12-2003

The Demand and Supply-Side Impact of the Kimberly-Clark, Scott Paper Products Merger in the Facial Tissues Category

Andre Bonfrer

Singapore Management University, andrebonfrer@smu.edu.sg

Jagmohan S. Raju

Wharton School of Business, University of Pennsylvania

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November, 2003

André Bonfrer
Singapore Management University

Jagmohan S. Raju
The Wharton School, University of Pennsylvania

The authors would like to express their thanks to IRI for providing the data, to Mary Sullivan and Chuck Romeo from the US Department of Justice, to participants at the University of Auckland seminar series and the presentation at the 2003 University of Maryland Marketing Science conference, for helpful comments and suggestions. This research was funded by the Wharton-SMU Research center.

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Abstract

We investigate how market behavior changed in the facial tissues category, following the 1995/1996 Kimberly-Clark merger with Scott Paper Products in the paper products industry. The facial tissues category is of interest because the US Department of Justice (DOJ), anticipating reduced competition after the merger, imposed a consent decree, requiring that Scotts' facial tissues brands be licensed out to a third party.

We utilize a two-stage budgeting demand system developed by Deaton and Muellbauer (1980a), coupled with general form supply-side first order conditions to compare demand and competitive behavior before and after the merger. Our findings indicate that the merger coincides with substantial impacts on the substitution rates across different facial tissues brands, with the biggest changes for the Scott brand. We measure competitive conduct at a weekly level, using a Conjectural Variations approach. Our results indicate that before the merger, Procter and Gamble exhibited mild Stackelberg leadership in its pricing. In the year following the 1995 merger, however, we find evidence consistent with a switch in the pricing leadership role to Kimberly-Clark. Our findings are corroborated by an estimation approach that allows us to study how the parameters of the supply and demand system vary over time (see e.g. Sudhir, Chintagunta and Kadiyali 2003). Our study shows that brand ownership changes resulting from the merger can affect competitive conduct; in particular it can affect the Stackelberg price leadership position of the firms in an affected industry. We also show that competitive conduct and pricing behavior changed, despite the DOJ requirement that the Scotts brand be licensed out ensuring that the number of brands on the market remained unchanged after the merger.

Introduction

Background

Horizontal acquisitions can be a highly effective way for a firm to expand its resources and capabilities. For example, a merger can build a firm's resource base (e.g. marketing expertise, see Capron and Hulland 1999); it can increase the firm's market coverage (i.e. to enter market segments, geographic or otherwise, where the firm currently does not operate, see Rao, Mahajan and Varaiya 1991); or a merger can remove competitive constraints in the markets where the firm currently conducts business. A combination of these reasons is likely to be at work in the decision for a firm to acquire, or merge with, another firm. We focus on how a horizontal acquisition can alter the competitive conduct in a category in an empirical analysis of the 1995/1996 Kimberly-Clark and Scott Paper Products merger in the facial tissues category.

The 1995/6 merger between Kimberly-Clark (herein KC) and Scott Paper Products (herein Scott) companies was preceded by considerable changes in the paper products industry, particularly with respect to Scott. At the beginning of 1994, Scott hired a new CEO, who substantially restructured the firm, and this exercise culminated in the July 1995 (about one year later) merger announcement with KC and the US Department of Justice requiring KC to license out the Scotts brand. We study how demand and supply behavior changed before and after the merger event. We examine the impact of the merger on each of the facial tissues brands' overall prices, merchandising and assortment. A second goal of this study is to examine and report the market response and substitution patterns in the facial tissues category, before and after the merger. Third, we study the competitive interactions among the main firms in the facial tissues category to understand how competitive interactions changed as a result of the merger event.

Our findings suggest that the merger event in this industry had a significant impact on the post-merger market behavior. First, prices increased and merchandising activities changed significantly. Second, substitution patterns changed substantially with the own-price elasticity of the Scotts brand doubling, and strong changes in the cross-price elasticities between Scotts and the two other facial tissues brands. Third, competitive conduct changed to such an extent that the price leadership, historically belonging to P&G, shifted to Kimberly-Clark after the merger. The latter finding represents evidence that the price leadership roles can be affected by market structural changes. Furthermore, our findings suggest that the Department of Justice consent decree (December 1995) to license out the Scotts brand was not able to dampen the change in post-merger competitive aggressiveness of Kimberly-Clark.

Mergers and acquisitions (M&A) represent an important change to how marketers could operate, and the money at stake is substantial. In 2000 they were $3.4 trillion globally, although in 2001 activity fell to $1.75 trillion (*Wall Street Journal*, January 4, C12, 2001; *The Economist*, January 27, page 59-60). The Kimberly-Clark acquisition of Scott Paper Products was valued at close to US$7billion. The way in which a merger can change the market structure and consequent competitive behavior in an industry is highly contentious. The change in competitive behavior is at the heart of many of the Department of Justice antitrust cases, and considerable attention is paid by economists to simulating, or predicting, the impact of mergers on market conduct (e.g. Nevo 2001, Hausman and Leonard, 2002). The assumptions driving these predictions are often quite restrictive. For example, an important assumption is that all firms in the pre-merger oligopoly are engaged in Bertrand-Nash competitive behavior. Another assumption is that costs do not change post-merger. However, a number of studies estimate the competitive conduct in a market and these studies suggest that oligopolies are often not in Bertrand-Nash competitive equilibria (Roy, Hanssens and Raju 1991, Kadiyali 1996, Sudhir 2001b, Sudhir, Chintagunta and Kadiyali 2003).

A merger, or more precisely, a horizontal acquisition, in an industry presents marketers with an ideal opportunity to study changes in the market structure and the consequent

impact on demand and supply behavior. Economists and marketers are interested in the long term impact of a merger on market behavior. Many of the empirical studies focus on the consequent impact of the merger on prices and on product differentiation (quality). Moreover, most studies are based on pre-merger data, and attempt to forecast or predict what would happen to market behavior after the merger.

