15.575 Final Paper

Introduction

Previous work by Bakos/Brynjolfsson and Nalebuff has shown that small entrepreneurs face an uphill battle against an incumbent bundler. Bakos and Brynjolfsson have demonstrated that bundling in large enough quantities can squeeze virtually all surplus from the market. Nalebuff showed that even small bundles can be an extraordinary deterrent against entry. In terms of the effect of bundling on innovation, the conclusions that one could draw from this literature are quite unsettling. A large bundler of zero marginal-cost information goods such Microsoft, through the power of bundling, would prevent market entry by small entrepreneurs, and ultimately discourage innovation by startups. The existing literature in this area implies that future innovation may be carried out by the bundlers themselves, instead of small start-ups. Will anti-trust authorities have to regulate bundlers if they grow too large to correct this problem?

This paper will add to the existing literature by demonstrating that the incentives to innovate in the face of competing bundles have in fact, not been destroyed, but actually grow stronger as bundles get larger. This work will explore the new possibility: Small entrepreneurs who undertake innovation with the exit strategy of selling to the bundler have a powerful incentive to innovate.

The key question this paper will explore is what happens to the incentives to innovate as the bundle size grows larger? Some venture capital firms have a strong aversion to funding any startup that competes with Microsoft.[1] If this is the case, will there incentives for startups to innovate in these markets, or will the innovation have to be undertaken by the bundlers themselves? As the bundle size grows larger, the incentive

[1] Put reference here

by entrepreneurs to sell goods to add to the bundle will grow larger because the bundler will be able to squeeze more surplus out of every additional good.

Some key questions to be answered by a perfect substitutes and imperfect substitutes model –

- How does the incentive to innovate change as the bundle size grows?
- What is the change in value of the bundle to the incumbent?
- What is the resulting change in profit for the small entrepreneur?
- What is the degree that an entrant is treated as input vs. being eliminated as competition?

Hypothesis – Managing entry correctly, where the entrant is welcomed, and then bought out, can be much better for the incumbent than a no entry scenario.

As the bundle grows larger, small firms are used as "inputs" into larger firms.

Previous literature

{Eventually to be expanded into 2 pages}

Bundling can make it difficult for new competition to enter the market.

> Bakos and Brynjolfsson (1999):
>
> "A monopolist selling a low-quality good as part of a bundle may enjoy higher profits and a greater market share than could be obtained by selling a higher-quality good outside the bundle."
>
> Bakos and Brynjolfsson (2000):
>
> "Because a bundler can potentially capture a large share of profits in new markets, single-product firms may have lower incentives to innovate and create such markets. At the same time, bundlers may have higher incentives to innovate."
>
> Nalebuff (2003) also found a bundler enjoys a huge advantage, especially as an entry deterrent, even in small bundle sizes.
>
> "A monopolist, even without fear of entry, has incentives to bundle, either as a way to achieve better price discrimination…or to help save costs…But most important to a firm with market power is preserving that power, by deterring a potential entrant or reducing the impact of a one-product rival. It is in this role that bundling truly shines. Entry is more easily deterred, in which case profits are more than doubled [In a two good case]. And when entry deterrence fails, post-profits are still more than 50 percent higher when products are sold as a bundle [In a two good case]."

The Model

Assumptions:

- Monopolist with *n* goods against an entrant with one good.
- Each good is valued i.i.d on the uniform [0,1] distribution.
- Value of Bundle is the sum of the individual values in the bundle.
- Fixed costs *F* but no marginal costs (information goods).
- Assume no complementarities for now.
- Entrant offers one good only.
- No mixed bundling allowed (the monopolist can't offer the bundle and a separate good too).

Each consumer has a valuation V for each good sold in the bundle. The variable V is drawn from a uniform [0,1] distribution, and every good is identically and independently distributed. A consumer will buy a good it if her value for it, V, is greater than its price, x. For example, If a good is selling for x=\$0.25, then a consumer with a realization of V >\$0.25 will buy the good, and a consumer with a realization of V <\$0.25 will not buy that good.

Entrant good is a *perfect* substitute for one of the goods in the bundle.

For the purpose of this example, imagine that Microsoft Office is the bundle, and a perfect copy of Excel is the lone good competing against Microsoft Office.

First, we will derive explicitly the equilibrium for a 2-good bundler against a one-good entrant, and then derive the case of *n* good bundles. For the purposes of this example, imagine that the two goods in the Office bundle are Word and Excel. The entrant's good is a perfect substitute for one of the goods in the bundle. So one could imagine that it is an exact copy of Excel, or, perhaps it is a different spreadsheet that any given consumer thinks is *exactly* the same as Excel.

