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Analyzing Relative Costs

On August 10, 2003, Margaret Casper, the CEO of Flagstaff Manufacturing, received a worrying report about competitors.[1] Flagstaff produced "nubs," disposable plastic parts that beverage makers used on high-speed filling lines. Filling lines were major capital investments, so most beverage makers used each line for several products (e.g., regular soda, diet soda, caffeine-free soda). When a filling line was changed over from one product to another, small nubs on the filling lines had to be replaced, with old nubs thrown out and new nubs put in place. Changing nubs ensured, for example, that leftover regular soda was not pumped into bottles of diet soda. A number of factors made the nub-producing industry surprisingly profitable. Few customers or potential competitors thought much about nubs, and two companies dominated the industry: Flagstaff and Japan's Tsujimura Corporation. Moreover, Flagstaff and Tsujimura had historically focused on different regions. Tsujimura led the market in Japan and Europe, while Flagstaff served mostly the Americas.

Now, however, Casper received unwelcome news: According to a customer, Tsujimura had just broken ground on a nub-making plant near Chicago. The industry's cozy duopoly might soon disintegrate.

That afternoon, Casper assembled her senior team to consider how Flagstaff might respond to Tsujimura. Three options emerged. First, Flagstaff might simply accept Tsujimura's expansion in the Americas. Second, the company might resist Tsujimura's expansion vigorously and, elsewhere in the world, signal its displeasure with Tsujimura. It might, for instance, send a shipload of nubs to Japan and announce that it was tentatively exploring the Japanese market. The aim of such moves would be to prompt Tsujimura to abandon its American efforts. Third, Flagstaff might expand immediately and aggressively into the Japanese and European markets, with a goal of winning over those regions.

As Casper and her team worked through what they would have to believe to prefer each option over the others, they realized that much hinged on Tsujimura's cost position relative to Flagstaff's. With Tsujimura expanding, the companies might increasingly compete on price, and the company with the lower cost was likely to prevail in a price war. Tsujimura's cost position might also shed light on how low Flagstaff would have to price its nubs in order to expand in Japan or to force Tsujimura out of the Americas. Realizing that she and her team knew little about Flagstaff's own costs, let alone Tsujimura's, Casper called a friend at a strategy consulting firm. Soon, consultants were working feverishly alongside Flagstaff personnel to size up Flagstaff's relative cost position.

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[1] The Flagstaff example is fictional. The authors of this note have constructed the example by combining several real-life relative cost analyses familiar to them. Names, industries, data, and dates have been altered to maintain strict confidentiality.

Professors Hanna Hałaburda and Jan W. Rivkin prepared this note as the basis for class discussion.

A Prominent Tool

Among the intricate quantitative analyses that strategists undertake, relative cost analysis may be the most common. The goal of a relative cost analysis is simply to estimate how a company's costs compare to a rival's. Companies examine relative costs for a host of reasons: to anticipate how a rival is likely to react to a price change; to predict how a price war may evolve; to test whether a cost advantage it believes it has is real and sustainable; to decide how low a company must bid in order to win a competitive contract from a rival; to identify opportunities for internal cost reduction; to estimate, in the context of an acquisition, how much the costs of an acquired company might be reduced and what a reasonable price might be for the company; and so forth.

At a conceptual level, it is easy to see why relative cost analyses are so important. When a company's costs are lower than rivals' for similar products, the company can drive a wider wedge between willingness to pay and costs than rivals achieve and thereby attain a competitive advantage.[2]

Relative cost analysis is like detective work. Rarely do competitors reveal their cost structures in any detail, so one must piece together many shards of evidence to build a comprehensive picture of a rival's costs. As in detective work, there are standard procedures one should follow, but there is also a lot of room for creativity and improvisation. A typical relative cost analysis involves the following steps:

1. Focus on a particular product line or service that is the locus of competition.
2. Construct one's own cost structure for the focal product or service.
3. Using an understanding of what drives each cost item and how a rival differs in terms of those drivers, build up an estimate of the competitor's current cost structure.
4. In light of the decision at hand, use the cost analysis to conduct what-if experiments.

We consider each step in turn.

1. Focus on a particular product or service

The first step in a relative cost analysis is to choose a product or service line on which to focus. Typically a management team focuses on the line that overlaps most with the competitor of interest, the largest line, or a line where it believes a cost difference really matters (for instance, because customers of the line are price-sensitive). Flagstaff, for instance, produced a variety of nubs, but for its relative cost analysis, it looked first at a product line that constituted 60 million of its total annual volume of 100 million nubs. This line competed directly with one of Tsujimura's main product lines.