The field of marketing has witnessed the development of a number of models under the paradigm of the New Empirical Industrial Organization (see Kadiyali, Sudhir, Rao 2001, for a recent detailed review); the central theme of these studies is to understand competitive conduct, taking into account that demand behavior changes with the actions of the competition. The equilibrium outcome of the supply and demand side interactions is modeled. A subset of this NEIO literature studies the impact of some market structural change on demand-supply behavior. For example, the impact of the entry of a store brand by a retailer (Chintagunta, Bonfrer and Song 2002) and the entry or exit of a new national brand (Kadiyali 1996, Dixit and Chintagunta 2003). NEIO researchers have also started to consider how competitive conduct may change over time (see Sudhir, Chintagunta and Kadiyali 2003). We aim to add to this body of literature by studying a series of related market structure that took place in the early 1990s in the paper products industry. These changes were the hiring of Al Dunlap (aka Chainsaw Al) at the beginning of the second quarter, 1994; accompanied by the restructuring exercise by Scott Paper products, culminating in the merger of Kimberly Clark and Scott Paper Products in late 1995.

What do we know about mergers?

Mergers are a topic of extensive interest to industrial organization economists. Most of the substantive issues concern market conduct and the consequent impact on prices and therefore consumer welfare. Many studies attempt to predict the impact on post-merger prices charged to customers resulting from the reduction in competitive constraints. At the center of this issue involves opposing arguments where the merger may result in cost-

efficiencies or productivity improvements that pose a downward pressure on prices, versus the upward pressure on prices resulting more directly by the ability of competing firms to raise prices due to the lowered competitive constraints. Thus the argument centers around the end impact on consumer welfare arising from the altered market structure, in particular focusing on prices, but also concerning the quality (e.g. breadth of assortment or level of differentiation provided by the post-merger markets).

Marketing strategy practitioners and academics generally concern themselves more about the "efficiency and effectiveness" incentives underlying the motivation for a firm to acquire a horizontal competitor. For example, Capron and Hulland (1999) adopt the resource-based view of the firm (Wernerfelt, 1984) and argue that the motivation for firms to acquire its competitors is underpinned by the strategic advantage of gaining access to resources it would otherwise need to build at greater cost. They argue that one subset of these resources is the marketing resource, such as branding and distribution infrastructures, the combination of which provides strong synergies to the combined firms' marketing growth.

As far as we know, there have been no studies in marketing which directly address the impact of horizontal merger activity within a category on competitive conduct. We wish to motivate such research. Our starting point is to compare the pre- and post-merger marketing environments centered on a horizontal acquisition in the paper products industry. Knowledge of the impacts of such a merger event will be of interest to several groups.

Competitive strategists should be interested in the outcome of an important event such as a merger, which is likely to impact competitive behavior across multiple industries in which such multi-brand firms operate. A literature in marketing has built up both around the tradition of New Empirical Industrial Organization models. Researchers such as Roy, Hanssens and Raju, (1991) and Sudhir (2001a,b) for example, study market conduct with a fixed set of firms. Recently, this literature has turned its attention to studying how competitive behavior changes over time. In this spirit, Sudhir, Chintagunta and Kadiyali

(2003) study the way that competitive behavior changes in times when industry demand falls or rises, with an empirical illustration from the US Photographic film industry. Although at a strategic level (i.e. firms solve business decisions under an objective function with a long-term horizon), the decision to merge with another firm is endogenous to the marketing environment, and we view such events as exogenous when it comes to studying competitive behavior within sub-markets of these firms' business activities. There are many such change-agents of competitive behavior. Possible catalysts include the investment by one or more competitors in plant or capacity improvements, the entry or exit of firms in the industry (e.g. Berry 1992, or Kadiyali 1996), or just the entry (or extension) of a single new brand (e.g. Hausman and Leonard 2002).

Public policy researchers may be interested in the outcome of a look-back study that examines post-merger conduct in the markets affected by the merger. Perhaps due to the limited availability of both pre and post-merger data, most studies of mergers in the industrial economics literature tend to focus on pre-merger simulation of what would happen given the merger were to occur. This approach is limited in its insight as to what actually happens. Many assumptions underlie these types of simulations, such as that the pre- and post-market shares, prices and merchandising activities are constant across the regimes; that competitive entry does not or is less likely to occur post-merger; that competitive conduct is described by a Bertrand-Nash equilibrium; costs remain the same, and so on.

Finally, the change in competitive conduct following a merger should also be of interest to business disciplines outside of marketing. For example, the changing expectations of the financial performance of firms involved in these mergers (or the industry in which the merger occurs) is a major mover of the asset prices of the firms, and the actual performance of the merged firms is controversial (see e.g. Weston and Chung, 1983).

In our estimation of demand and supply, we use a two-stage budget-based model of demand. At the top level is the budget allocated (across cities) to the entire facial tissues

category. We express this as a function of time invariant city-specific fixed effects, city income levels, and a price index for the facial tissues products. The bottom level of demand is the expenditures share for each brand in this category. We couple this demand system of equation with a simultaneous system of equations for the first order conditions of each competing brand in the facial tissues category. We adopt the "conjectural variations" approach, to estimate the nature of competition.

Our econometric model is calibrated using IRI data available for the facial tissues category. Our data are available at the brand-city level, for 46 major US cities, and our observation time series (weekly) spans from 1992 to 1997. Prior to the merger, the three dominant competitors include Procter & Gamble (hereafter P&G), Scott Paper Products, and Kimberly-Clark. After Kimberly-Clark made the announcement to acquire Scott Paper Products, the Department of Justice (herein, DOJ) imposed a consent decree requiring that the Scotts brand of facial tissues be licensed out to a third party.

The paper is structured as follows. After we provide a brief synopsis of the events in the paper products industry over 1994-1997, we describe the demand methodology, and motivate and develop the supply side estimation equations for this model. Then we measure and discuss the pre-merger demand and supply behavior, which is used as a benchmark for comparison with post-merger market behavior. In the final sections we measure the change in prices due to the merger, and we measure and discuss post-merger demand and competitive behavior. Our discussion delves further in the time-varying nature of competition in the same system of demand-supply behavior, to understand the impact of the events leading up to and following the merger.

The merger of Kimberly-Clark and Scott Paper: a synopsis

On April 19, 1994, Scott Paper Products hired Al Dunlap as CEO. Shortly thereafter, Scott Paper Products underwent a cost-rationalization exercise, culminating in the July

1995 merger announcement. The timeline for the KCS merger is presented in Table 1. The merger would combine the brands of both companies. In the diapers category, Kimberly-Clark owned the "Huggies" brand of disposable diaper. Kimberly-Clark also owned the "Kleenex" brand of facial tissues. Scotts owned brands in the facial tissues (Scotties, or Scotts), toilet tissues (Cottonelle) and paper towels categories (Viva).

