The Efficiencies Defense in Mergers: The Baby-Food Case Reconsidered

Abstract

The Federal Trade Commission's successful challenge to the proposed merger of Heinz and Beech-Nut baby food operations in 2001 remains a controversial case that raises concern over the role of cost efficiencies in merger analysis. Although the FTC argued that the merger would result in an increased likelihood of coordinated effects, we develop an alternative explanation for why the merger was likely to harm consumers even in the absence of such cooperation. We show that a conventional model of vertical product differentiation is able to replicate the premerger market data. Vertical product differentiation assumes that consumers agree on the relative quality of different products, which seems to describe the baby food market. When the model is then used to determine potential post-merger outcomes, we find that only using the most favorable assumptions for Heinz, would the claimed cost-efficiencies have been passed on to consumers. Under any more conservative and realistic scenarios, consumer prices rise substantially. The analysis supports the decision to oppose the merger. It also raises some doubt about the merit of cost efficiencies as a merger defense when an industry is characterized by vertical product differentiation.

The Efficiencies Defense in Mergers: The Baby-Food Case Reconsidered[1]

1. *Introduction*

The Federal Trade Commission's (FTC) successful challenge to the proposed acquisition

of the Beech-Nut baby food company by Heinz in the summer of 2000 remains one of the most

controversial merger cases in recent years. While some analysts consider that effort broadly

consistent with the modern antitrust analysis and policy[2] others, such as Robert Hahn and former

FTC economist, Jonathan Baker, have argued that the merger should have been allowed.[3] At one

conference discussing efficiencies, one noted antitrust practitioner observed, "I think it's quite

possible that this case will live in antitrust infamy, maybe much more so than any antitrust case

I've seen."[4] Another noted, "The Heinz-Beech-Nut case, I agree with all the negative things that

have been said about that decision, I think it's going to be the Proctor and Gamble/Clorox of our

generation."[5] These statements were made despite the fact that five out of five D.C. Circuit

judges, at least two of whom were extremely well-versed in antitrust law and economics, found

that the proposed merger did raise substantial questions.[6]

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[1] We thank Dan Bernhardt, Joseph Brodley, Richard Brunell, Glenn Ellison, George Norman, Lynne Pepall, Tom Ross, and Michael Salinger for very helpful comments and suggestions.

[2] Larry White, White. L., "Antitrust During the Clinton Administration: An Assessment," in High Stakes Antitrust: The Last Hurrah? 11-44 (ed. R. W. Hahn 2003).

[3] Robert Hahn "An End to the Clinton Antitrust Era," AEI-Brookings Joint Center Policy Matters, (2001); Jonathan Baker, "Mavericks, Mergers, and Exclusion: Proving Coordinated Competitive Effects Under the Antitrust Laws," NYU L.Rev. 135 (Apr. 2002)("hereafter "Mavericks"). Indeed, according to Professor Baker, the decision to challenge the merger was hotly contested within the FTC. Jonathan Baker, "Efficiencies and High Concentration: Heinz Proposes to Acquire Beech-Nut" in The Antitrust Revolution: Economics, Competition and Policy 150 (J. Kwoka and L. White, eds) (2004). Professor Baker was the testifying expert for Heinz and Beech-Nut.

[4] Mark Gidley, Federal Trade Commission Merger Workshop Day 3 (Feb. 19, 2004), at 44.

[5] William Kolasky, Federal Trade Commission Merger Workshop Day 3 (Feb. 19, 2004), at 64. *See also* William Kolasky, "Lessons from *Baby Food*: The Role of Efficiencies in Merger Review," 16 Antitrust Magazine 82 (2001); William Kolasky, "The Role of Economics in Merger Enforcement: Efficiencies and Market Definition under Conditions of Price Discrimination," Presented at Charles River Associates Conf. on Mergers and Antitrust (Dec. 2002).   Mr. Kolasky filed an amicus brief to the D.C. Circuit on behalf of the "Citizens for Voluntary Trade" urging that the merger be permitted.

[6] In a rare decision, the DC Circuit granted the FTC's motion for an emergency stay following the lower court's ruling to permit the merger. FTC v. Heinz, 2000 Trade Cas. (CCH) P73,090 (D.C. Cir. Nov. 8, 2000). The panel consisted

This case obviously has given rise to spirited debate. In this paper, we present a new framework in which to analyze the issues raised by the baby food case including, specifically, the role of cost efficiencies in overall merger policy. Our analytical framework uses a vertical product differentiation model, a standard theory familiar to most economists. However, its application to a merger setting is somewhat new. Our results suggest that there were solid theoretical reasons to oppose the baby food merger even in the face of strong cost savings and even if the merger did not increase the likelihood of coordinated interaction between the post-merger entity and Gerber. The reason is that use of a vertical product differentiation model shows that Heinz's profit maximizing strategy would be to maintain its value brand even if it realized substantial efficiencies, and that there would be very little, if any, pass-through of cost savings to consumers. Indeed, this model predicts that prices would likely have risen substantially. While the FTC did not rely on these arguments at the time, the analysis may have implications for future merger cases.

2. *The Baby Food Case: Background*

The essentials of the baby food case are relatively straightforward. In the summer of 2000, Heinz proposed to acquire Beech-Nut. Baby food was clearly the only market relevant for antitrust analysis and the FTC presented a conventional antimerger argument. The market for prepared or jarred baby food was an asymmetric triopoly. The dominant firm was the Gerber Corporation with approximately 65 to 70 percent of the market.[7] The other two major firms were Heinz and Beech-Nut, which, while important players, were somewhat distant also-rans with

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of Judges Ginsburg, Garland, and Tatel. The merits panel consisted of Judges Garland, Henderson, and Randolph. Judge Ginsburg is a former Assistant Attorney General for Antitrust appointed by President Reagan (1984-85), and Judge Garland has taught antitrust at Harvard Law School.

[7]The market share varied somewhat by type of baby food, and whether or not private label was included. But the parties and the court effectively ignored these variations, and so shall we.

market shares of roughly 17 percent and 15 percent, respectively. There had been virtually no

entry into the market over the prior 40 years and all parties admitted that entry barriers were high.

In short, the baby food market at the time of the merger had a high Herfindahl-Hirschman

Index (HHI)[8] of about 5000 and threatened to raise that index by over 500 points. As a result,

the proposed merger clearly fell within the danger zone established by the DOJ/FTC merger

guidelines in which the presumption is that the merger will lessen competition. Moreover, new

entry could not be relied on to provide additional competition in the post-merger market. In

addition, beyond the structural and entry considerations that could apply even with a larger

number of firms, the Heinz/Beech-Nut merger would result in a duopoly. This raised the

additional fear that it would greatly facilitate pricing coordination to the further detriment of

consumer interests. Indeed, this was the principal argument advanced by the FTC, and it

played a significant role in the appellate court decision to block the merger.[9] The FTC noted

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[8]HHI is a measure of market concentration generated by summing the squares of the market shares in a relevant market. For example, if there are three firms with shares of 70, 20, and 10, the HHI is $(70 \times 70 + 20 \times 20 + 10 \times 10)$ = 5500. The maximum HHI is 10,000. HHIs over 1800 raise a presumption of anticompetitive effects where the "delta" – the increase in the HHI resulting from a merger, is over 50. *See* Department of Justice and Federal Trade Commission, Horizontal Merger Guidelines § 1.5.