A common mistake in relative cost analysis is not to focus on a particular product line, but to compare the costs of an average product from Company A to the costs of an average product from Company B. **Exhibit 1** illustrates the problem with this approach. In this example, Company A has higher costs per unit on every product line than does Company B, but its product mix is weighted much more than Company B's toward low-end, cheaper product lines. A poor analyst who compares only averages might observe that Company A has a lower cost per unit than Company B, and he or

[2] Relative cost analysis is also useful for a company that pursues a differentiation (higher willingness to pay) strategy. Such a firm has to make sure that any extra costs it incurs to differentiate itself are more than offset by its superiority in terms of relative willingness to pay.

she might conclude, erroneously, that Company A has the better cost position. To the contrary, Company B has the better cost structure when competing for any specific piece of business.

2. Construct one's own cost structure

Having chosen a focal product or service, the team can start to build up the cost structure for its own offering. This step may sound easy, but surprisingly few management teams have easy access to information on the costs of specific products. It is common for the first weeks of a relative cost effort to focus on determining the company's own costs. Many companies keep two sets of accounts: financial accounts for reporting purposes and management accounts for understanding what is really going on in the firm. Management cost accounts are usually the more detailed of the two and are the right place to start a relative cost analysis.

To determine the costs associated with a particular product line, a management team must allocate fixed costs such as R&D and overhead across product lines. Activity-based allocation of costs, sometimes a tricky task, is covered in courses on financial reporting and control.[3] In cases in strategy courses, we often are given the costs per unit of output for one company, and we focus on estimating the costs for its rival. Real-life relative cost analyses require skills from both financial reporting and strategy courses.

Exhibit 2 shows the cost structure that Flagstaff determined it had for the focal product. The first column of figures shows the cost per nub in dollars. The per-unit figures are typically the most useful because they reflect how well prepared a firm is to prevail in price competition; the firm with the lowest unit cost can make a profit even when prices fall so low that others lose money. The second column of figures reports the cost associated with the total product line—in this case, 60 million nubs—and the third column of numbers includes a handful of corporate-level costs (sales, R&D, overhead) that apply to Flagstaff's full output of 100 million nubs.

Typically, a good cost analysis enables you to envision how a product gets to market. In this case, the cost analysis in **Exhibit 2** paints the following picture of the focal Flagstaff product. The product was manufactured by thirty Flagstaff production workers processing plastic resin on five dedicated production lines. The production lines ran at 50% capacity utilization; the lines were capable of producing 120 million nubs per year, not just the 60 million that Flagstaff actually made. A nub was produced from 26 grams of resin and was packaged on a 5″-by-5″ piece of cardboard, encased in plastic film. Beyond resin, cardboard, film, labor, and equipment, the main inputs were electricity and a sterilization process. Corporate sales, R&D, and administrative personnel provided support for the product, while third parties handled distribution, charging a fixed fee of a nickel for each nub. Flagstaff carried 180 days of finished goods inventory and 60 days of raw material inventory, reflected in the capital charge at the bottom of **Exhibit 2**.

The final column in **Exhibit 2** explains briefly how the Flagstaff analysts and consultants derived the costs. For example:

- Flagstaff used 26 grams of polyethylene resin to produce each nub. (Raw resin, in the form of small plastic pellets, was melted, poured into a mold, and cooled to make a nub.) Flagstaff paid $0.009 for each gram of resin, so the resin cost per nub was 26 x $0.009 = $0.23.

[3] See, for instance, Anthony Atkinson, Robert S. Kaplan, and S. Mark Young, *Management Accounting*, 4th edition, Upper Saddle River, N.J.: Pearson Prentice Hall, 2004, especially Chapter 4.

- Manufacturing labor consisted of 30 production workers dedicated to the focal product line. The fully loaded cost of each worker was $70,000 per year, so the total labor cost for the focal product line was 30 x $70,000 = $2.1 million. This implied a labor cost per unit of $2.1 million / 60 million nubs = $0.04.

- Twenty corporate sales people, each costing $150,000 per year, sold the full 100 million nubs of the entire company. The cost per nub, then, was 20 x $150,000 / 100 million = $0.03.

We recommend that you now recreate the other calculations that underlie **Exhibit 2**, using the assumptions in the final column of the exhibit.