Post-merger, the new company (herein KCS) would compete with Procter & Gamble (herein P&G) in key paper products categories, including paper towels, toilet tissues, facial tissues and diapers. P&G owns the "Pampers" and "Luvs" diaper brands, and the "Bounty" brand of paper towels. Financial analysts (see *LA Times*, July 18, 1995) stated that the merger represented a "good fit", since the Scott company produced value-price products, and the Kimberly-Clark company produced higher-end brands. This separation in market positioning was thought to exist because there is low cannibalization among the brands. In the facial tissues category, this suggests that the substitution rates among Scotts and KC brands (Scotties versus Kleenex) would be low, and the sales response to each others' price changes would be low.

A complaint was filed against the merger in the US District Court of Texas (December 12, 1995), in United States of America and State of Texas v. Kimberly-Clark Corporation and Scott Paper Company. This complaint alleged that the proposed merger would "substantially lessen competition in production and distribution, and raise prices to consumers in retail sale, of facial tissue and baby wipes in the United States." (page 1). The alleged result of the lowered competition would be seen in a likely increase in prices and lowering of product innovation in the affected categories.

Table 1 about here.

The final judgment required the merged company to divest the Scott's recently introduced Scotties facial tissues label, and any two of the four US tissue mills. The latter requirement was placed because it was thought that the fixed costs of entry were high due to the need for significant investment in plant equipment and in the building and

positioning of an equivalent competitive brand. This was a concern because the plaintiffs reasoned that the merger would result in either the complete removal of the competitive brand "Scotts", or the level of cooperation (in prices) would effectively render the Kleenex and Scotts/Scotties brands as one competitor. The requirement that Kimberly-Clark divest the Scotties brand stemmed from a fear that competitive constraints in the facial tissues category would be lowered to such an extent that significant unilateral price increases may result, and the Kimberly-Clark-Scotts company would effectively be faced with a single competitor: Proctor & Gamble with their Puffs brand.

More specifically the final judgment required that, in the facial tissues category, Kimberly-Clark must, within 180 days, divest two of four specified Scotts tissue mills plants, and grant a "…25-year, royalty free, exclusive and assignable, perpetually renewable license for the Scotties facial tissues label" (p7). In June 4, 1996, the papermaker Irving Tissue, Inc., based in Saint John, NB acquired the U.S. marketing rights to the Scotties brand of facial tissues in the USA, and one tissue mill located near Albany, NY , subject to Department of Justice approval.

Methodology for estimation of supply and demand

Over the observation period encompassing the merger event, the facial tissues category was dominated by three major brands, with about 90% of the category's sales combined, across all cities in the USA. Post-merger, this share of the category did not change much. The three brands, Kleenex by Kimberly-Clark; Scotts/Scotties previously owned by Scotts and now licensed by Irving Tissue; and Puffs (P&G) remained in the market. However, the relative shares and deflated prices of the three brands changed considerably (see Table 3).

Estimation of Demand

We adopt a flexible functional form demand system based on a two-stage budget allocation process by consumers. In the first stage (often referred to as the "top-level" of demand), consumers make decisions on how much to spend on facial tissues. At the second level, consumers choose the brand, given the menu of prices and other brand-specific marketing mix instruments (e.g. merchandising activities or advertising). For details of this expenditure-based demand system the reader is referred to Deaton and Muellbauer (1980a, or 1980b, pp73-78). In the mergers context, this expenditure system is also detailed in Hausman and Leonard (1997), see also Cotterill and Putsis (2001). For demand, this functional form is flexible in that it does not constrain cross-substitution effects, and also allows for non-homothetic behavior.

Primary demand is specified in the log of total expenditures on the product category (in our case, facial tissues). For each time period *t*, and city *i* in region *r*, we model the log of total expenditure on facial tissues ($\log E_{it}$) as a function of log income and an log of overall price index as follows:

$$\log E_{it} = \mu_i + \lambda \log Y_{it} + \delta \log P_{it} + \xi_{it} \qquad (1)$$

where μ_i is a fixed effect for the geographic city *i,* Y_{it} is the income level of city *i*, and P_{it} is the city level price index, as measured by Stone's Index, which is an index of weighted average prices:

$$\log P_{it} = \sum_{j=1}^{J} \omega_{ji} \log p_{jit} \qquad (2)$$

where the weight for brand j, ω_{ji} , is the average expenditure share (across all weeks) of that brand, and p_{jit} is the price per volume for brand *j*, city *i*, week *t*. Finally, ξ_{it} is a city/week-specific random disturbance term, representing unobservable and non-systematic city and time specific demand shocks.

The second level of demand (given total expenditure E_{it}) is a market share value, where the share here is expenditure share, for j=1,…,J brands:

$$s_{ijt} = \alpha_{rj} + \varphi_j \log \frac{E_{it}}{P_{it}} + \sum_{k=1}^{J} \beta_{jk} \log p_{kit} + d_{kit}\Gamma_{jk} + \varepsilon_{ijt} \quad (3)$$

In (3), the parameter α_{rj} is a region *r* (a city is located in a region, such as the "South"), brand *j* time-invariant fixed effect, to take into account idiosyncratic differences in demographics and consumer preferences across cities and brands. The linear component $d_{kit}\Gamma_{jk}$ represents demand-shifters, including (in our case) merchandising activities (display, feature). The component $\varphi_j \log \frac{E_{it}}{P_{it}}$ is a link to the primary demand and allows for non-homothetic behavior in the expenditure shares, due to a change in the income levels of the customers, through E_{it}. The disturbance term, ε_{jit} accounts for random demand shocks relevant to market share for each brand.

Estimation of Supply and Competitive Conduct

We model the supply side using the conjectural variations approach (herein CV). We utilize this approach because the primary goal of this study generate a broad comparison between pre- and post-merger market behavior, and the conjectural variations approach is considered to be a reduced form way of capturing dynamic behavior using a static specification (see e.g. Schmalensee 1989, Farrell and Shapiro 1990, Cabral 1995). In other words, we are not interested in testing alternative hypotheses about the dynamics of the competitive behavior in either pre or post-merger regimes. For the CV approach, we first need a quantity demand equation:

$$q_{jit} = \frac{s_{jit}E_{it}}{p_{jit}}. \quad (4)$$

The profit function for manufacturer (brand) j is assumed to be:

$$\Pi_{jit} = (p_{jit} - c_{jit})q_{jit}. \quad (5)$$

where c_{jit} is the average cost for brand *j*, in city *i* and week *t*. From here, we generate the first order conditions for each brand:

$$\frac{\partial \Pi}{\partial p_{jit}} = 0 \tag{6}$$

Following the CV approach, the conduct parameters are θ_{jk}, representing the partial derivative, $\frac{\partial p_j}{\partial p_k}$. In trying to understand how competitive behavior changed after the merger event, our primary interest involves the interpretation of these parameters.