[9] *FTC v. H. J. Heinz Co.,* 246 F.3d 708 (D.C. Cir. 2001):

> The combination of a concentrated market and barriers to entry is a recipe for price coordination. *See University Health*, 938 F.2d at 1218 n.24 ("Significant market concentration makes it 'easier for firms in the market to collude, expressly or tacitly, and thereby force price above or farther above the competitive level.' " (citation omitted)). "[W]here rivals are few, firms will be able to coordinate their behavior, either by overt collusion or implicit understanding, in order to restrict output and achieve profits above competitive levels." *PPG*, 798 F.2d at 1503. The creation of a durable duopoly affords both the opportunity and incentive for both firms to coordinate to increase prices. The district court recognized this when it questioned Baker on whether the merged entity will, up to a point, expand its market share but "then [with Gerber will] find a nice equilibrium and they'll all get along together." 9/8/2000 Tr. 1014. Tacit coordination is feared by antitrust policy even more than express collusion, for tacit coordination, even when observed, cannot easily be controlled directly by the antitrust laws. It is a central object of merger policy to obstruct the creation or reinforcement by merger of such oligopolistic market structures in which tacit coordination can occur. 4 Phillip E. Areeda, Herbert Hovenkamp & John L. Solow, *Antitrust Law* ¶ 901b2, at 9 (rev. ed. 1998). Because the district court failed to specify any "structural market barriers to collusion" that are unique to the baby food industry, its conclusion that the ordinary presumption of collusion in a merger to duopoly was rebutted is clearly erroneous.

that the baby food companies had defended themselves in a price fixing case by maintaining

that there was fierce competition between and among all of the companies.[10] One of the most

significant documents relied upon by the Commission and the DC Court of Appeals was from

Heinz indicating that it was in a bidding and price war with Beech-Nut and one of the best way

out of this was to buy Beech-Nut.[11] The Commission and the Court of Appeals concluded that

competition would be lost if the merger was consummated.

In defense of the merger, Heinz and Beech-Nut offered two main justifications. The first

was a cost efficiencies argument. The merging parties argued that while Heinz and Gerber had

relatively modern production facilities, Beech-Nut's plant in Canajoharie, New York was largely

out-of-date with the result that Beech-Nut's unit cost of bringing the product to market was on

the order of 15 to 20 percent higher than those of its rivals. The reallocation of this production to

more efficient plants that the merger would make possible was therefore a potential cost savings

that could be passed on to consumers.

The second line of defense extended the cost efficiencies justification by further arguing that

realization of those efficiencies would create a new fierce rival to the Gerber giant. Gerber and,

to a lesser extent, Beech-Nut enjoyed recognition among consumers as a quality brands, while

Heinz was typically regarded as a "discount" baby food. The merging parties contended that in

the post-merger market they would offer the Beech-Nut quality product but now do so at a much

lower cost with the result that the new firm would, in fact, offer much more price-competition to

Gerber than the two weak rivals, Beech-Nut and Heinz offered separately. This was especially

the case, it was argued, when one considered scale effects. By combining the operation of the

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[10] The testimony of Dr. Almarin Phillips—an economist retained by Heinz at that time—was particularly
insistent on this point. See *In Re Baby Food Antitrust Litigation*, 166 F. 3d 112 (3d Cir. 1999).

[11] The others involved competing harder on price and innovation.

two firms, the new entity would have a strong incentive to compete against Gerber aggressively so as to earn the large market share that would make the efficiencies all the more likely. In short, Heinz argued that the post-merger entity would create competition by becoming a maverick in a moribund industry.[12]

Proponents of the merger further supported their arguments with econometric evidence that the cross-elasticity of demand between Heinz and Beech-Nut was low.[13] Thus, it was argued that there was little retail price competition between Heinz and Beech-Nut. As a result, proponents claimed that a merger between the two could not have much adverse effect on consumers.[14]

3. *The Baby Food Market: Theoretical Considerations*

Like many retail consumer goods markets, the baby food market is one of differentiated products. It follows that any evaluation of the post-merger market outcome needs to specify the nature of that differentiated product competition to see how it might play out in the post-merger world. Unfortunately, the theoretical economics literature does not give a unique answer to this question. There are different types of product differentiation and, as well, different competitive assumptions about price competition within these alternative frameworks. Thus, forecasting the post-merger scenario may depend heavily on the framework and associated competitive assumptions one chooses.

With respect to the analytical market framework, there are two basic approaches. The first of these is referred to as horizontal product differentiation and was pioneered by

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[12] *See e.g.,* Trial tr. 1013 (Testimony of Professor Baker); Baker, *Mavericks*, *supra* note __ ("Heinz claimed, in contrast, that the merger would destabilize the possibility of postmerger coordination by creating a maverick").
[13] Trial tr. 953-55 (Testimony of Professor Baker).
[14]Some, *see, e.g.,* David Scheffman, "Whither Merger Simulation, Transcript of ABA Brown Bag Presentation, reprinted in Antitrust Source, http://www.abanet.org/antitrust/source/05-04/whither.pdf, (May 2004), have been notably critical of such econometric evidence and in particular, what elasticities estimated at the retail level may or may not imply for wholesale competition.

Hotelling and Salop.[15] These models are built on the assumption that consumers agree on how much they are willing to pay for a top quality brand but disagree on what constitutes the top quality. In the simplest case, the metric of quality is geographic so that the closer a store is to one's location, the higher quality one considers its products to be.

However, as Hotelling emphasized, the dimension of differentiation can be sweetness, or color, or other alternative measure. A common interpretation is that the distinctions are really due to brand-building efforts on the part of the firm. In this view, the "location" of each firm's product reflects its commitment of resources to develop the brand image associated with that product position.

In a rough way, most merger simulations are rooted in a horizontal differentiation framework.[16] Indeed, such simulations can be seen as an effort to operationalize that framework in a realistic way. One difficulty that arises in this connection is the product selection choice of the surviving Heinz/Beech-Nut firm. The own-price and cross elasticities measured in the pre-merger market are based on the existence of three distinct products. However, in the post-merger market, there would be just two product lines and it is not obvious how the pre-merger elasticities apply in this new setting. Thus, while the empirical evidence is useful, theory may also have a role to play if it can provide additional insight into the post-merger market.

Indeed, to the extent that the market is one of differentiated products and given that Heinz/Beech-Nut made clear its intent to offer only one post-merger product line, it is clear that

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[15] H. Hotelling, "Stability in Competition," 39 Econ. J. 41 (Jan. 1929).