It is often useful to think of each cost item as consisting of two elements: a *factor (or input) cost* and some measure of *productivity*. Factor cost is the input cost per unit of input. For example, Flagstaff paid $0.009 per gram of polyethylene resin. Productivity reflects the number of units of output that each unit of input yields. For Flagstaff, each gram of resin generates 1/26 of a nub. For each type of input…

$$\text{input cost per unit of output} = \frac{\text{input cost per unit of input}}{\text{units of output per unit of input}}$$

…so it follows that…

$$\text{input cost per unit of output} = \frac{\text{factor cost}}{\text{productivity}}.$$

For resin, for example:

$$\text{resin cost per nub} = \frac{\$0.009}{1/26} = \$0.23.$$

Firms with low factor costs or high productivity have low cost positions. Factor costs in **Exhibit 2** include $0.009 per gram of resin, $0.002 per square inch of film, $0.003 per square inch of cardboard, $70,000 salary per year for a production worker, $10 million capital expenditure for a production line, $0.08 per kilowatt-hour of electricity, $150,000 per year for a salesperson, and a 15% cost of capital. We'll see below that it is sometimes useful to break down differences in costs across companies into differences in factor costs and differences in productivity.

The first and most prominent column of figures in **Exhibit 2** is expressed in terms of dollars per nub. Cost per unit of output (here, dollars per nub) is usually the most relevant and telling way to look at relative cost analysis. Analysts who look at cost structures in terms of percent of sales rather than cost per unit of output run a risk: they often confuse cost differences and price differences. Imagine that a firm charges $110 for its product while competitors charge $100, and the firm incurs total cost of $95 per unit versus $90 for competitors. The firm's cost as a percent of sales is 86.4%—lower than competitors' 90%. Yet it would be fundamentally wrong to conclude that the firm has a cost advantage. Similarly, analysts who focus on total cost instead of cost per unit also run into problems: they cannot tell whether a company can afford to set a lower price per unit than its rivals.

3. Build up an estimate of the competitor's current cost structure

Having grasped its own cost structure, a management team is prepared to estimate a rival's costs. To do so, the team must combine knowledge of what drives each cost item with an understanding of

how the rival differs in terms of those drivers. The rival may differ in how much it pays for inputs or how well it uses those inputs; that is, it may differ in factor costs or productivity. Common drivers of factor costs include the following:

- *Bargaining power over suppliers:* Companies that buy inputs at large scale, as Wal-Mart does for instance, are often able to negotiate discounts from suppliers.
- *Location:* For example, manufacturers in high-wage countries incur higher labor costs per hour.
- *Policy choices:* A firm may choose, for instance, to use inputs of higher quality, purchased at higher prices, to make customers willing to pay more for its products.

Common drivers of productivity include the following:

- *Scale:* Large-volume players can spread fixed costs over more units of production, thereby lowering their cost per unit. In the brewing industry, for instance, Anheuser-Busch and Miller pay the same fee for a Superbowl ad for Bud Light or Miller Lite, respectively, but Anheuser-Busch, with the larger Bud Light market share, spreads the fee over more than twice as many cases of beer. Similarly, large-scale production facilities are typically less expensive per unit. Both Anheuser-Busch and Miller, for example, can produce beer in larger vats than can microbrewers, and geometry dictates that doubling the capacity of a vat increases the vat's surface area—and the cost of steel associated with the vat—by just 60%. Per barrel of beer, then, the national brewers enjoy lower equipment costs than do microbrewers.
- *Capacity utilization:* Firms that achieve higher capacity utilization also spread fixed costs—here, the costs that don't rise with greater utilization—over more units of output.
- *Experience:* Firms that accumulate greater production experience or achieve greater specialization typically enjoy higher productivity, as they work out the kinks in their production processes, devise process improvements, and reduce waste or rework.
- *Policy choices:* Finally, a host of policy choices can affect productivity. A firm that reduces product variety and refuses to interrupt production runs for special orders, for instance, is likely to attain higher productivity. (It may, however, also sacrifice willingness to pay among customers.)

Consider, for example, Flagstaff's estimate of Tsujimura's cost structure, summarized in **Exhibit 3**. Flagstaff and its consultants worked carefully through each cost item. The Flagstaff team members knew they would eventually have to estimate Tsujimura's costs in its new Chicago plant, but they started by analyzing the costs of Tsujimura's current facilities in Japan. Flagstaff had good data about Tsujimura's Japanese operations and very little information about Chicago: the Japanese plant was running, and Tsujimura's past public financial statements reflected the Japanese operations.

When examining raw material costs, Flagstaff engineers noted that Tsujimura's product was slightly heavier than Flagstaff's, but suppliers and former employees at Tsujimura reported process improvements that improved yields and reduced scrap. As a result, Flagstaff estimated that Tsujimura used only 25 grams of resin for each nub. On the other hand, resin prices in Japan—the location of Tsujimura's only factory—were 33% higher than in the United States, reflecting high petrochemical prices in Japan. The results of these differences (higher productivity but higher factor costs) are calculated in **Exhibit 3**: Tsujimura's resin cost per nub was $0.30, $0.07 higher than Flagstaff's. Plastic film was likewise more expensive for Tsujimura, despite its smaller packaging.

