: the customer gets the content in return for accepting the ads, and no money changes hands.

At a bundle price of 1 (net price of 0), firm profit is $1/2$: the firm sells its content for free to half the market and makes 1 in ad revenue, for a profit of $1/2$. (We assume that content is free to produce.) At a price of 0.82, the firm sells to two-thirds of the market for a profit of 0.54.

These results are standard in the bundling literature. (Adams & Yellen, 1976,[6] and McAfee, McMillan & Whinston, 1989[7] are the classic analyses of buy/buy bundling.) Here, however, instead of putting the value of good B on the horizontal axis, we plot the net gain to the customer from selling attention and getting paid 1 to do so. Thus, a customer with attention cost c will gain $1 - c$. Even a customer with a very low or near-zero value of content will buy (and consume) the content provided $1 - c > p$.

If we move away from the assumption that content value and attention cost are independent, we see that the ideal case for the firm is when the value of content and the net value of selling ads are perfectly negatively correlated across customers. For example, if $v + (1 - c) = 1$ for all customers, the firm could charge a price of 1 and transact with all customers for a net profit of 1, up from 0.54. This case implies $v = c$, that is, the value of the content is perfectly *positively* correlated with the customer's cost of attention. Because one component of the bundle is flipped from selling to buying, the most desirable correlation for bundling is reversed. The cost of attention can be thought of as the customer's value of time. Under this interpretation, the desirable case is when the customer's value of content is positively correlated with the value of time. This might arise if both are positively correlated with income.

III. ONE-WAY BUNDLING

As a general matter, we know that mixed bundling is always at least as profitable for the firm as a pure bundle. And yet we see many instances of pure sell/buy bundles in the digital economy. This leads us to ask: When will the firm find it optimal to sell only a bundle and not sell content on its own? Of course, the firm can achieve the same result as with a pure bundle by offering content with no ads at a very high price. What we mean by a pure-bundle strategy is that the firm will find it optimal to price the mixed bundle so that all customers end up with the content/ad bundle or nothing—no one buys just the content.

Let p_1 be the price of just the content and $1 - p_2$ be the price offered for the customer's attention. The firm's incremental profit from buying attention is thus p_2 (since it also collects 1 from the advertiser).

Only one-way bundles are possible. That is, customers can sell their attention only if they buy the content. Customers have a choice between three options:

- buy content only at price p_1,
- buy content and sell attention at net price $p_1 - 1 + p_2$,
- do neither.

As can be seen in Figure 2, customers for whom $v > p_1$ and $1 - c \leq p_2$ will choose to purchase just the content. Customers for whom $v + 1 - c > p_1 + p_2$ and $1 - c > p_2$ will choose to purchase the content and sell their attention. All other customers will not transact.

6 Adams, William & Janet Yellen (1976), "Commodity Bundling and the Burden of Monopoly," *The Quarterly Journal of Economics*, 90, 475–98.

7 McAfee, R. Preston, McMillan, John & Michael D. Whinston (1989), "Multiproduct Monopoly, Commodity Bundling, and Correlation of Values," *The Quarterly Journal of Economics*, 104, 371–383.

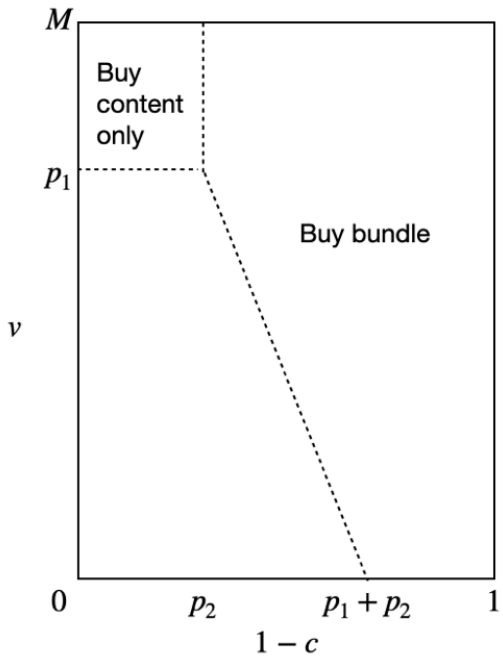

Figure 2

Following the analysis in Chen and Nalebuff (2006)[8] adapted to the case of a sell/buy bundle, the profit-maximizing solution under the uniform distribution is:

for $M > 3/2$,

$$p_1 = 1/4 + M/2,$$
$$p_2 = 0.$$

for $M \leq 3/2$,

$$p_1 = 2M/3,$$
$$p_2 = 1/2 — M/3.$$

In particular, if $M > 3/2$, so that the average value of content is at least 50 percent higher than average cost of attention, it makes sense for the firm to price so that *all* customers who buy the content also sell their attention. This follows from $p_2 = 0$. Only sell/buy bundles are transacted.

If $M = 3/2$, the price of content is 1 and the rebate for selling attention is also 1, leading to a net price of 0. The firm gives away its content and, in return, the customer looks at ads. We can think of this as the current "barter" or pure-bundle strategy of Facebook and Google.