In marketing, the usual approach to the estimation of the supply side requires the consideration of the behavior and influence of channel members (e.g. retailers) in setting prices (e.g. Kadiyali, Chintagunta, Vilcassim 2000, Sudhir 2001b). However, these approaches are typically used at a more local level, or when data for specific retailers are available. Approaches used by Nevo (2001) and Sudhir (2001a) however, involve the estimation of market demand and supply aggregated across a number of retailers, and they do not model the behavior of channel members. We follow the latter approach for two reasons. First, we have available data aggregated across retailers (within a distribution type, such as grocery/food outlets). Second, the retailer-manufacturer interactions may exhibit many different patterns across different retailers, (e.g. vertical Stackelberg-Nash, vertical Bertrand-Nash), so if we were to try to model these interactions, we end up with estimates that represent only a mix of this behavior, providing little in the way of substantive insight.

Costs are a very important component for the study of the supply side post-merger. The bulk of the arguments used by the DOJ and the defending merging companies, centers around the net outcome on prices of the cost efficiencies, and thereby reduced prices, realized due to the combined operations of two firms' production capacities, versus the opposing impact of rising prices arising from reduced competitive constraint of competing with one (or more less) competitors in the industry. Therefore, in our view, it is unsatisfactory to estimate the supply side and the CV parameters, using an approach not calibrated with a cost function.

Our cost function, as discussed earlier (see(10)), consists of basic factors of production, parameterized for each brand. We attempt to estimate a fairly comprehensive cost function. First is the cost of production of the fluff pulp, as measured in the spot market. Second is the cost of labor. For this we sourced the labor cost from the Bureau of Labor Statistics. The third is a factor accounting for city-specific travel costs. To get an accurate measure of transportation costs, we measure the total distance for the facial tissues to travel from the nearest tissue mill, to the focal city. This distance is measured as the "shortest" distance using Mapquest™. We therefore assume that all competitors and cities use identical modes of transportation to ship the product to the city. Although two of the mills had to be divested, as a requirement from the DOJ, this event did not occur until the end of 1996. Our observation series post-merger is focused only on the year following the merger announcement, so we did not alter these distances to allow for this event.

Appendix A gives full details of the derivation of the supply-side equations. We include in the system of equations the following J first-order conditions:

$$\left(\frac{\partial s_{jit}}{\partial p_{jit}} (p_{jit} - c_{jit}) + \frac{s_{jit} c_{jit}}{p_{jit}} \right) = 0, \text{ where}$$

$$\frac{\partial s_{jit}}{\partial p_{jit}} = \frac{-\varphi_j \frac{\partial P_{it}}{\partial p_{jit}}}{P_{it}} + \frac{\beta_{jj}}{p_{jit}} + \sum_{\substack{k=1 \\ k \neq j}}^{J} \frac{\beta_{jk}}{p_{kit}} \frac{\partial p_{kit}}{\partial p_{jit}} \tag{7}$$

So in summary, the full system of equations to be estimated include (1)-(3) and (7). There are J demand equations, J first order condition equations (assuming that firms only choose prices to maximize profits, or at least this is separable from merchandising), and one primary demand equation. This system of equations involves a mixture of log-linear, and non-linear equations and therefore must be estimated using an appropriate estimation procedure. In line with recent research (e.g. Nevo, 2001), and because of its asymptotic consistency properties, we use Generalized Method of Moments estimation. See Hamilton (1994) for full details of this estimation procedure. The GMM procedure involves minimizing an objective function, or a function of the moment conditions. The GMM objective function also requires a set of instruments to accommodate the

endogeneity among prices and the utilities of individual items (see Chintagunta 2001). We exploit the panel nature of the data, and use city-specific fixed intercepts, exogenous costs, and the (assumed exogenous) merchandising activities as instruments.

An alternative approach often used by NEIO researchers is the Full Information Maximum Likelihood method (FIML, Amemiya 1977). The method of GMM is a more natural choice for the general form non-linear equations which comprise the first order conditions, and the computational time for FIML is greater than that of the GMM models. This latter advantage of GMM is important when estimating the system over time.

Recent research suggest, especially with more disaggregate data, that the endogeneity among prices and brands' utilities, may be overshadowed by heterogeneity (e.g. Yang, Chen and Allenby 2003). In our study, the data are aggregated to the metropolitan city level, and thereby represents the aggregate behavior of the consumers in this market. The approach used by Nevo (2001) exploits demographic data to accommodate consumer heterogeneity in price response parameters. In our study, we use city-level fixed effects to partially account for across market customer heterogeneity.

Available Data

This section discusses the data available for analysis. We have available data for 260 weeks, or 5 years of weekly data (spanning 08/30/1992 to 08/17/1997) for the Facial Tissues category. For the pre-merger analysis, we delete any observations prior to the entry of Al Dunlap as the CEO of Scott Paper Products, or 14th April 1994. We do this for two related reasons. The first reason is that we want to measure an average (across weeks) of demand and supply behavior pre-merger, across a relatively stable time period. The second reason for studying this time frame is that we want to isolate the effect of the merger in isolation of other major events that may have transpired (i.e. the leadership change event). We also deleted observations after January 1997, because of the lack of availability of some supply side data (e.g. costs on pulp prices). This data filtering gives

us approximately the same number of data points (67 weeks before the merger announcement and 73 after).

Our database consists of the standard metrics of price, volume and basic stub file information (brand/sub-brand, UPC, package size, selected attribute information, parent company). We also have data on the volume sold on feature and display, weighted average of price reductions, the average number of items per store. Although we have data at individual sub-brand level (even the item level), for the purpose of this study we aggregate across these sub-brands within the facial tissues category. See Table 2 for the details of these brands, and their sub-brands.

Table 2 about here.