The calculations in **Exhibit 3** made use of other information Flagstaff gathered on Tsujimura. In its factory, for instance, Tsujimura was able to produce 75 million nubs of the focal type with just four production lines, lines purchased from the same supplier Flagstaff used. Since each line was capable of producing 24 million nubs per year, Tsujimura's output reflected a capacity utilization rate of 78.1% (= 75 / (4 x 24)). With fewer lines than Flagstaff, Tsujimura needed only 24 production workers. Labor savings were offset, however, by relatively high wage rates in Japan. Tsujimura's cost position also suffered from high electricity rates in the prefecture where its factory was located. Flagstaff personnel and consultants could not obtain any information about Tsujimura's sterilization procedures. Noting, however, that sterilization was a small part of the cost structure and that sterilization procedures were fairly standard around the world, they simply assumed that Tsujimura's sterilization costs per nub were comparable to Flagstaff's. **Exhibit 3** shows how Flagstaff's analysts used these pieces of information.

Using their understanding of Japanese and European customers and markets, Flagstaff estimated Tsujimura's total output, beyond the focal product line, at 120 million nubs. Information from mutual, global customers allowed Flagstaff to estimate Tsujimura's sales staff to include 20 people in Japan and 10 in Europe. Based on recent efforts to compete for sales talent, the Flagstaff team believed that salesperson compensation differed between the two companies only to the degree that costs of living differed in the places that the salespeople were posted. It was estimated that Tsujimura personnel lived in Japanese and European locales that, on average, were 10% more expensive than the locations of Flagstaff salespeople in the Americas. This information permitted the estimate of sales cost shown in **Exhibit 3** ($0.04 per nub).

To size up R&D and other general and administrative (G&A) costs, Flagstaff and its consultants turned first to the financial statements that Tsujimura had filed as a public company. Although the statements included line items for R&D and G&A, Flagstaff's team was not comfortable that the lines were truly comparable to what was included in the same lines of Flagstaff's own cost structure. For this reason, the team decided to "triangulate"—that is, to see if the figures in the aggregate financial statements could be confirmed through a separate, bottoms-up analysis. The team located the addresses of Tsujimura's corporate facilities in Japan, viewed them from the outside, counted personnel entering and leaving, and used their observations to estimate costs. The team concluded that Tsujimura's R&D efforts were comparable to Flagstaff's and were consistent with the costs stated in the public financial statements. On G&A, the team was impressed by how spartan the Tsujimura corporate facilities were. Their cost estimates reflected this frugality.

Flagstaff's examination of Tsujimura's logistics and distribution system revealed two things. First, Tsujimura likely had to pay slightly more than Flagstaff for distribution, reflecting the convoluted Japanese distribution system and transportation costs from Japan to Europe. On the other hand, just-in-time manufacturing approaches at Tsujimura and their customers allowed Tsujimura to hold considerably less inventory than Flagstaff.

The Flagstaff team concluded that Tsujimura's cost in Japan was comparable to, but slightly lower than, Flagstaff's cost in the United States: $0.92 per nub vs. $0.96 per nub. As a final check (another example of triangulation), the team gathered information on Tsujimura's average selling price for the focal product in Japan and Europe, calculated the operating margin implied by their price and cost estimates, and compared those margins to the figures Tsujimura reported in its financial statements. The estimated and reported margins matched reasonably well, making the Flagstaff team members more confident in their work.

4. Use the cost analysis to conduct what-if experiments

Some analysts at Flagstaff interpreted the analysis of current costs as good news: Tsujimura did not have a large cost advantage to use as a lever to open up the American market. CEO Casper reminded them that it was too early to relax: "In essence, the relative cost analysis boils down to this: U.S. factor cost advantages related to resin, plastic film, labor, electricity, and distribution have allowed us to be competitive despite poor productivity, low capacity utilization, and high overhead. But what happens when Tsujimura opens a production line outside Chicago and taps into U.S. factor costs? How do relative costs look *then*?"