[16] We have in mind simulations similar to those employed in, among others, the following articles: Timothy Bresnahan & Jonathan Baker, "The Gains from Merger or Collusion in Product Differentiated Industries," 38 J. Industrial Econ. 427 (1985); Gregory Werden & Luke Froeb, "The Effects of Mergers in Differentiated Products Industries: Structural Merger Policy and the Logit Model," 10 J. L., Econ. & Org. 407 (1994); Jonathan Baker, "Contemporary Empirical Merger Analysis," 5 George Mason L. Rev. 347 (1997), J. Hausman & G. Leonard, "Economic Analysis of Differentiated Products Merges Using Real World Data," 5 George Mason L. Rev. 321 (1997); Roy Epstein & Daniel Rubinfeld, "Merger Simulation: A Simplified Approach with New Applications," Working Paper from UCB Dept. of Economics (2001).

the post-merger outcome would depend importantly on whether post-merger product line was different from the Gerber product line, and if so, by how much. This is another reason that, as Schefman has argued, the empirical evidence may not be that helpful.[17] The newly-merged firm's product selection choice is a strategic one made with a view to maximizing profit. Ideally, this choice should be an outcome generated by the analytical model chosen. Yet, it is not clear how the econometric evidence can be used to address this product choice question since, again, that evidence is derived from data generated by a three-product world.[18]

An alternative to the model of horizontal product differentiation is that based on vertical differentiation presented initially by Mussa and Rosen, Gabszewicz and Thisse, and Shaked and Sutton.[19] Here, consumers actually do agree on how the products rank in quality. That is, each consumer shares the same view regarding the quality of the top product, that of the second best product, and so on.   Now, the differences among consumers stem from disagreements over how much each is willing to pay for a higher quality brand. Some consumers value increased quality very highly and are willing to pay a lot for it. Other consumers do not value quality so highly. For these consumers, buying a low quality good at a low price is preferable to buying a high quality product at a high price.   As with the distance in the horizontal models, quality in the vertical models can be given various definitions such as how safe the product is or the level of

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[17] Scheffman, *supra* note 14.

[18] Gandhi, Froeb, Tschantz, and Werden (2005) acknowledge this issue explicitly. *See also* Malcolm Coate, *Efficiencies in Merger Analysis: An Institutionalist View*, 13 S. Ct. Econ. Rev. 189 (2005):

> Nash-Bertrand models also assume that each firm's product offerings remain constant over time. This is a striking assumption in the world of differentiated products where firms compete by offering products to serve diverse consumer needs. It appears that the model's mathematical structure abstracts from a crucial source of reality and thus undermines its general applicability. Although theoretical models exist to partially address this situation so the analyst could utilize more sophisticated state-of-the-art models, even a state of the art model has significant limitations.

[19] M. Mussa and S. Rosen, "Monopoly and Product Quality," 18 J. Econ. Theory 301 (1978); J. Gabszewicz & J. Thisse, "Price Competition, Quality, and Income Disparities," 20 J. Econ. Theory 340 (1979); J. Gabszewicz & J. Thisse, "On the Nature of Competition with Differentiated Products," 96 Econ. J. 160 (1986); A. Shaked & J. Sutton, "Relaxing Price Competition Through Product Differentiation," 49 Rev. Econ. Stud. 3 (1982).

ancillary services provided by the supplier. Again, however, a common interpretation is that the quality distinctions reflect a brand effect so that a well-known or premium brand is considered to be a higher quality than a generic brand.

One implication of the vertically differentiated model is that the ranking of product prices should match the ranking of product qualities. That is, the product uniformly regarded as the highest quality should sell for the highest price, the next-highest quality should sell for the next-highest price, and so on. This is so regardless of each firm's individual cost so long as the firm can break even. The reason for this ranking is straightforward. No consumer will pay as much for a product of lower quality as she would for a product of higher quality. Hence, unless lower-quality goods sell at lower prices, no one will buy them.

4. *The Baby Food Market: A Vertical View*

Market share and price data were widely available at the time of the proposed merger. As noted above, the market share data showed Gerber dominating the market with a roughly 65 to 70 percent share, while Heinz and Beech-Nut split the remainder rather evenly. With respect to prices, there was some dispute over the role of the coupon reductions frequently offered by the two smaller firms. In general, however, Gerber's prices were highest, followed by Beech-Nut, and then Heinz, which was known as the discount brand. Indeed, former FTC economist Jonathan Baker (2000)[20] stated that at the retail level, a price per four-ounce jar was $0.40 for Gerber, $0.38 for Beech-Nut, and $0.33 to $0.35 for Heinz.

As can be seen, the hierarchical ranking of prices suggests a vertically differentiated framework in which Gerber is the premium brand, Heinz is the low-quality brand, and Beech-Nut is somewhere in between. We take this suggestion seriously. That is, we ask whether additional

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[20] Jonathan Baker (2004), and Trial tr. 1074-75 (Professor Baker).

evidence is consistent with a vertical framework in which consumers rank the quality of the three

products in the way suggested by the product prices. To the extent that this is the case, we then

ask what does such a vertical framework imply for the likely post-merger outcome?

Certainly, the trial evidence left little doubt that the comparison of the Gerber and Heinz

prices is consistent with a widespread industry review that Gerber was perceived as a higher

quality product than Heinz. Where Beech-Nut's baby food ranked in consumer preferences

though is somewhat unclear. At least two bits of evidence however point to a quality ranking

somewhere between the Heinz and Gerber brands just as the priced data indicate. First, Beech-

Nut had been viewed as a discount brand up until the 1980's when it tried to raise its quality

image by introducing its *Stages* line. Since brand images take years to develop, it is more than

plausible that consumers still viewed the Beech-Nut line as a less than fully premium product.[21]

Second, as the appellate court noted, Beech-Nut consciously kept its price below Gerber's. Yet

there would be no need to do this if Beech-Nut were the top quality baby food. Indeed, the cost

advantage that Beech-Nut was alleged to suffer should have given it even more reason to price at

the high end if it had been the superior brand. The fact that it consciously did not do this thus

suggests that Beech-Nut was a lower quality than Gerber and, moreover, knew it.[22]

We now test the idea that the baby food market may be usefully viewed through the lens of

vertical differentiation in a somewhat more rigorous fashion. Specifically, we ask whether it is

possible to calibrate a vertically differentiated model that approximately replicates both the

observed prices, market shares and cost differentials that were reported at the time of the merger.

The analytical details of the model are spelled out in the Appendix. The results are shown in

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[21] *See In re Baby Food Antitrust Litigation* 166 F.3d 112, 116 (3d Cir. 1999). "Gerber is the undisputed market leader and premium brand" and evidence reviewed therein.