There are three types of outlets: food, mass merchandising and drug. We use the data for the "food" distribution outlets only, because it is the only outlet type for which we have data available at the city-UPC level. These data are aggregated at the weekly level across an entire IRI Infoscan market. For example, for Kleenex 175ct box of facial tissues, we know how much was sold for a given week in food outlets (e.g. week ending September 17, 1995) for Los Angeles[2]. Table 3 presents the descriptive statistics for shares, prices, assortments and merchandising activities for the two time periods studied.

Table 3 about here.

We also augment these data with other data from a variety of sources. See Table 4 for details. Income and population, measured at the city level, are sourced from US Government sources. We deflate any measurements involving monetary units (e.g. prices, costs) using the Consumer Price Index (CPI). Labor costs are measured on a

[2] For the outlet level data on drug and mass merchandising, the data are only available aggregated (by UPC) to the country level.

monthly basis, as average US dollars per hour. Fluff pulp prices are measured as spot-market prices, again measured on a monthly basis. The final cost factor we try to measure is the transportation cost; that is, the cost of transporting the facial tissues to each city which is measured in the following way. First, we find out the location of the nearest mill to each city, for each brand. Then we calculate the distance from the mill to each city using the Mapquest™ direction finder service. We assume that each city will transport the facial tissues from the nearest mill, and that the measure of the distance by road is a good proxy for the actual distance traveled (e.g. if the facial tissues are transported by rail, this measure should still be highly correlated, across cities, with the road distance).

Table 4 about here.

Pre-merger analysis

Using data available pre-merger, we estimate the expenditure system described in (1) to (3) and (7). The data used to estimate this system consists of measures of brands' category share, log of price, and percent of volume sold on display and feature. Price (per volume) is measured (for each brand) by aggregating across all UPCs contained within that brand, across each week, each outlet/store type and across the entire city. Display and feature intensity measures are defined as the percentage of volume sold with a corresponding display or feature promotion. The market share is the total expenditure share of the category that the brand enjoyed for that week, in a given city, aggregated across the items under that brand. For the pre-merger estimation, 3,082 observations were available, which is 67 weeks times 46 Infoscan markets (some cities were dropped due to unavailable information).

The model diagnostics and fit statistics are reported separately in Table 6. For this pre-merger study, we find that the explanatory variables are able to explain from 70% to 73% of the total variation in market shares equations. There is evidence of a strong fit for the

primary demand equation for facial tissues, with adjusted $\overline{R}^2$ of around 94%. This is likely to be due to the presence of the 45 city-level fixed effects, which can absorb considerable amounts of variation due to idiosyncratic unobserved city-specific characteristics (e.g. population, density, climate).

Table 5 and Table 6 about here.

Table 5 presents estimation results for pre-merger demand and supply. The top panel presents the demand parameter estimates, both the primary demand and expenditure share models, while the bottom panel presents the estimation results for the supply parameters. Overall, there exists strong face validity in the estimates presented, with positive responses to promotions, and negative responses to own-price changes, and mostly positive reactions to changes in prices of competitors. Any figures presented in italics are not significant at the 95% confidence level. Only three of the 51 demand estimates are not statistically significant at this criterion. Two of the 45 city-specific parameters in the top-level demand equation are not statistically significantly different from zero.

Table 7 about here.

We now examine the effects of pricing and merchandising activities on the expenditure shares of each of the brands. Our flexible specification of demand allows for asymmetries in the cross-effects of these instruments, in contrast to an aggregate logit specification. Indeed, in accordance with our flexible functional form used to estimate demand, we do observe considerable asymmetries present in the cross-price and the cross-feature/display elasticities. To enable a comparison across brands with different price/share ratios, we report price elasticities in Table 7, illustrated in Figure 1. These own- and cross price elasticities are quantity sales elasticities, and are calculated based on both levels of demand. The formula for this is (see Hausman and Leonard, 2002):

$$\eta_{jk} = \frac{1}{s_i}\left[\beta_{jk} - \varphi_j \omega_j\right] - 1[j = k] + \left(1 + \frac{\varphi_j}{s_i}\right)(1+\delta)\,\omega_j \qquad (8)$$

where the variables are as described in equations (1)-(3). We use point elasticities here, so the observed variables in (8) are measured at their average pre-merger levels. The Kleenex own-price elasticity is around –1.4, compared with the Puffs own-price elasticity of –2.0. From the cross-elasticities, the price changes of Puffs appear to have a slightly weaker impact on Kleenex share than the price changes of Kleenex have on Puffs' market share. This asymmetry is considerably more pronounced for the Scotts-Puffs brand pair, with the asymmetry strongly in favor of Puffs. The cross-price elasticities among the Scotts and Kleenex brands, in both directions, are negative, suggesting some level of complementarity among these brands rather than cross-brand substitution.

Table 8 about here.

Elasticities are also reported for the merchandising activities. These point elasticities are based on the average values of each of the measures of the merchandising activities, as presented in Table 3, and the estimated parameters as reported in Table 5. The elasticity here is simpler, since we are only reporting the share-based elasticities. That is they are not the quantity-based elasticities we report for prices. We wanted to be able to compare the merchandising elasticities across different types of merchandising activities, not between prices and merchandising activities. So the calculation for each elasticity is the percentage change in expenditure share of brand *j* given a percentage change in each of the merchandising activities of brand *k* (f=feature, d=display, fd=feature and display, any variable $\overline{x}$ is the arithmetic mean of *x*):

$$\eta_{j,k}^{\{f,d,fd\}} = \frac{\partial s_j}{\partial\{f,d,fd\}_k}\frac{\{\overline{f},\overline{d},\overline{fd}\}_k}{\overline{s}_j} \qquad (9)$$

All the own-merchandise elasticities are positive, and most of the off-diagonals of these merchandise based substitution matrices are negative. The own-display elasticities across the three brands are not very different, generally ranging from 0.02-0.03. Kleenex

displays tend to draw much more share from the Scotts brand than from the Puffs brand, although this may be due to the higher relative market share of the Kleenex brand to either of these brands. The Puffs displays tend to draw more percentage share from the Kleenex brand than the Scotts brand. Features tend to be strongest in lifting shares for Scotts, than for Kleenex or for Puffs brands. Again this may be because of the lower shares. This pattern also is true for the combination of feature and display. It is interesting to note that the combination of feature and display does not tend to have as much impact on share as the display or feature by themselves, for the two major brands. It appears, however, that the Scotts feature and display activity combined are more effective.