Flagstaff team members went back to work. With the current cost analysis in hand, they could conduct a what-if analysis by adjusting only some entries. For instance, they considered a scenario in which Tsujimura opened a single production line in its U.S. plant, ran it at the company's Japanese utilization level, and therefore produced 78.1% * 24 million = 18.7 mm nubs. U.S. operations, they estimated, would raise Tsujimura's total corporate overhead expense by $2 million and require 10 additional sales people. Based on these and earlier assumptions, the team calculated Tsujimura's U.S. cost structure. We urge you to attempt this calculation yourself based on **Exhibits 2** and **3** before you examine Flagstaff's analysis in **Exhibit 4**. The Flagstaff team projected a 13¢ cost advantage for Tsujimura in the U.S.—large enough to make a major competitive difference. (Moreover, if Tsujimura's U.S. volume came from Flagstaff, not from other competitors, the shift might raise Flagstaff's unit costs and make Tsujimura's cost advantage even larger.)

Why did the Flagstaff team start by analyzing current costs in Japan (**Exhibit 3**) when their goal was to examine the Tsujimura plant in Chicago (**Exhibit 4**)? Without all the work leading to the entries in **Exhibit 3**, the team would not have been able to estimate very well the productivity and other elements that Tsujimura would "bring with it" to Chicago—in other words, the elements that did not change between **Exhibits 3** and **4**.

The Flagstaff team followed the initial what-if analysis with other cost-related analyses (some of which you might try to recreate). How expensive would it be for Flagstaff to resist Tsujimura's U.S. entry with an across-the-board price cut? How expensive might a targeted price cut be?[4] What would Tsujimura's U.S. cost position be if its volume were limited so much that its capacity utilization reached only 25%? What would Flagstaff's relative cost position be if it entered the Japanese market? And so forth. The Flagstaff team coupled these analyses with other competitor research efforts—some quantitative and many qualitative. Of particular note, the team concluded that Tsujimura was not fully committed to the U.S. market, at least not yet. The company had just broken ground outside Chicago; it had not yet finalized orders for nub-making equipment; and Tsujimura might use the plant to produce a new, altogether different product that did not compete with Flagstaff. Moreover, the Flagstaff team saw little opportunity for Flagstaff to establish a competitive advantage in Japan or to gain market share there without a mutually destructive battle.

In light of the analysis, Flagstaff opted for a three-pronged approach. First, the cost analysis identified areas in which Flagstaff simply fell short of industry best practice: its inventory levels were shamefully high, and it was running (and staffing) five production lines at 50% utilization instead of three lines at 83%. The company launched initiatives to tighten its operations, eventually reducing its costs by $0.10 per nub. Second, Flagstaff quickly and visibly took steps to lock in prominent U.S. customers with long-term contracts and better customer service. The steps made it apparent to Tsujimura that Flagstaff was determined to defend its turf at all costs. Finally, Flagstaff executives

[4] To complete the analyses related to price cuts, Flagstaff needed additional data on current price levels and had to estimate the sizes of the price cuts that would be required.

made clear in public statements that it was not eager to enter global markets but might do so if competition made it necessary. (This last step involved careful consultation with antitrust attorneys.)

Soon afterwards, Tsujimura announced that its new plant outside Chicago would be used for products other than nubs. Casper believed that Flagstaff's actions had caused Tsujimura to alter its plans for the plant, but she never knew for sure.

Good Habits

In closing, let us highlight some habits associated with good relative cost analyses, many of which were illustrated in the Flagstaff example.

- *Always keep ethics in mind.* Competitor analysis—for the purpose of estimating relative costs or for other reasons—often raises ethical concerns. How far should one go in order to gather information about competitors? Some activities are clearly out of bounds: misrepresenting oneself in interviews, for instance, or bribing rivals' employees to reveal information they know to be confidential. Other steps are clearly proper—for example, speaking with customers about competitive offerings in order to meet their needs better. Between the extremes lies a large gray area where you must use your judgment.

  We find two perspectives to be useful in navigating the gray zone. First, no piece of competitive information is more valuable than your reputation for ethical behavior. Second, creativity can often make it possible to gather information without acting unethically. For example, we were involved in one relative cost effort in which it was important to estimate the total wage bill in a competitor's factories. Surreptitious interviews of the rival's blue-collar workers probably would have produced the needed information, but senior management felt uncomfortable with that approach. Instead, the analytical team examined the many factories run by the company itself (not by the rival). Team members collected data on the company's own factories, and they realized that each factory's wage bill could be predicted accurately if you knew a few things: the average income level in the surrounding counties, the number of cars entering the factory gate each shift, and—importantly—the mix of car makes entering the factory gate. (Toyotas and especially BMWs were associated with high wage bills, while Chevrolets predicted low wage bills.) The team used internal data to build a model relating these variables to the wage bill; collected the variables for the rival's factories; and used the model to estimate the rival's wage bills. This creative approach raised no ethical concerns.