Table 1. Like Epstein and Rubinfeld, we keep things simple by assuming one unified market and making no distinction between wholesale and retail.[23]

Table 1

Pre-Merger Values Calibrated by the Vertically Differentiated Product Model

	Price Per Jar	Market Share
Gerber	**$ 0.425**	**69.5%**
Beech Nut	**$ 0.375**	**13.9%**
Heinz	**$ 0.342**	**16.6%**

The simulated results reported in Table 1 are strikingly close to the real world observations. Recall that the actual prices reported were $0.40, $0.38, and $0.33 - $0.35 for Gerber, Beech-Nut, and Heinz, respectively. Recall as well that Heinz had a slightly larger market share than Beech-Nut but that both were on the order of 15 percent while Gerber's share was in the range of 65 – 69 percent. Finally, with respect to Beech-Nut's cost disadvantage, the trial judge reports an estimate of 20 percent while Epstein and Rubinfeld (2001) cite Jonathan Baker as suggesting a 15 percent figure. The estimates above imply a value of 17 percent.

The results of the simulation also make clear an important feature of vertically differentiated markets. This is the disproportionately strong position of the top quality brand. For example, the quality index settings used to calibrate the model are such that the Beech-Nut brand is only about four percent lower quality than Gerber. Nevertheless, Gerber's position as the top brand, along with Beech-Nut's higher costs, translates into a very large competitive advantage for Gerber. In short, in all crucial respects the simulated values in Table 1 almost exactly replicate those of the

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[22] Judge Robertson found at trial that Beech-Nut quality is "generally comparable to Gerber," (Slip op. at 4). This conclusion seems contrary to other evidence in the record particularly both Beech-Nut's earlier history as a discount brand and the twin facts that it: a) consistently priced below Gerber, yet: b) nevertheless had a smaller market share.
[23] As long as the retail sector is competitive, this should have no impact on the analysis. Note that our prices are long-run, retail prices. So, the costs that we impute include both capital costs and retailing costs. These imputed costs per jar are: $0.31 for Gerber and Heinz, and $0.362 for Beech-Nut.

actual pre-merger baby food market. Indeed, each calibrated value is within a 5 percent margin of the actual data in every case. Yet these calibrations are totally derived from a theoretical construct that simply sets initial consumer preferences and quality index parameters and then works out the implications of these values in a standard model of three-way price competition in a vertically differentiated market.[24]

We read the findings in Table 1 as strong support for the view that the baby food market at the time of the proposed Heinz and Beech-Nut merger can be reasonably well-modeled by a vertically differentiated framework. The nature of that vertical differentiation is such that consumers agree that: Gerber is the top quality product, Beech-Nut is the intermediate quality good, and Heinz is the discount brand.[25] The question then becomes what this analytical framework implies regarding the likely outcome of a Heinz/Beech-Nut combination.

5. *Consequences of the Heinz/Beech-Nut Merger*

We begin by asking a simple question. Given the calibrated model's ability to closely replicate the pre-merger baby food market, what does the model imply for the post- market outcomes if the newly merged firm does indeed market a product of Beech-Nut quality and does so at the lower unit cost of Heinz. Because everything goes as well as could possibly be expected, we refer to this scenario as the Utopian one. The results of the subsequent calibration using the cost and quality values inferred from the pre-merger analysis are shown in Table 2 below.

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[24] At trial, Heinz expert economist, Jonathan Baker, argued that the most likely description of the pre-merger market was one in which Gerber acted as a dominant firm exercising price leadership. Gerber's large market share was offered in support of such a view. Note however that the vertically differentiated model here generates the observed price and market share data without such dominant price leadership. In other words, the data are perfectly consistent price competition being alive and well in the pre-merger market despite the Gerber's large market share.

[25] In the baby food market, supermarkets almost always carry only two major brands. Gerber is found in virtually on stores, while Heinz and Beech-Nut compete to be the second brand on the shelf. This market fact does not preclude viewing the market as vertically differentiated. For example, the supermarket's choice may serve as the proxy for the consumer's judgment on quality.

Table 2

**Impact of Merger Under Utopian Scenario
Of Heinz/Beech-Nut**

	Change from Pre-Merger Price	Post-Merger Market Share
Gerber	- 1.2%	67%
Heinz/Beech-Nut	- 2.7%	33%

As one can see from Table 2, the model predicts that post-merger prices will fall by a modest amount. The Gerber price falls by 1.2 percent while the price of the Beech-Nut product (in comparison with the price of pre-merger Beech-Nut baby food) falls by 2.7 percent. This greater reduction in price of the Beech-Nut line does eat into Gerber's market share, which declines by approximately 2.5 percent. While these are positive gains, they are not large. This is true despite the fact that this scenario assumes that all of the claimed cost efficiencies are realized. The intuition behind this somewhat surprising result is two-fold. First, recall that Beech-Nut initially enjoyed only a 14 percent market share. A 17 percent reduction in the cost of this product line is therefore only about an eight percent reduction over the non-Gerber portion of the market.[26] Moreover, this small effect is offset somewhat by the loss of the Heinz versus Beech-Nut competition. In fact, prior consumers of Heinz suffer a price increase.[27]

The second reason that even this utopian scenario results in only modest consumer benefits stems from the feature noted above about vertical differentiation and brand strength. Again, when a market is vertically differentiated, the highest quality firm enjoys a very large advantage such that it serves a disproportionately large market share and earns extra high profits. Thus, Gerber tends to maintain its dominance even in the face of a lower-cost rival selling Beech Nut quality.

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[26] The D.C. Circuit recognized this point. 246 F.3d at 721 ("After the merger, the two entities will be combined, and to determine whether the merged entity will be a significantly more efficient competitor, cost reductions must be measured across the new entity's combined production - not just across the pre-merger output of Beech-Nut.")

Note that while consumer gains from the merger are small, the profit gains are substantial. Prior to the merger, the average operating margin across the two product lines combined was just a bit over seven percent. With the merger, the new combined firm earns an average markup of eighteen percent while slightly increasing its total market share.[28] Whatever the interests of consumers, it is clear that the merger is profitable for Heinz and Beech-Nut.[29]

One implication of the findings displayed in Table 2 is that failure to achieve the full amount of the claimed cost efficiencies could well mean that the consumer welfare would necessarily decline as a result of the merger.[30] This is, of course, a legitimate worry. Merging parties have strong incentives to claim efficiencies as a justification for the acquisition, yet the historical record gives substantial reason to doubt such claims. Table 3 shows the results when

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[27] Here, we compare the post-merger price of Heinz/Beech-Nut with the pre-merger price of Beech-Nut, the line that continues to be offered. Note that while these price effects are mildly beneficial, some consumers are worse off in that they have now lost the option of buying a low quality product, i.e., Heinz, at a lower price.

[28] Throughout all simulations, we make the standard assumption that the market is "covered", i.e., that prices are sufficiently low that all potential baby food customers purchase one of the available brands.

[29] An illustrative calculation may help. Let there be 1,000,000 customers. In the pre-merger market (Table 1) Heinz serves 166,000 of these, and earns ($0.342 – $0.31) from each. Total profit is $5,312 per period. Similarly, Beech-Nut serves 139,000 and earns ($0.342 - $0.31) from each. Economic profit--profit beyond a normal return on capital--is $5,312 per period. Similarly, Beech-Nut serves 139,000 earning ($0.375 - $0.36) from each for an economic profit of $2,085 per period. Thus, the combined pre-merger periodic profit of both firms is $7,397. In the post-merger market (Table 2), Heinz/Beech-Nut serves 330,000 customers earning ($0.365 - $0.31) from each. Total profit is $18,150 per period. The merger is profitable.