Next we turn to the results of the estimation of the supply side of this system. Recall that we measure competition using the Conjectural Variations parameters, hereafter the CV parameters. The estimated CV parameters are reported for the pre-merger facial tissues market in the lower panel of Table 5. For illustrative purposes, we report these CV parameters in Figure 2. All of the CV parameters show statistical significance, and possess strong face validity. These parameters should be in the range of [0,1], but may sometimes be either negative or above one (see Kadiyali, Sudhir and Rao, 2001). If, among all three competitors, the CV parameters are 1/J (in our case 1/3), then we have evidence of a Cournot-Nash competitive equilibrium. If the CV parameters equal zero, then we have evidence consistent with a Bertrand-Nash competitive equilibrium. Another common equilibrium is the Stackelberg "leader-follower" Nash competitive equilibrium. In that case, the leader has a CV parameter equal to zero, while the followers have CV parameters not equal to zero. Finally, if all the CV parameters are equal to one, then the behavior in this market is consistent with a collusive equilibrium.

We are particularly interested in the interactions, pre-merger, between Kimberly Clark and Procter & Gamble. This we hold as a benchmark for comparison with what happens after the merger (see later sections and discussion). Pre-merger, we find that $\theta_{13} = 0.50$, and $\theta_{31} = 0.10$. This suggests that the two competitors, on average over the pre-merger

period, were engaged in a mild form of the Stackelberg leadership competitive game, with P&G the price leader and KC the follower. This is interesting because, based on market share; Kimberly Clark is the larger competitor. For the Scotts and Kimberly-Clark brands, it appears that they are engaged in fairly strong price competition with both conduct parameters close to zero ($\theta_{12} = -0.1, \theta_{32} = -0.0$), more consistent with Bertrand-Nash competition. For the Scotts-Puffs brands, our results again suggest that the firms are engaged in a Stackelberg-Nash price leadership game, with Puffs the price leader $\theta_{23} = 0.7$, and Scotts the follower ($\theta_{32} = 0.09$).

What happened post-merger?

In this section, we first estimate the direct impact of the merger on the prices, displays, and feature advertising activities, and breadth of assortment of the various facial tissues brands. We then estimate the same demand and supply system as in the pre-merger analysis and compare the various parameters with the study of the pre-merger system. We follow this section with a discussion of our findings and a set of questions that emerge from our empirical results.

The effect of the merger on prices, merchandising and assortment

In Table 3 we listed the descriptive statistics for both the before and after merger markets, for prices of all three brands, and for each of the mechanizing activities. The direct test of the pricing, however, should control for possible cost-side changes in prices. We therefore adopt an approach suggested by Hausman and Leonard (2002) to directly test the changes on prices and merchandizing using a simple general linear model.

Our model to test the impact of the event on prices controls for account possible city-specific and for cost-side factors that may account for the changes in the various metrics studied. Formally, the model specification, for brand j, sold in city i, during week t is:

$$\ln p_{jit} = \alpha_j + \delta_{p_j} I_{m(t)} + f(c_{jit}) + \nu_{jit} \quad \forall j \tag{10}$$

where p_{jit} is the price per unit volume (ounces) and α_i is a city specific fixed effect. The variable $I_{m(t)}$ is a indicator variable for the merger event, occurring at time *m(t)*. The parameters (to be estimated) δ_{p_j} represent the impact of the merger event directly on log prices. In other words, the δ_{p_j} parameter represents the price changes in the market where the merger occurred versus where the merger did not exist. $f(c_{jit})$ is a city level cost component for brand *j*, and ν_{jit} is a random disturbance. The cost function here is specified as:

$$f(c_{jit}) = \alpha_{ji}^{\text{distance}} \log(\text{milldistance}_{ij}) + \alpha_{j}^{\text{fluffpulp}} \log(\text{fluffpulp}_{t}) + \alpha_{j}^{\text{labor}} \log(\text{labor}_{t})$$

where the milldistance_{ij} cost component is the distance from city *i* to the nearest mill producing brand *j* facial tissues, as measured by Mapquest (for details see the data section). The component fluffpulp_{t} is a measurement of the cost of the raw material of the facial tissue, and labor is an index representing labor costs over time in the USA. This cost function is consistent with a Cobb-Douglas production function (for details see e.g. Berck and Sydsaeter, 1993). The random disturbance component, $\nu_{jit} \sim N(0, \sigma_{j}^{2})$, represents the unobserved brand, city and time component not explained by the covariates in the regression.

We are also interested in how various merchandising activities change. The IRI measure for merchandising is summarized by three key variables. The first is percent display which measures how much of the quantity volume was sold with a coinciding display for that UPC, but no feature advertisement. This is measured as a percent of total volume sold. The second and third measures are feature only, and percent "feature and display only". It is important to note that all these merchandising activities may or may not be accompanied by a price discounting activities. We use a similar model as (10) to understand how these merchandising activities changed for each brand:

$$\left.\begin{array}{c} display_{jit} \\ feature_{jit} \\ feature \,\&\, display_{jit} \end{array}\right\} = \alpha_{ji}^{\{d,f,fd\}} + I_{m(t)}\delta_{\{d,f,fd\}} + \nu_{jit}^{\{d,f,fd\}} \qquad (11)$$

where $\alpha_{ji}^{\{d,f,fd\}}$ is a brand-city specific intercept for each of the feature, display and feature-display activities, and $\delta_{\{d,f,fd\}}$ is a similar merger-related response parameter as discussed above. Finally, we also test the impact of the merger on assortments in the same way. In the interest of brevity we do not provide the specification – see (11). The dependent variable used to measure each brand's "assortment" is the number of distinct Stock Keeping Units (SKUs) on the shelf, per week, per city.

Table 9 about here.

We used OLS to estimate the parameters in (10) and (11). We present the results of this analysis in Table 9. Overall, while the model fit is not great across the models, suggesting that there is a considerable amount of variation not accounted for by the factors we used for costs and due to the merger event, most of the parameter estimates are statistically significant. One explanation for the low fit statistics of these models is that we are using weekly data for the prices, but much of the variation in the cost variables is measured on a monthly basis. Moreover, except for the measures of the transport costs, the costs are measured on a national basis, and do not take into account possible regional or city-level variations. After controlling for possible cost effects, the coefficients for all the price δ s were positive and statistically significantly different from zero, indicating that, after the merger of Kimberly-Clark and Scott Paper Products, the prices per volume across all brands in the facial tissues increased. The price increases varied in magnitude from 8.5% for the Scotts brands, to just over 13.1% for the Kleenex brand.