- *Triangulate.* Whenever possible, try to confirm cost estimates by approaching the task from multiple angles. For instance, as described earlier, the Flagstaff team estimated Tsujimura's R&D costs both by observing the company's physical facilities and by examining corporate financial statements. The team built up Tsujimura's cost structure item by item, but it also confirmed the analysis by comparing calculated operating margins to reported margins.

- *Use public financial statements with caution.* Public financial statements are useful in relative cost analyses, but one must beware of relying on them too heavily. Disclosure rules rarely require companies to disclose data at the level of granularity needed for competitive decision-making; accounting standards leave managers enough discretion that line items with identical labels are often not comparable across companies; and companies with complex product mixes lump very different products into composite financial statements. Our typical approach is to use public statements when they are the only available sources. Whenever

possible, however, we build up cost estimates in a bottom-up fashion first—based on our understanding of cost drivers and differences in those drivers across companies—and use public financial statements for triangulation.

Information for a bottom-up analysis comes from a variety of sources. The most useful include one's own salespeople, who often know rivals well; one's own engineers, who can reverse-engineer competitors' products and size up their likely costs; suppliers who also serve rivals; former employees of competitors who now work for you; shared customers; competitors' press releases and speeches; and public filings such as tax records and requests for construction permits.

- *Consider marginal cost as well as total cost per unit.* The Flagstaff analysis focused on calculating total cost per unit for the focal product line. A company's total cost includes its fixed costs and the sum of the marginal (or incremental) cost incurred with each unit it produces and sells. For some analyses, the marginal cost of an incremental unit is more important than the total cost per unit, so skilled analysts examine both marginal cost and total cost per unit. Suppose, for example, that Flagstaff wants to estimate the lowest price Tsujimura would be willing to offer to a Japanese customer who asks to buy one incremental nub. That nub causes Tsujimura to incur some incremental raw material, electricity, sterilization, and distribution costs. But it doesn't require extra labor, equipment, sales people, R&D, or G&A. The marginal cost, calculated from **Exhibit 3**, is roughly $0.60. It is unlikely that Tsujimura would sell an incremental nub for less than $0.60 since doing so would reduce its total profit.

- *Ready, fire, aim.* Virtually every relative cost analysis is fraught with gaps in competitive data. This is true in reality, and it is even more true in case studies, which inevitably exclude lots of information that is available in reality. Inexperienced analysts often freeze up in the face of such gaps. Veterans of relative cost analysis, in contrast, keep moving despite the gaps. They make the best assumptions they can, note the presence of assumptions, and complete a rough-and-dirty analysis. Then they double-back to the assumptions and decide which ones warrant investment and refinement. In particular, they focus on assumptions that are so critical that they might drive decisions one way or another. The Flagstaff team, for instance, lacked data on the relative costs associated with the nub sterilization process. They made a neutral assumption (neither company has an advantage) in their initial analysis, and they later decided that the assumption did not warrant much attention since sterilization was a tiny portion of the overall cost structure.

  More broadly, good analysts usually spend little time on cost categories that do not differ across companies and are too small to influence competitive outcomes. Categories that rivals approach differently and categories that account for a significant portion of costs deserve greater attention. When good analysts are uncertain about particular cost items, they sometimes run sensitivity analyses on those items to see how much their uncertainty affects their interpretation of a competitive situation.

- *Practice.* The formulaic steps described in this note may make relative cost analysis appear to be a science. In fact, it is an art. Like most arts, mastering it requires trial and error, iteration, guidance from experienced individuals, patience, and lots of practice. Practice is the goal of cases and assignments in strategy courses.

Exhibit 1 Example of Comparing Costs of Average Products

	Company A	Company B
Low-end product		
Cost per unit	$100	$90
Units	50	20
Midlevel product		
Cost per unit	$150	$140
Units	30	30
High-end product		
Cost per unit	$200	$190
Units	20	50
Total cost	$13,500	$15,500
Total units	100	100
Average cost per unit	$135	$155

Source: Casewriter example.