Put another way, under the Utopian scenario, the cost savings to Heinz/BN total approximately $6950. The total savings to BN consumers equals $1390. This would imply a pass through rate of approximately 20% (leaving aside Heinz consumers that gain quality but must pay more). The remainder of the cost savings, as shown above, would translate into higher profits for the merged entity. *Cf.* Trial Tr. 1113 (Professor Baker)(estimates pass through of 50-100%). The agencies do not undertake a total welfare analysis but focus on the impact of the merger on consumers in the relevant product line. As a result, the enforcement agencies and courts often focus on pass-through rates when efficiencies are at issue. *See* DOJ & FTC Horizontal Merger Guidelines, "Efficiencies" ("the Agency considers whether cognizable efficiencies likely would be sufficient to reverse the merger's potential to harm consumers in the relevant market, e.g., by preventing price increases in that market"). *See also FTC v. Staples*, 970 F. Supp. 1066, 1090 (D.D.C. 1997) (pass-through of efficiencies based on historical data would be approximately 15 percent).

[30] Coate discusses some of the issues regarding the measurement of efficiencies for the purpose of merger analysis:

> Efficiencies are also likely to raise a range of measurement problems. Efficiency effects are driven by the magnitude of the benefits, the pass-through of the savings (both in the short and long run), the probabilities the efficiency claims are cognizable and the duration of the efficiencies. Again, it is possible that the analyst would attempt to summarize the savings in a single number (i.e. six percent savings in out-years 3 to 8); however such a conclusion could require heroic probability assumptions. Instead, it is often necessary to consider a range of efficiency information addressing expected savings, relevant probabilities, pass-throughs and timing profiles.

the merger yields just half of the claimed cost savings. That is, the newly merged firm produces

the Beech-Nut quality line but does so at an 8.5 percent cost disadvantage relative to Gerber,

i.e., at a cost of about $0.336 per jar.

Table 3

Impact of Proposed Mergers When Only
Half the Claimed Cost Efficiencies Are Realized
And Beech-Nut Quality Is Achieved

	Change from Pre-Merger Price	Post-Merger Market Share
Gerber	+0.72%	72%
Heinz/Beech-Nut	+1.96%	28%

Reducing the cost efficiencies clearly reduces the consumer benefits of the merger. Once

only half the savings are realized, prices rise by an average of one percent across the entire

market. Indeed, further simulation shows that the impact on consumers turns from positive to

negative if all but 30 percent of the claimed cost efficiencies are realized. Market prices rise

slightly and, as before, there is an additional loss that results from a reduction in variety. Once

again, however, the combined profit of Beech-Nut and Heinz still rises as their margin over cost

rises to 13.7 percent.[31] That is, the merging firms have good reason to combine their operations

and to press the courts for the legal right to do so even if only 50 percent of the claimed

efficiencies are achieved but consumers suffer even if 70 percent of the savings are realized.

Failure to achieve the claimed cost efficiencies is however only one of the possible problems

that could arise in the post-merger market. There are at least two others. The first arises in

connection with the product selection issue noted earlier. While Heinz and Beech-Nut claimed

that they would market a Beech-Nut quality product, the fact is that they have very little incentive

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[31]The calculation is conceptually identical to that in note 20, *supra*. The new firm's costs are higher than
claimed but, knowing that Heinz/Beech-Nut is less cost effective induces Gerber to set a higher price. This in
turn permits Heinz/Beech-Nut to pass the higher costs on to consumers, at least in part, by way of a higher price.

to do so.[32] By continuing to market the Beech-Nut line, the merged firm offers a product that is a

relatively close substitute for the Gerber product. As a result, *unless the firms can reach an*

explicit or tacit agreement on prices, such a choice would intensifies the price competition

between the two surviving firms.[33] Heinz/Beech-Nut would instead do much better if it

differentiated its product more substantially from Gerber's by instead dropping the Beech-Nut line

and marketing a product of the lower Heinz's quality.[34] In so doing, Heinz/Beech-Nut truly

responds to the incentive to distance its product from Gerber's as much as possible. Table 4

shows the results of this simulation. Unlike the previous scenarios, where we compared the post-

merger price of the Heinz/Beech-Nut with the pre-merger price of Beech-Nut, we now compare

this price with the pre-merger Heinz price since that is the product that continues to be marketed.

Table 4
Impact of Proposed Merger Assuming Full Cost Reduction
But That Heinz/Beech-Nut Quality Is That of Current Heinz

	Change from Pre-Merger Price	**Post-Merger Market Share**
Gerber	**29.3%**	**66.7%**
Heinz/Beech-Nut	**25.8%**	**33.3%**

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[32] *Cf.* Michael Salinger, "Treatment of Efficiencies in Merger Enforcement," Remarks Before the Antitrust Modernization Committee (Nov. 17, 2005)("No matter how much we believe that efficiencies are a plausible outcome of mergers, we cannot conclude that a merger will generate efficiencies simply because the parties say it is so. Mere assertion is not proof or even, by itself, supporting evidence.")

[33] The companies argued that Heinz would make a strategic choice to mimic Gerber. Producing identical products in Bertrand (price) competition would yield marginal cost pricing and would not be profit maximizing. The only way in which it would possibly be in Heinz interest to maintain price and increase quality would be if Heinz could "leap frog" Gerber in terms of brand image and perceived quality. Given the promotional expenditures and history that have established each firm's identity, this is not a plausible argument. It is also not a complete one. If Heinz can raise its perceived quality, Gerber can, too. In any case, as the FTC argued and the Court of Appeals found, if the merger took place and the new firm followed through on its pre-merger promise to become more like Gerber, it would have every incentive to find a means to coordinate with Gerber on pricing. *See* note22, *supra*.

[34] *See* Ari Hyytinen & Otto Toivanen, "Monitoring and Market Power in Credit Markets," http://fmwww.bc.edu/ RePEc/es2000/1879.pdf (December 1999). In discussing quality choices in a hypothetical bank market, Hnytinen and Toivanen explain that "Because the two banks want to avoid entering price competition in Bertrand fashion (in homogeneous goods), it is easy to verify that with simultaneous entry, there exist two asymmetric sub-game perfect equilibria." These are with, say, firm 1 choosing high quality and firm 2 choosing low quality or vice-versa. Again, the point is that the firms wish to differentiate their products as much as possible so as to soften price competition.

Under this scenario, prices rise quite dramatically. This is true despite the fact that the high-cost middle product has been eliminated. Nor is this just a quirk result due to specific features of the baby food market. Recent work by Norman, Pepall, and Richards demonstrates that in a vertically differentiated market, two merging firms that lie adjacent to each other in the quality ladder will always drop the higher quality product line so as to distance their product from the top quality good.[35] They show that when this product selection choice is included in the strategy space of the merged firm the result is that consumer prices rise for virtually any plausible value of merger-generated cost efficiencies. The above simulation based on the baby food case confirms this hypothesis. Thus, while Heinz claimed that it would market the high-quality Beech-Nut product and compete "head-to-head" with Gerber, both intuition and the above simulation argue strongly that Heinz had every reason *not* to do this.