The parameter estimates for the merchandising activities are also presented in the second panel of Table 9. We only report here the estimates of the δ parameters; there is no need to translate these into percentages since the dependent variable is a percentage value. The way to read these numbers is therefore the number of percentage points by which each parameter changed post-merger. For display, we see that none of the changes in Kleenex's merchandising activity were statistically significantly different form zero, although there is some suggestion that feature activity increased and the combination of feature and displays decreased. For Puffs, the major competitor to Kleenex, features increased significantly (by 0.34 points on average) and there is no significant impact on display activity. Finally, for the Scotts brand, the post-merger merchandising activities were characterized by a clear drop in both display (-0.09) and feature activity (-0.33). The bottom panel of Table 9 presents the changes in the assortment, as measured by the change in the number of distinct SKUs available in each city, per week. Here we see significant changes post-merger, with some mixed results across brands. We see that the

Kleenex brand assortment increased slightly, by around 4%, the Puffs assortment dropped by around 4%, and the Scotts assortment dropped by 20%.

To summarize our findings of the direct impact on price and merchandising activities, we find that after KC acquired the Scott Paper Products company, prices increased significantly for all the brands, even after we control for costs. There were some mixed results on how merchandising activities changed, however. The results do suggest some evidence of an increase in the use of feature advertising, particularly by the P&G Puffs brand, but the Scotts brand of facial tissues saw a significant reduction in such feature activity. Fewer changes were seen in the level of display activity, and these tended to be of a smaller magnitude. Finally, the results suggest that the net impact on the product mix was small, but significant, with both of the smaller brands seeing a reduced assortment, and the leading brand of facial tissues, Kleenex, enjoying a broader assortment.

Estimation of post-merger demand and supply

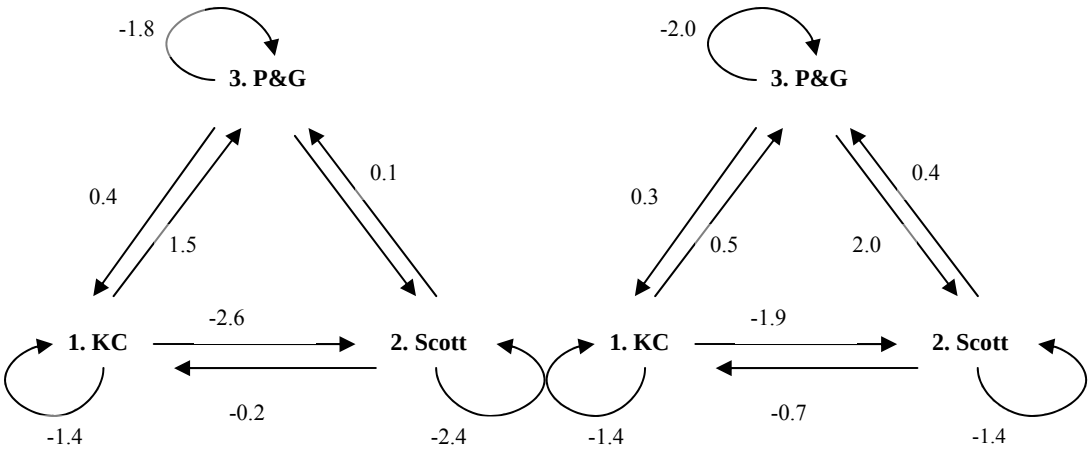
The post-merger study uses the same system of equations and database as with the pre-merger study. The event study only takes into account the merger event. We studied other potential changes in this market that may have affected demand or supply, but found none that would have taken any impact until after 1997.

For the results of the estimation of the demand and supply system post-merger, see Table 10. Again, the top panel presents the demand parameters, and the bottom panel present the supply parameters. The data used included the same 46 Infoscan markets as pre-merger, but now we used 73 weeks post-merger (73x46 markets = 3,358 observations). Beyond the 79 weeks, we see considerably more missing data, notably for the Scotts brand (this is perhaps due to the divestment requirements of the Scotts brands and it consequent success in the market). From Table 6, we see that the fit of the demand and supply equations was quite comparable between the two studies, with adjusted $\bar{R}^2$ for the expenditure share equations at around 70% and the top level demand around 90%.

Table 10 about here.

Own price and cross-price elasticities for the post-merger facial tissues brands are reported in the lower section of Table 7, again illustrated in the right hand panels of Figure 1. For the merchandising elasticities, see Table 8. The notable changes are that the own-price sensitivity for the Kleenex brand and the Puffs brands dropped, whereas that for the Scotts brand increased substantially (from -1.4 to –-2.4). Recall that this increase in price sensitivity is accompanied also by a large drop in Scotts' market share across cities. The price-based substitution across the Puffs brand and Scotts brand also altered dramatically, in favor of the Puffs brand. That is, the price discounts of Puffs now can draw substantially more share from Scotts, than the price change in Scotts can draw from Puffs' share. For the Kleenex-Scotts cross-price substitution, the pattern is similar as prior to the merger, with a slight advantage in the asymmetry toward Scott. For the merchandising activities, it appears on the whole that the own-merchandising effects were lower in the post-merger market than in the pre-merger market, with the possible exceptions of Scotts and Puffs feature/display promotions combined.