If $M < 3/2$, the firm prices its content so that exactly two-thirds of customers who most dislike ads ($c = 1$) will buy the content only. In the limit, as M becomes very small, as much as one sixth of customers will pay the higher price and buy content only.

In presenting this solution, we have ignored potential issues around a negative net price. When $M < 3/2$, the net price the customer pays for content and accepting ads is

$$p_1 + p_2 — 1 = M/3 — 1/2 < 0.$$

8 Chen, M. Keith & Barry Nalebuff (2006), "One-Way Essential Complements," Cowles Foundation Discussion Paper 1588.

A negative price has the potential to create moral hazard. Google might not want to pay people to do a search because that would lead people to do searches solely for the purpose of collecting the fee.[9] Similarly, if customers are paid to receive content along with ads, they might take the money and not read the content. That way they do not have to pay the attention cost c. Of course, if the customer is not paying attention, the advertiser is not willing to pay 1. This moral hazard problem can arise even when the product is given away. Advertisers are only willing to pay a high price if they know the magazine and hence the ads are actually being read. For this reason, magazines with a high-end readership often require paid subscriptions even when the ad revenue would more than justify giving away the content. A zero price is less of a concern when the customer is seeking the content than when the content is being pushed to the customer.

IV. EXTENSION

We have assumed that the value of the ad to the content provider exceeds the attention cost to the customer. This seems like a reasonable assumption in the case of print media where it is easy to flip the page. But it is more debatable for content provided on mobile devices, or for ads in video or audio content. In the case of mobile devices, the ad can take up a large fraction of the screen and make it harder to read the content. It can lead to mistaken taps. In the case of ads in video or audio content, it is hard to skip over them. In some cases, such as YouTube, it is impossible to skip without first watching ads for some predetermined amount of time. In all these circumstances, we expect there to be some customers for whom the attention cost exceeds the value of the ad. In our model, that would mean $c > 1$ for at least some customers.

There is a general result for this case: It is always optimal for the firm to provide a content-only option (no ads) which some strictly positive fraction of customers purchase. The only assumption required is that there is strictly positive density for all customer types (v, c) over $[0,M]$ x $[0,C]$, where $C > 1$ is the maximum attention cost.

The intuition is that if the amount some customers are willing to pay the firm not to see the ad is greater than what the advertiser is willing to pay the firm, then the firm should sell the no-ad option to those customers. Making only a bundle available is equivalent to setting the price p_2 for customers' attention equal to $1 - C$. This implies that customers are being paid C for their attention, which is more than the revenue the ad yields. The firm would do better to reduce what it pays for attention down from C to 1, which increases the net price to 0, and then lower p_1 to the earlier bundled price of $p + 1 - C$. The profit from bundled sales remains constant at $p + 1 - C$:

original pricing: $(p_1, p_2) = (p, 1 - C)$,

new pricing: $(p_1, p_2) = (p + 1 - C, 0)$.

Under the new pricing, the firm makes the same profits from those customers who continue to buy the bundle. It also makes the same amount from those who switch from the bundle to content only. It makes more money by increasing content-only sales. This can be seen in Figure 3 below, where the firm gains a new set of content-only customers who provide the same profit as with the original bundle sales. These customers were not previously willing to buy the content when they had to sell their very costly attention in the process.

9 That said, negative prices can and do arise. Facebook Study pays $10 to $20 monthly to individuals who allow Facebook access to expanded user data; see https://www.facebook.com/facebookstudy.