First, we need to answer the question – who buys Office, who buys Excel, and who buys nothing? Some notation first: V_{Excel} is the consumer's value of Excel, V_{Word} is the consumer's value for Word, and V_{Office} is the value for Office. We assume that

(1) $V_{Office} = V_{Excel} + V_{Word}$

Or that the value of Office is equal to that of Word plus Excel. For simplicity, we assume there are no complementarities between Word and Excel, nor is there any correlation in value between the two goods. Because the value that any given consumer places for each good lies along the uniform [0,1] distribution, the distribution of V_{Office} is between $0.00 and $2.00 for each consumer.[2]

Because the entrant's good is an exact copy of Excel, consumers could potentially buy Office, or Excel, or nothing at all. In this world, nobody would buy both Excel and Office. Assume that the entrant is pricing Excel at p_e, and the bundler prices Office at x.

Thus, the three possibilities facing the consumer are:

(2)	$V_{Excel} - p_e$	Surplus from Excel
(3)	$V_{Office} - x = V_{Excel} + V_{Word} - x$	Surplus from Office
(4)	0	Purchases nothing

Condition (3) ensures that the consumer will only buy a product that gives her a positive surplus. Assume that a consumer is strictly trying to maximize her surplus from

[2] This is no longer a uniform distribution, but it is triangular. After only a few goods, the sum of *n* unform variables resembles a normal distribution. Bakos and Brynjolfsson (1999) explore this fact in great detail to illustrate the power of bundling to extract consumer surplus. (perhaps go into further detail?)

the goods, that is, the consumer is picking the maximum between equations (2), (3), and (4).

Excel consumers

The consumer who buys Excel alone must get a positive surplus from Excel and a surplus greater than that from Office. In terms of our equations, this means

$V_{Excel} - p_e > V_{Excel} + V_{Word} - x$ (2) > (3)

$V_{Excel} - p_e > 0$ (2) > (4)

Rerarranging, it means

$V_{Word} < x - p_e$ and $V_{Excel} > p_e$

That is, the consumer would not only have to value Excel enough to buy it, and that given Excel, doesn't feed that Word is worth the incremental value of $x - p_e$.

Office customers

The consumer who buys Office, then, must satisfy both

$V_{Excel} + V_{Word} - x > V_{Excel} - p_e$ (3) > (2)

$V_{Excel} + V_{Word} - x > 0$ (3) > (4)

Which, rearranged, means the consumer satisfies the following

$V_{Word} > x - p_e$ and $V_{Word} > x - V_{Excel}$ (5)

Thus, Office customers come from two separate groups of consumers: The ones with a high valuation for Excel, (where $V_{Excel} > p_e$), and the ones with a low valuation for Excel, $V_{Excel} < p_e$. If $V_{Excel} > p_e$, then condition (5) is always satisfied as long as $V_{Word} > x - p_e$, whereas if $V_{Excel} < p_e$, then (5) is satisfied as long as $V_{Word} > x - V_{Excel}$.

Consumers who purchase nothing

Using our terminology, a consumer will buy nothing if

$0 > V_{Excel} - p_e$ (4) > (2)

$0 > V_{Excel} + V_{Word} - x$ (4) > (3)

Put together, a consumer buys nothing if

$V_{Excel} < p_e$ and $V_{Word} < x - V_{Excel}$

We illustrate these consumers in Figure 1:

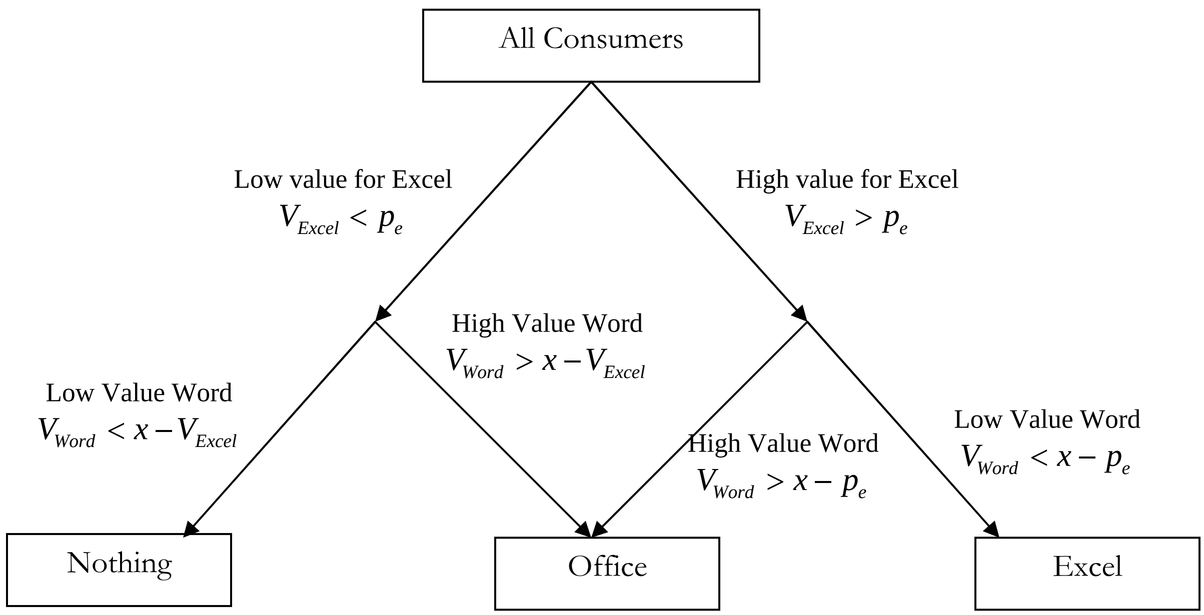


Figure 1: Consumer Demand, Perfect Substitutes Case

Nalebuff (2004) (list pages here) derives the equilibrium prices and quantities in explicit detail for this case. An uncontested two-good monopolist would charge x =\$0.82, and profits would be \$0.54. In that case, a consumer buys Office if $V_{Office} > x$, or nothing if not.

If one assumes that the monopolist cannot or does not change prices, then an entrant would react to the monopolist price of x =\$0.82 with p_e =\$0.30 and makes \$0.11 in profit. The profit of the monopolist falls to \$0.39. If the monopolist fights a price war, the ensuing equilibrium is x =\$0.63, p_e =\$0.26 with profits for the monopolist and the entrant respectively of \$0.40 and \$0.07.

Entrant good is an *imperfect* substitute for one of the goods in the bundle.

The example we will be working with is Lotus 1-2-3 competing against Microsoft Office. Lotus as a spreadsheet competes against Excel, which is part of the Office bundle. Since both are distributed independently on the uniform [0,1] interval, then half of consumers would prefer Lotus, and half would prefer Excel. Since they compete against each other, we are not going to assume that, if given both Excel and Lotus, a consumer would value that package as the sum of them both. Rather, we are going to make the following assumption: If given both Excel and Lotus, a consumer would derive get the maximum of the two, and leave the other one unused.

(6) $V_{Excel+Lotus} = \max(V_{Excel}, V_{Lotus})$

Thus, in the imperfect substitutes case, consumers potentially buy the entrant good *or* the bundle *or* ***both*** *or* nothing. Let's go through a two-good example again to understand who would buy what. First, we list the following surplus choices facing each consumer:

(7) $(V_{Lotus} - p_e) + (V_{Word} - x)$ Surplus from Lotus plus Office

(8) $V_{Lotus} - p_e$ Surplus from Lotus only

(9) $V_{Office} - x = V_{Excel} + V_{Word} - x$ Surplus from Office only

(10) 0

Lotus and the Office together

In (7), the surplus calculation from both Lotus and Office together does not include Excel because the consumer derives benefit from the maximum of Excel or Lotus. Thus, a consumer purchases both Office and Lotus together only if $V_{Lotus} > V_{Excel}$ for that consumer. If, for a given consumer, $V_{Lotus} < V_{Excel}$, then adding Lotus to an Office bundle doesn't give her any more value, so she wouldn't pay anything for it. If she has Lotus already, then buying Office would be the equivalent of throwing away Lotus. Putting together all of the necessary constraints so that (7) is larger than either (8), (9) or (10), a consumer would purchase both together only if

$V_{Word} > x$ and $V_{Lotus} - p_e > V_{Excel}$

Thus, the rest of the bundle must be worth it for a consumer (since they are using Lotus, not Excel), and the surplus from Lotus must be greater than the loss in value of Excel.