Exhibit 2 Flagstaff Cost Structure

	Cost per nub (in dollars)	Cost for total product line (60 mm nubs) (in $ mm)	Cost for total corporation (100 mm nubs) (in $ mm)	Rationale
Raw material				
Product: resin	0.23	14.0	NA	• 26 grams of polyethylene resin * $0.009 per gram of resin
Packaging: plastic film	0.07	4.3	NA	• 36 square inches of plastic film * $0.002 per square inch of film
Packaging: cardboard	0.08	4.5	NA	• 25 square inches of cardboard * $0.003 per square inch of cardboard
Subtotal	0.38	22.9	NA	
Manufacturing labor	0.04	2.1	NA	• 30 prod'n. employees * $70 K fully loaded cost per employee / 60 mm nubs
Equipment depreciation	0.12	7.1	NA	• 5 production lines * $10 mm per line / 7-yr depreciable life / 60 mm nubs
Electricity	0.04	2.4	NA	• $0.08 per kilowatt-hour * 1/2 kilowatt-hour per nub
Sterilization	0.03	1.8	NA	• Charge for separate equipment, chemicals, water, electricity
Sales	0.03	1.8	3.0	• 20 corporate sales people * $150 K fully loaded cost per person, spread equally across 100 mm units
Distribution	0.05	3.0	NA	• Five-cent commission paid per unit to third-party distributors
Research & development	0.07	4.2	7.0	• Corporate total: $7 mm, spread equally across 100 mm units
Other general & admin	0.15	9.0	15.0	• Corporate total: $15 mm, spread equally across 100 mm units
Carrying cost of non-equipment capital	0.05	3.2	NA	• {180 days of finished goods inventory + 60 days of raw material inventory} * 15% cost of capital
Total	0.96	57.6	NA	

Source: Casewriter data.

Note: Totals and subtotals may appear slightly off due to rounding.

Exhibit 3 Estimate of Tsujimura Cost Structure in Japan

	Flagstaff cost per nub (in dollars)	Tsujimura cost per nub (in dollars)	Rationale for Tsujimura's Costs
Raw material			
Product: resin	0.23	0.30	• 25 grams of polyethylene resin * $0.012 per gram of resin
Packaging: plastic film	0.07	0.09	• 33 square inches of plastic film * $0.0027 per square inch of film
Packaging: cardboard	0.08	0.07	• 22 square inches of cardboard * $0.003 per square inch of cardboard
Subtotal	0.38	0.46	
Manufacturing labor	0.04	0.03	• 24 production employees * $80 K fully loaded cost per employee / 75 mm nubs
Equipment depreciation	0.12	0.08	• 4 production lines * $10 mm per line / 7-yr depreciable life / 75 mm nubs
Electricity	0.04	0.05	• $0.10 per kilowatt-hour * 1/2 kilowatt-hour per nub
Sterilization	0.03	0.03	• Assumed similar to Flagstaff's
Sales	0.03	0.04	• 30 corporate sales people * $165 K fully loaded cost per person, spread equally across 120 mm units
Distribution	0.05	0.06	• Six-cent commission paid per unit to third-party distributors
Research & development	0.07	0.08	• Corporate total: $9 mm, spread equally across 120 mm units
Other general & admin	0.15	0.10	• Corporate total: $12 mm, spread equally across 120 mm units
Carrying cost of non-equipment capital	0.05	0.01	• {30 days of finished goods inventory + 20 days of raw material inventory} * 15% cost of capital
Total	0.96	0.92	

Source: Casewriter data.

Note: Totals and subtotals may appear slightly off due to rounding.

Exhibit 4 Estimate of Tsujimura Cost Structure in the United States

	Flagstaff cost per nub (in dollars)	Tsujimura cost per nub in Japan (in dollars)	Tsujimura cost per nub in the U.S. (in dollars)	Rationale for Tsujimura's U.S. Costs
Raw material				
Product: resin	0.23	0.30	0.23	• 25 grams of polyethylene resin * $0.009 per gram of resin
Packaging: plastic film	0.07	0.09	0.07	• 33 square inches of plastic film * $0.002 per square inch of film
Packaging: cardboard	0.08	0.07	0.07	• 22 square inches of cardboard * $0.003 per square inch of cardboard
Subtotal	0.38	0.46	0.36	
Manufacturing labor	0.04	0.03	0.02	• 6 prod'n. employees * $70 K fully loaded cost per employee / 18.7 mm nubs
Equipment depreciation	0.12	0.08	0.08	• 1 production line * $10 mm per line / 7-yr depreciable life / 18.7 mm nubs
Electricity	0.04	0.05	0.04	• $0.08 per kilowatt-hour * 1/2 kilowatt-hour per nub
Sterilization	0.03	0.03	0.03	• Assumed similar to Flagstaff's
Sales	0.03	0.04	0.08	• 10 U.S. sales people * $150 K fully loaded cost per person, spread equally across 18.7 mm units
Distribution	0.05	0.06	0.05	• Five-cent commission paid per unit to third-party distributors
Research & development	0.07	0.08	0.06	• Corporate total: $9 mm, spread equally across 120 + 18.7 mm units
Other general & admin	0.15	0.10	0.10	• Corporate total: $14 mm, spread equally across 120 + 18.7 mm units
Carrying cost of non-equipment capital	0.05	0.01	0.01	• {30 days of finished goods inventory + 20 days of raw material inventory} * 15% cost of capital
Total	0.96	0.92	0.83	

Source: Casewriter data.