The final problem that we consider reflects the concern stressed by the FTC itself, namely, that by creating a duopoly the merger would alter the nature of price competition in the market. In particular, the FTC feared that the merger would result in greater price coordination between the two surviving firms. This view is consistent both with Stigler's conceptual arguments that coordination is easier as the number of firms decreases and with much empirical evidence.[36] The FTC also relied on the Stiglerian view that increased product and cost homogeneity would raise the chances of coordination.[37] The question then is how precisely to model such coordination.

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[35] George Norman, Lynn Pepall, & Daniel Richards, "Product Differentiation, Cost-Reducing Mergers, and Consumer Welfare," forthcoming in Canadian J. Econ. (Nov. 2005).

[36] George Stigler, "The Theory of Oligopoly," 72 J. Pol. Econ. 44 (1964).

[37] Trial tr. ___ (Dr. Hilke); Stigler, *supra* note __. *See also* M. Ivaldi, B. Jullien, P. Rey, P. Seabright, and J. Tirole, "The Economics of Tacit Collusion," at 46, Final Report for DG Competition, European Commission (March 2003). Contrary to some thinking, cost differences and quality differences are not two sides of the same coin. In a vertically differentiated setting, two firms with identical costs can each be profitable if they market different qualities. The converse is not true. If two firms have the same quality but different costs, the high-cost firm will have to exit.

There are many ways that firms may tacitly coordinate their prices without a formal, and illegal, price-fixing agreement. One of the most common mechanisms, however, is for one firm to serve as a price-leader and all others to act as followers. In this scenario, the leader firm takes all the initiative in announcing prices while the follower firms set their prices in reaction to the leader's announcement. As noted above, some such as William Kolasky[38] and the Heinz expert economist at the trial, Jonathan Baker, have argued that the pre-merger market was best described precisely along such price-leadership lines with Gerber in the leadership role. Yet, as we demonstrated with our first simulation (Table 1), the pre-merger market shares and prices are quite consistent with the absence of any price leadership dynamic. From our perspective, then, the real import of Baker's comment is that price leadership by Gerber might well be the most likely form that the tacit collusion feared by the FTC might occur.[39]

Accordingly, our final simulation asks what the post merger outcome would be if the newly merged firm did indeed achieve the cost efficiencies claimed by its proponents and if it also chose, despite the negative profit consequences shown in Table 4 above to market a Beech-Nut quality product, but in which prices are coordinated by Gerber playing the role of price leader. Thus, in this setting, the assumption of simultaneous pricing is replaced with one in which Gerber announces its price first, after which Heinz then responds with the price that maximizes

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[38] Kolasky, W. "Lessons From Baby Food: The Role of Efficiencies in Merger Review," *16 Antitrust Magazine* 82 (2001).

[39] This was the major charge brought by grocers in the prior baby food case. *See in re Baby Food Antitrust Litigation,* 166 F. 3d 112 (3d Cir. 1999). Yet in defense of the merger, the parties' economic expert testified that he believed the pre-merger competitive environment was characterized by such a price leadership paradigm. Trial tr. __ (Testimony of Professor Baker); Trial tr. __ (*See also* W. Kolasky, "The Role of Economics in Merger Enforcement: Efficiencies and Market Definition under Conditions of Price Discrimination," Paper presented at Charles River Associates Conf. (Dec. 2002). In prior litigation, however, the baby food companies argued that the industry was characterized by intense competition, and this argument won the day. *See in re Baby Food Antitrust Litigation,* 166 F. 3d 112 (3d Cir. 1999): "Our review of the record convinces us that the evidence overwhelmingly establishes that the defendants in their marketing activities acted independently rather than in "complete unanimity," competitively rather than conspiratorially, and aggressively rather than supinely. There is positive and unequivocal evidence that the defendants engaged in unilateral, aggressive competition limited only by budgetary considerations, cash, and market conditions."

its profit given the Gerber announcement. Under such an arrangement, Heinz/Beech-Nut now has full information about its rival's choice at the time that Heinz/Beech-Nut sets its price, and moreover, Gerber understands that this will be the case when it sets its own price initially.[40] The outcome under this more coordinated pricing arrangement is shown in Table 5.

Table 5
Impact of Proposed Merger Assuming Utopian Scenario
(Full Cost Reduction and Beech-Nut Quality)
But That Gerber Is A Price-Leader

	Change from Pre-Merger Price	Post-Merger Market Share
Gerber	**12.1%**	**50%**
Heinz/Beech-Nut	**4.9%**	**50%**

As Table 5 shows, the optimistic scenario again turns sour when simultaneous pricing is replaced with a more cooperative price leadership regime. Former Gerber consumers either now pay a higher price or switch to the lower quality Heinz/Beech-Nut brand. Former Beech-Nut consumers now pay a higher price, too. Former consumers of Heinz must now switch to a much higher priced Heinz/Beech-Nut brand.

There is, however, a distinctive feature of the price leadership scenario. This is that Heinz/Beech-Nut gains considerable market share relative to the other outcomes. The reason for this is straightforward. Prices are strategic complements. That is, the higher the price set by Gerber, the higher the price that Heinz/Beech-Nut will want to set. Gerber recognizes this and so sets a very high price. In so doing, Gerber recognizes that such a high price opens the door for Heinz/Beech-Nut to follow with a smaller price that steals customers from Gerber. Gerber nonetheless will earn greater profits on the units that it does sell. Indeed, both firms do better in

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[40] This change in assumptions reflects a shift in the competitive nature of the industry, though it may not fully capture the FTC's concern that the merger would increase the likelihood of tacit collusion. That is, the model continues to rely on basic game theory but uses the switch from simultaneous to sequential moves to capture the FTC's argument the merger would lead to increased likelihood of tacit or express collusion and yet higher prices.

the post-merger world with price leadership than with simultaneous pricing (Table 2). Gerber's

total profit increases by 12.6 percent while the Heinz/Beech-Nut profit more than doubles.[41]

It may seem somewhat surprising that the cooperative price leadership outcome shown in

Table 5 raises prices less than the strategic product choice outcome described in Table 4. Recall,

however, that the products being offered in the market are much closer substitutes in the

leadership game because here we assume that Heinz/Beech-Nut does indeed market a Beech-Nut

quality good. This gives Heinz/Beech-Nut much greater opportunity. As noted above, when

Gerber sets its price first, it faces the concern that Heinz/Beech-Nut will then announce a lower

price that steals many Gerber customers. Yet when Heinz/Beech-Nut markets a relatively close in

quality to Gerber's, even a small price cut will have precisely that effect. As a result, Gerber has

to be much more cautious about setting its price high in the first place when the two goods are

closer substitutes. In short, cooperative pricing under a price-leadership model would in fact lead

to a substantial price rise on the order of eight percent or so when averaged across the entire market.