Consumers who buy Lotus only

In order to maximize (8) against the other three choices, a consumer will buy Lotus alone if

$(V_{Lotus} - p_e) > (V_{Office} - x)$ given

$V_{Lotus} - p_e > 0$ and

$V_{Word} - x < 0$ (this condition which is only added when $V_{Lotus} > V_{Excel}$).

Consumers who buy Office only

A consumer will purchase Office by itself if

$(V_{Office} - x) > (V_{Lotus} - p_e)$ given

$V_{Office} - x > 0$ and

$V_{Excel} > V_{Lotus} - p_e$ (this condition is added only when $V_{Lotus} > V_{Excel}$).

Consumers who buy nothing

A consumer will buy nothing at all when the following inequalities hold:

$V_{Lotus} < p_e$

$V_{Office} < x$

Interesting aside

Even if a consumer has a positive surplus for Lotus, *and* thinks Lotus is a better spreadsheet, the consumer might still choose not to buy Lotus. Although this might seem counterintuitive, the answer is quite simple – once you have decided to buy Office, it's costly to throw away Excel. For example, let's say for a given set of prices, we find a consumer with the following valuations:

$V_{Lotus} = \$0.99$

$V_{Excel} = \$0.80$

$V_{Word} = \$0.99$

$x = \$0.70$

$p_e = \$0.20$

Then, the consumer will face the following surpluses:

Lotus only:	$0.79
Lotus + Office:	$1.08
Office only:	**$1.09**

Even though the consumer thinks that a) Lotus is a substantially better spreadsheet than Excel, and b) that Lotus would be worth buying on its own (positive surplus for Lotus) she picks the Office bundle and does **not** buy Lotus at all! This result illustrates the power of bundling. Although Nalebuff (2004) focused on perfect substitute case, we see that bundling together Office can truly be a power play against Lotus.

Tables and charts

Bundle size	**Percentage of Consumers where** $V_{Lotus} > V_{Excel}$	**Percentage with positive surplus for Lotus**[3]	**Demand for Lotus**	**Demand for Office**
2	50%	~70%	TBA	TBA
3	50%	~70%	TBA	TBA
4	50%	~70%	TBA	TBA
5	50%	~70%	TBA	TBA
9	50%	~70%	TBA	TBA
10	50%	~70%	TBA	TBA
24	50%	~65%	TBA	TBA
25	50%	~65%	TBA	TBA
49	50%	~63%	TBA	TBA
50	50%	~63%	TBA	TBA
74	50%	~61%	TBA	TBA
75	50%	~61%	TBA	TBA
99	50%	~60%	TBA	TBA
100	50%	~60%	TBA	TBA

Table x: Illustrating that a bundle is very difficult to compete with

[3] At equilibrium price and quantity in the Bertrand competition scenario.

Hypothesis to be illustrated

- In the imperfect substitute case, both the monopolist and the entrant have much to gain if the monopolist buys out the entrant and adds the good to the bundle.

- For now, assume the surplus is divided evenly between the monopolist and entrant.

- In perfect substitute case, there are still gains to be had by both if the monopolist buys out the entrant and discards the product. (Question – is that greater than the profit if the monopolist bought the entrant and reoptimized the prices so that she is maximizing the *sum* of Office and Excel profits together?)

- **There are still incentives to innovate by entrepreneurs, even as the bundle size grows large.**

Other Questions to be answered

If Microsoft buys out Lotus 1-2-3, how are the gains divided from:

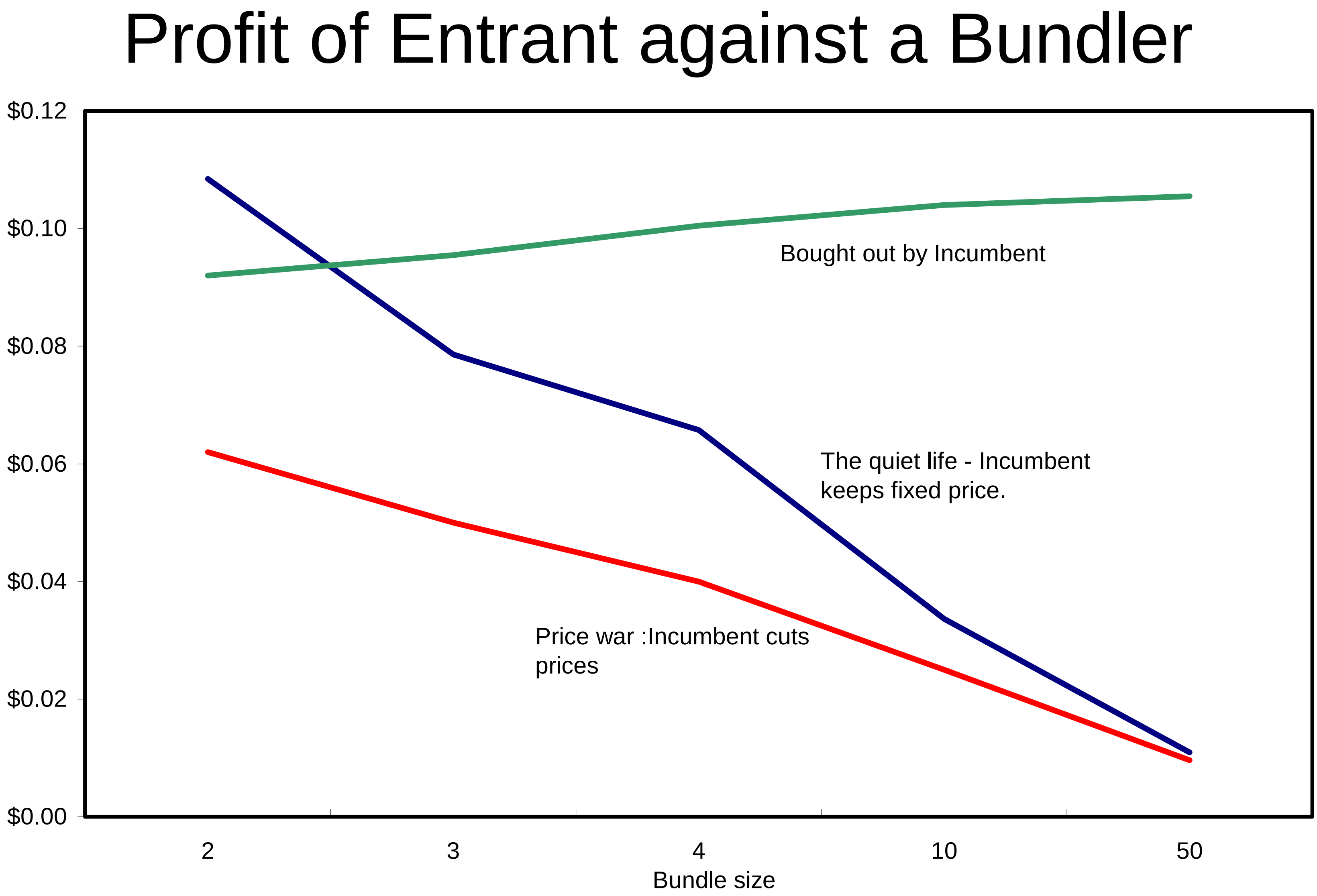
- Removing Lotus as competition
- Adding it to the bundle
- Re-optimizing the price

More tables charts here

Tables to put in about the Imperfect substitutes case.

	Incumbent	Split in Gains	50%	Entrant		
		Additional Gains above Baseline				
	Sleeping Incumbent	Engaging in a price war	Buying entrant and discard	Profit if ignored "The quiet life"	Profit if fight "Bumpy"	Profit if bought out
Bundle Size	**Baseline**					
2	$0.36	$0.012	$0.09	$0.108	$0.062	$0.092
3	$0.67	$0.010	$0.10	$0.079	$0.050	$0.096
4	$1.00	$0.010	$0.10	$0.066	$0.040	$0.101
10	$3.24	$0.010	$0.10	$0.034	$0.025	$0.104
50	$20.36	$0.020	$0.11	$0.011	$0.010	$0.106

Figure x: **Perfect Substitutes case** The Entrpreneur loves being bought out, the Bundler finds it profitable as well.


Profit of Entrant against a Bundler
$0.12
$0.10
$0.08
$0.06
$0.04
$0.02
$0.00
Bought out by Incumbent
The quiet life - Incumbent keeps fixed price.
Price war :Incumbent cuts prices
2
3
4
10
50
Bundle size

Future directions

- Bargaining – not Nash 50% each solution.
- Effect on consumer surplus.
- Small entrepreneurs with more than one good.
- Unbundling Excel as well – consumer faced with Office, Excel, or Lotus.
- Correlated values between the goods in the bundle.

Bibliography

Bakos Brynjolfsson (1999)

Bakos Brynjolfsson (2000)

Nalebuff (1999)

Nalebuff (2004)