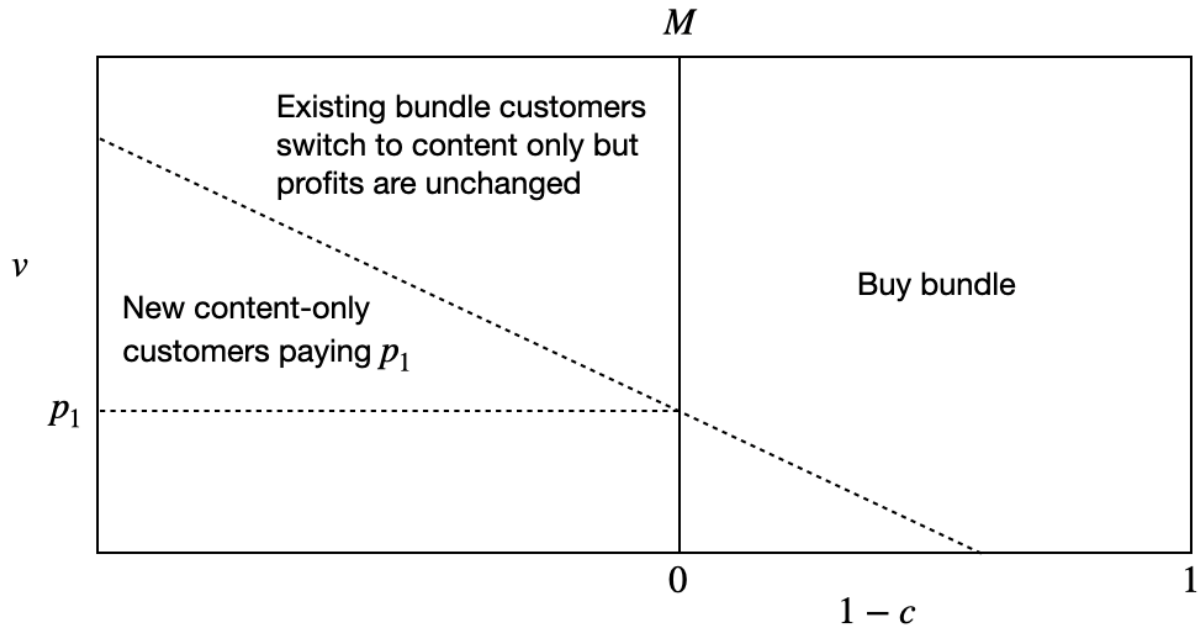

Figure 3

Another way to see this result is that the firm should sell the ad to the highest bidder. Normally, the highest bidder is the advertiser, who is willing to pay 1. If there are customers willing to pay more than 1 not to see the ad, it is more profitable to allow those customers to buy back their attention at a price of 1. Under our pricing convention, $p_2 = 0$ at an attention price of 1, so the firm is giving all the ad revenue back to the customer and doesn't make any profit from the ad. The firm does better to set $p_2 = 0$ and allow customers with $c > 1$ to avoid ads than to set $p_2 < 0$.

V. CONCLUSION

Why do we see firms offering a pure sell/buy bundle without giving customers the option to pay more and get content without seeing ads or providing data? We do see examples of ad-free content sold at a premium price: Hulu+, Slate+, and YouTube Premium, as mentioned earlier. And neeva.com is offering no-ad search and data privacy at a premium price. But why isn't this strategy more common? Our analysis provides some possible answers.

One explanation is that the customer's value of content is large relative to the value of the ad ($M > 3/2$) and customer attention costs are relatively low ($C < 1$). In this case, the profit-maximizing strategy is to price so that all customers buy the bundle.

There are several other explanations for the use of bundle-only strategies that fall outside our model. As we discussed earlier in the example of network news, it may be costly to provide a no-ad version. The no-ad version requires creating more content and not just removing the ads.

Creating a no-ad premium version of a product or service can also lead to conflicts inside the organization. If the customer is allowed to pay a premium in order to avoid ads (or keep data private), this will change the allocation of profits inside the firm. Presumably, the manager in charge of advertising will not want to give up the revenue that would then be credited to a premium subscription. To solve this problem, the incremental charge for the premium subscription over the ad-based model should be credited to the advertising department. It is as if the customers are the ones paying for the ad space (to be blank) and thus are buying out their own ads.

Following a bundle-only pricing strategy may help protect a monopolist from being perceived as charging a monopoly price, a point made Gillian Tett.[10] The bundled price is lower than the content-only price. Indeed, it is often zero in practice. The public and regulators may have a hard time recognizing the implied content-only price since it never appears. If the firm offers an unbundled option, this makes its market power clear to all.

10 See https://hbr.org/2021/07/the-data-economy-is-a-barter-economy.

On the flipside, there are arguments for offering a no-ad premium product in addition to the bundle. One expects that there will some be customers for whom the cost of their attention exceeds the value of the ad. (This is $C > 1$ in our model.) If so, profits are higher when the firm also offers an unbundled option. However, if the number of such customers is small, the complications may not be worthwhile.

Another reason why the monopolist might offer a no-ad version is that doing so would reduce the supply of ads to be sold, which would allow the monopolist to charge a higher price to advertisers. This, too, is outside our model since we have fixed the price the firm receives from the advertiser at 1. If the demand for ads is determined on a customer-by-customer basis, then this supply reduction doesn't improve profits. The problem is that the firm is reducing the supply all the way to zero for a group of customers. (Zero times a high price is still zero.) This suggests an intermediate sell/buy bundle solution in which customers pay an intermediate subscription price, somewhere between the ad-supported and no-ad prices, and, in return, the firm is limited to showing a reduced number of ads (perhaps even just one) per day. A company called The Trade Desk is providing a platform that limits the number of ads on free services.[11] We thmink it would be interesting to consider a similar tiered strategy for a premium platform. A low premium price would come with a low number of ads and a higher premium price would come with no ads.

The one-way bundling framework is a good starting point for understanding profit-maximizing strategies for sell/buy bundles. The next step is to add features to the model that recognize some of the "hidden" or indirect costs associated with offering a mixed-bundle option. Another important step is to conduct a full welfare analysis of sell/buy bundling. We can make one immediate observation: When $C > 1$, offering a no-ad version at the bundled price would be a Pareto improvement, though this may not be the monopolist's profit-maximizing choice. We leave further welfare analysis as an open issue.

11 https://www.cnbc.com/2021/07/07/trade-desk-seeks-to-limit-number-of-streaming-ads-with-new-launch.html

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