It should also be clear from both Table 5 and the foregoing discussion that cooperative price

leadership, while it enhances the profits of both firms, is particularly beneficial for Heinz/Beech-

Nut whose market share rises dramatically in this simulation. This demonstrates a further

weakness in the merging parties' contention regarding scale economies. Heinz/Beech-Nut

claimed that the merger would permit it to achieve a large scale of operations that would, in turn,

guarantee the realization of the claimed cost efficiencies. The price leadership scenario results

described in Table 5 make clear that this may be true—the merger may enable Heinz/Beech-Nut to

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[41] Again, assume 1,000,000 customers for convenience. In the non-cooperative scenario assumed in Table 2, Gerber would sell to 670,000 customers at a price of $0.423 and a cost of $0.31 for a total profit of $75,710. Heinz/Beech-Nut would sell to 330,000 customers at a price of $0.365 and again, a cost of $0.31, for a total profit of $18,150. Under the price leadership regime assumed in Table 5, Gerber now sells to only 500,000 consumers but at a price of $0.479. Given its unit cost of $0.31, it now earns profit of $84,500. Likewise, Heinz/Beech-Nut now sells to 500,000 consumers at price of $0.393. Its total profit is ($0.393 - $0.31) x 500,000 = $41,500.

win a large market share and to achieve all the alleged efficiencies—but that even so, those lower costs do not necessarily show up as lower prices to consumers. If the FTC's concerns regarding price coordination are valid, the merger puts consumers at risk even if Heinz/Beech Nut realizes all the claimed cost savings and also wins a market share equal to that of Gerber's.

6. *Summary and Conclusions*

The FTC's successful effort to block the proposed merger of the Heinz and Beech-Nut baby food operations in 2001 has led to much criticism concerning the antitrust agencies' treatment of efficiencies. Because the merger claimed significant cost savings, many had expected it to be approved, especially in light of the 1997 revisions of the Merger Guidelines integrating such efficiencies more completely into public policy. Consequently, the case has led many observers to question what role, if any, antitrust policy will permit for cost efficiencies as a merger defense.

We have used a standard model of vertical product differentiation to analyze the baby food case. While such a model has not commonly been applied in merger analysis, we have shown that this framework describes reasonably well the observed pre-merger features of the market.   This is not to say that the complicated rivalries of the baby food market are exactly duplicated by our stylized framework. However, we believe that our model fits the data well enough to yield useful insights about that industry. In particular, the model should in our view satisfy the requirement expressed by one of the harshest critics of the baby food decision, William Kolasky, that, "An evaluation of the efficiencies claim does not really involve a weighing of the cost savings from the claimed efficiencies against the potential price increases from an increase in market power, but instead requires understanding how the efficiencies will change the competitive dynamics of the market."[42] Our model is a formal and rigorous way to generate such understanding.

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[42]William Kolaski, **"**The Role of Economics in Merger Enforcement: Efficiencies and Market Definition under Conditions of Price Discrimination", Charles River Associates Conference on Current Topics in Mergers and Antitrust Enforcement" at 9 (Dec. 11, 2002).

Our model offers insights regarding both the pre-merger and post-merger baby food market. First, contrary to what many appear to believe, Gerber's large share of the pre-merger market is not necessarily evidence that competition in that market was moribund, or that the market was best described by a regime in which Gerber acted as a price leader while Heinz and Beech-Nut simply priced under the Gerber "umbrella". To the contrary and as noted above, the pre-merger market is quite consistent with non-cooperative, independent price-setting by each of the three firms in a setting in which all consumers agree that Gerber's sells the highest quality product, Beech-Nut the second highest, and Heinz sells the discount brand.

Second, when our model is applied to simulate the likely postmerger outcomes, the merit of the merger looks very questionable. Failure to achieve less than 70 percent of the claimed cost efficiencies will render it harmful to consumers. Moreover, even if all the claimed efficiencies are achieved, the impact will be negative if the newly-merged firm chooses its product line strategically (i.e., in a manner to maximize profits), and not merely assumed to specialize in a Beech-Nut quality product. Finally, if the post-merger market is characterized by tacit coordination implemented by price leadership, then even full realization of the claimed cost efficiencies and complete specialization in the Beech-Nut line will not be enough to undo the harmful effects of the greater price coordination that the FTC feared would result from reducing the number of active competitors to two.

In short, once the baby food industry is viewed through a vertically differentiated lens, there are many ways that the baby food merger could have "gone wrong" for consumers even if virtually all the cost efficiencies that Heinz and Beech-Nut claimed were actually achieved.[43] The simple fact is that price competition in vertically differentiated markets is "soft" and

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[43] *See* F. M. Scherer, " Some Principles for Post-Chicago Antitrust Analysis" in <u>Antitrust: New Economy, New Regime</u>, Second Annual Symposium of the American Antitrust Institute (Fall 2001):

dominated by observed brand or quality differences with the result that merger-generated cost savings will not typically have a large impact on post-merger prices. Of course, the claimed cost savings may themselves be doubtful,[44] in which case the benefits claimed for the merger are even more questionable. In any case, however valid are the claimed efficiencies, the merging parties assertion that they would market a close substitute for the Gerber product <u>and</u> compete with Gerber head on in the post merger market is far less credible. In a vertically differentiated market, such a strategy is not profit-maximizing and, therefore, not believable. Indeed, the FTC's concern that the merger would facilitate price coordination is much more credible, as this is part of a profit-maximizing strategy.

As noted, our analysis has particular relevance to the baby food merger because the vertical framework appears to fit that market remarkably well. Whether the model applies with equal strength to other markets is less clear. To the extent that vertical differentiation is an important dimension of the brand distinctions in general, however, our results do suggest that cost efficiency claims made in defense of a merger in a highly concentrated industry should be viewed with some skepticism. The results further suggest that the choice between vertical and horizontal differentiation as the appropriate model is likely to have important ramifications for any efficiency defense.

Finally, there will be many cases in which the evidence of both efficiency effects and anti-competitive effects is uncertain and inconclusive. In such cases, one needs presumptions as to the side on which the risks of error are less severe. At Harvard's John F. Kennedy School of Government, we called such presumptions "tie-breaking" rules. Recognizing that many and perhaps most mergers fail to enhance efficiency, the proper tie-breaking rule would be to resolve the burden of doubt on the side of stopping questionable mergers. This appears to have been what the Court of Appeals did in preliminarily enjoining a proposed merger between the Heinz and Beech-Nut baby foods operations. Finding that "the district court never explained why Heinz could not achieve the kind of efficiencies urged without merger," it ruled that the "public equities weigh in favor of injunctive relief." As I read the case facts, the court was appropriately skeptical.

Interestingly, even Kolasky ultimately states that that "the court of appeals understandably found difficult to accept in a 3-to-2 merger" [that] "the efficiencies would have given the merged firm an incentive to behave as more of a maverick." William Kolasky, *supra* note ___, at 9.

[44] *See* M. Salinger, *supra* note 32.