Note: Totals and subtotals may appear slightly off due to rounding.

Appendix: Analyzing Relative Willingness to Pay

A firm achieves a competitive advantage by driving a wide wedge between the willingness to pay (WTP) it generates among customers and the costs it incurs to serve those customers—indeed, a wider wedge than competitors achieve. Accordingly, to size up a firm's competitive advantage, one must examine *both* its relative costs *and* the WTP it attains relative to that of rivals. The main body of this note discusses the analysis of relative costs. This appendix looks briefly at the analysis of relative WTP.

A customer's willingness to pay for a product is the maximum amount of money he or she would be willing to part with in order to obtain the product. The *relative* WTP of one product versus another is simply the difference between the WTPs of the two—or equivalently, the price premium that makes a customer indifferent between his or her more-preferred product and his or her less-preferred product. For instance, if customers are equally happy paying $5 for a hamburger from Wendy's or $4 for a hamburger from Burger King, then Wendy's enjoys a $1 WTP advantage relative to Burger King. (Note that Wendy's might still lack a competitive advantage over Burger King. Suppose, for example, that its cost per burger is $1.50 higher than Burger King's. Then its wedge between WTP and cost would be $0.50 smaller than Burger King's.)

Relative prices are a good, rough proxy for relative WTP in the long run. After all, a company cannot sustain a premium price without generating superior WTP. In the short run, however, relative prices and relative WTPs might be quite different. In the mid-1990s, for example, Dell produced personal computers for which corporate customers were willing to pay a premium. Nonetheless, it kept its prices below rivals' in a successful bid to gain market share. For a few years, relative prices of personal computers did not reflect relative WTP. Because of such possibilities, a strategist who wants to quantify relative WTP must do more than just survey relative prices.

Strategists typically use four types of techniques to quantify relative WTP:

1. *Economic value to the customer.* When rivals' offers have different and tangible economic impacts on customers, one can quantify those differences and use them to estimate relative WTP. Consider, for example, two producers of comparably-sized commercial aircraft. If the makers' models are very similar except that one maker provides greater fuel efficiency, then an airline that buys aircraft should be willing to pay more for the fuel-saving model. In fact, the WTP difference should be equal to the expected net present value of the fuel savings.

   This approach to quantifying relative WTP is most legitimate when customers truly focus on and calculate tangible economic impacts. This is more likely the case for big-ticket purchases with functional, not emotional, benefits and for industrial buyers (versus consumers).

2. *Market research.* Especially for products with less tangible benefits, strategists often rely on market research to quantify relative WTP. The most rudimentary technique—and a potentially misleading one—is simply to survey customers and ask them how much they would pay for one product versus another. A more sophisticated technique is conjoint analysis. In conjoint analysis, surveyed customers are presented with hypothetical products that have different attributes and prices, and they are asked to rank the products. From the results, analysts figure out the implicit value that customers place on different product attributes. The value of one product relative to another can then be estimated by examining the value of the attributes on which they differ.

3. *Market history.* Strategists can also deduce relative WTP by examining the history of pricing and customer behavior in a market. If there is a relative price at which customers have tended

to switch between two products, that difference probably reflects the difference in customers' WTP for the two. A technique that uses market history in a more sophisticated way is hedonic analysis. In essence, hedonic analysis examines the attributes of various products in a market and the prices at which they have sold; uses regression to assess the value that customers place on each attribute; and places a value on a product of interest by adding up the value associated with each of its attributes. One could, for instance, use the history of house sales in a market to figure out the value of each attribute of a house, and then rely on those values to assess the relative WTP of two houses—one with more living space but the other with a fireplace and a larger lot.

4. *Market experiments.* Rather than rely on historical prices and customer behavior, strategists can manipulate the prices of their products relative to rivals' and observe customer response—in essence, conducting controlled experiments. They can then assess relative WTP by noting the price differential that causes customers to switch between products. The credit card provider Capital One, for instance, commonly runs randomized trials to understand the relative prices (or interest rates) it can charge for credit cards with different attributes—different credit limits, loyalty programs, teaser rates, and so on.

Even when they cannot quantify relative WTP precisely, good strategists examine relative WTP qualitatively, simply by analyzing the relative performance of rivals in delivering the product attributes that customers want. A company that outperforms its rivals on the attributes that customers value the most is likely to enjoy a WTP advantage.

The most important message in this appendix is that strategists must pay attention to relative willingness to pay. Competitive advantage is about the relative gap between WTP and cost, so it is impossible to assess competitive advantage well if you ignore how WTP compares across rivals.