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Appendix: The Vertically Differentiated Product Market Model

We define the indirect utility consumer θ obtains from buying one unit of product i with characteristic content z_i at price p_i to be:

$$V_i(\theta) = \max\{0, V + \theta z_i - p_i\}, \qquad\qquad i = 1,2,3 \qquad\qquad (A1)$$

Each consumer buys exactly one unit of the product that offers the highest utility provided, of course, that this utility is non-negative. We assume that V is sufficiently high that the market is fully covered in any price equilibrium. We also assume that: $\underline{\theta} = \overline{\theta} - 1$. Thus, consumer preferences are indexed so as to lie in a unit interval. This facilitates market share calculations as a firm's market shares will be equal to its market share.

Each firm has a given product quality Z. For Gerber, Beech-Nut, and Heinz these are, respectively, Z_G, Z_B, and Z_H with $Z_G > Z_B > Z_H$. We then define: $\Delta Z_1 = Z_G - Z_B$; and $\Delta Z_2 = Z_B - Z_H$

Each firm also has a constant unit cost C. For Gerber, Beech-Nut, and Heinz these are, analogously, C_G, C_B, C_H. Here we assume that $C_B > C_G = C_H$. In particular, we assume that $C_B = \alpha C_G = \alpha C_H$ where $\alpha > 1$.

For prices P_G, P_B and P_H such that each good has a positive market share, the market demands are given by:

$$D_G(P_G, P_B, P_H) = \overline{\theta} - \frac{P_G - P_B}{\Delta Z_1} \qquad\qquad (A2a)$$

$$D_B(P_G, P_B, P_H) = \frac{P_G \Delta Z_2 - P_B + P_H \Delta Z_1}{\Delta Z_1 \Delta Z_2} \qquad\qquad (A2b)$$

$$D_3(P_G, P_B, P_H) = \frac{P_B - P_H}{\Delta Z_2} - \underline{\theta} \qquad\qquad (A2c)$$

The firms independently choose the prices of their brands to maximize profits, which from (A2a)-(A2c) are defined respectively by $\pi_G = (P_G - C_G) D_G$, $\pi_B = (P_B - C_B)D_B$, and $\pi_H = (P_H - C_H)D_H$. The best response functions are:

$$P_G = \frac{\left[C_G + P_B + \overline{\theta}\Delta Z_1\right]}{2} \tag{A3a}$$

$$P_B = \frac{\left[C_B + \dfrac{\Delta Z_2}{Z_G - Z_H} P_G + \dfrac{\Delta Z_1}{Z_G - Z_H} P_H\right]}{2} \tag{A3b}$$

$$P_H = \frac{\left[C_H + P_B - \underline{\theta}\Delta Z_2\right]}{2} \tag{A3c}$$

In any equilibrium in which all three firms have positive market shares, the equilibrium prices are:

$$P_G = \frac{2}{3}C_G + \frac{1}{3}C_B + \frac{\overline{\theta}\Delta Z_1}{2} + \frac{\Delta Z_1 \Delta Z_2}{6(Z_G - Z_H)} \tag{A4a}$$

$$P_B = \frac{2}{3}C_B + \frac{1}{3}C_G + \frac{\Delta Z_1 \Delta Z_2}{3(Z_G - Z_H)} \tag{A4b}$$

$$P_H = \frac{2}{3}C_H + \frac{1}{3}C_B - \frac{\underline{\theta}\Delta Z_2}{2} + \frac{\Delta Z_1 \Delta Z_2}{6(Z_G - Z_H)} \tag{A4c}$$

Corresponding to these Prices are Equilibrium Market Shares:

$$S_G = \frac{\overline{\theta}}{2} + \frac{C_B - C_G}{3\Delta Z_1} + \frac{\Delta Z_2}{6(Z_G - Z_H)} \tag{A5a}$$

$$S_B = \frac{\left(\overline{\theta} - \underline{\theta}\right)}{2} - \frac{\left(C_B - C_G\right)}{3\Delta Z_1} - \frac{\left(C_B - C_H\right)}{3\Delta Z_2} - \frac{\left(\Delta Z_1 + \Delta Z_2\right)}{6(Z_G - Z_H)} \tag{A5b}$$

$$S_H = \frac{C_B - C_G}{3\Delta Z_2} + \frac{\Delta Z_1}{6(Z_G - Z_H)} - \frac{\underline{\theta}}{2} \tag{A5c}$$

The results in the text describing the initial market equilibrium are derived from setting $\underline{\theta} =$ 0.012; $\overline{\theta} = 1.012$; $Z_G = 4.475$; $Z_B = 4.307$; $Z_H = 4.112$; $C_G = C_H = 0.28$; and $\alpha = 1.17$.

In the post-merger duopoly, define P_{HB} = Heinz/Beech-Nut price; Z_{HB} = Heinz/Beech-Nut quality; and C_{HB} = Heinz/Beech-Nut quality. Likewise, define $\Delta Z = Z_G - Z_{HB}$. Demands in this two-firm game are:

$$D_G(P_G, P_{HB}) = \overline{\theta} - \frac{P_G - P_{HB}}{\Delta Z} \text{ ; and} \tag{A6a}$$

$$D_H(P_G, P_{HB}) = \frac{P_G - P_B}{\Delta Z} - \underline{\theta} \tag{A6b}$$

With simultaneous Bertrand competition, firms set prices to maximize profit defined as above. This yields the following best response functions for the postmerger game:

$$P_G = \frac{\left[C_G + P_{HB} + \overline{\theta}(Z_G - Z_{HB}) \right]}{2} \tag{A7a}$$

$$P_{HB} = \frac{\left[C_{HB} + P_G - \underline{\theta}\Delta Z \right]}{2} \tag{A7b}$$

Equilibrium prices for any two-firm simultaneous Bertrand game are:

$$P_G = \frac{2}{3}C_G + \frac{1}{3}C_{HB} + \frac{(2\overline{\theta} - \underline{\theta})\Delta Z}{3} \tag{A8a}$$

$$P_{HB} = \frac{2}{3}C_{HB} + \frac{1}{3}C_G + \frac{(\overline{\theta} - 2\underline{\theta})\Delta Z}{3} \tag{A8b}$$

Equilibrium market shares for any simultaneous Bertrand game are:

$$S_G = \frac{C_B - C_G}{3\Delta Z} + \frac{2\overline{\theta} - \underline{\theta}}{3} \tag{A9a}$$

$$S_{HB} = -\frac{C_B - C_G}{3\Delta Z} + \frac{\overline{\theta} - 2\underline{\theta}}{3} \tag{A9b}$$

For a sequential price setting game in which Gerber goes first, define Gerber and Heinz/Beech-Nut unit costs respectively as C_G and C_{HB}. Gerber's optimal price is then given by:

$$P_G = \left(\bar{\theta} - \frac{\theta}{2} \right) \Delta Z + \frac{C_G + C_{HB}}{2} \qquad (A10)$$

The Heinz/Beech-Nut price may then be calculated using the best response function in equation (A8b), above. In turn, these prices may be used to calculate market shares from equations (A6a) and (A6b).