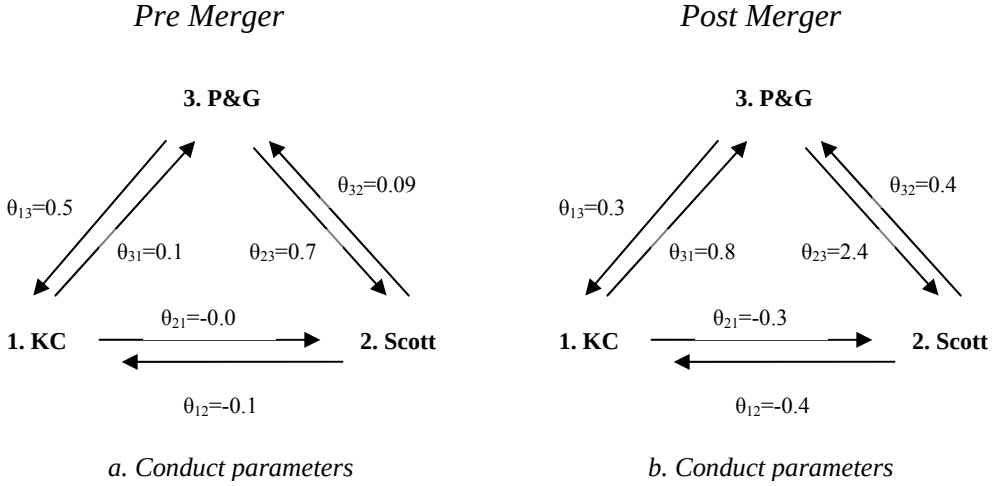
Figure 1. Pre and post merger market estimated price elasticities. KC = Kimberly-Clark's Kleenex brand; Scott = Scott Paper Products Scotts brands; P&G = Procter & Gamble's Puffs brands. To interpret the charts, follow the arrows from the source firm (brand) to the target, the number adjacent to the arrow represents the percentage change in quantity sold of the target firm (brand) given a percentage change in retail price of the source.



We are particularly interested in how the merger affected competitive relations between KC and P&G. Again, refer to Figure 2 for a visual representation of these conduct parameters. The CV parameters in this post-merger market do indicate that some changes occurred after the merger date. First, between the Kleenex and Puffs brands, recall from Table 3 that the share of the Kleeenex brand rose by about 3 percentage points, with Puffs staying at around the same level. However, now we see the price movements of Puffs affecting prices of Kleenex much less, resulting in the conduct parameter ($\theta_{13} = 0.3$) dropping as compared with pre-merger. However, the Kleenex price changes now have a much stronger impact on the Puffs brand with $\theta_{31} \approx 0.8$. It suggests a fairly strong movement toward Kimberly Clark, the owner of Kleenex, adopting a price-leader role, with P&G now the follower, although both competitors still show some level of collusion within this category. It is difficult in this context to read the role of the Scotts brand in this competitive market. Now the Kleenex brand seems to be negatively correlated with the price movements of Scotts ($\theta_{12} = -0.37$), and the Scotts brand pricing movements are similarly negatively correlated with KC pricing

($\theta_{21} = -0.3$). The position of Scotts toward P&G seems comparable as before the merger, except now the leadership behavior by P&G is much more prominent, with $\theta_{23} = 2.4$ versus $\theta_{32} \approx 0.4$. The more positive P&G CV parameter suggests that P&G now also reacts more towards the Scotts brand price changes than pre-merger.

Figure 2. Pre and post merger market estimated conduct parameters. KC = Kimberly-Clark's Kleenex brand; Scott = Scott Paper Products Scotts brands; P&G = Procter & Gamble's Puffs brands. To read the graphs, follow the arrows from the source firm (brand) to the target. The number adjacent to the arrow represents how the price of the target changes in response to a change in price of the source.



a. Conduct parameters *b. Conduct parameters*

Time varying market behavior

One may be concerned with the time varying behavior of the competitive conduct among the three firms in the oligopoly. This is of particular concern with the time series preceding the merger, because a) this is our benchmark for comparison with the post-merger regime; and b) because this spans a period of almost three years. There were considerable changes, in particular, in the ownership and strategic management of Scott Paper Products. The hiring of Al Dunlap as CEO in April 19, 1994 was accompanied by severe cost-reduction exercise spanning April 1994 to July of 1995 (the date of the merger announcement). Some of the relevant cuts included firing over 11,000

employees, whom included 20% of the hourly workers, a nearly 50% reduction in management, and 71% of the headquarters staff (*Business Week*, January 15, 1996).

It is instructive, therefore, to consider how these CV parameters may be evolving over time. To measure this, we adopt the following approach to understand how these changes impacted competitive conduct. In this analysis we focus on the time-varying changes seen in the competitive conduct between KC and Scott, and between P&G and Scott. Since the event study used in this approach does not necessarily account for just behavior due to the event, and may be correlated with other regime changes surrounding the event window, our goal here is to study how the CV parameters changed on a week by week basis. To do this, we estimate the same system of equations as earlier. We estimate the competitive conduct over a "window" of time. This window is N periods long. Since we have 46 cities, this means that we utilize 46*N observations of data. We begin by estimating this system starting from week t_τ, $\tau = \{1,...,\mathrm{T}-N\}$ and estimate the GMM objective function over $t_\tau + N$ periods. For the *T-N* estimations, the CV parameters are stacked into a matrix $\Theta = \{\bar{\theta}_{12}, \bar{\theta}_{13}, \bar{\theta}_{21}, \bar{\theta}_{23}, \bar{\theta}_{31}, \bar{\theta}_{13}\}$ where $\bar{\theta}_{ij} = \left[\theta_{ij1}, \theta_{ij2}, ..., \theta_{ij\{T-N\}}\right]'$ is the $(T-N)\times 1$ vector for the ij th conduct parameter estimates. This approach allows us to study gradual adjustments in the competitive conduct, using a "lens" of width N. The changes in competitive conduct can then be studied by overlaying a time series of events that occurred over the observation period.

Figure 3 about here.

It is important to note that the estimated conduct parameters are linear approximations to competitive behavior, based on N weeks of data. An important issue in this approach is the size of N. To provide sufficient degrees of freedom for estimation, we use a window of N=26 weeks (equivalent to two quarters). For each week that we run this estimation procedure, we estimate the CV parameters over this window. We then plot these CV

parameters in Figure 3. Note that we are not able to estimate any CV parameters with this time window after week (229-N), since this is the last "window" of the time series. Figure 3 has three panels, depicting the pair wise competitive behavior for the competitors. The top panel represents the competitive behavior of KC's Kleenex versus P&G's Puffs brands. The middle panel is for the competitive interaction between KC and Scott and the bottom panel is the competitive interaction between P&G and Scott. The three lines on each graph in Figure 3 depict various events. The first line is the hiring of Al Dunlap as CEO of Scott Paper Products (4/19/1994). The second line corresponds to the merger announcement (7/17/03) and the third line corresponds to when the merger was both approved by the shareholders and the consent decree was issued by the DOJ (December 1995). We make several interesting points about these chronological CV movements, relevant to our event study. The first is that the time series of the CV parameters parallels our major finding for competitive interactions among the three competitors. KC and P&G "swapped" pricing leadership roles after the merger event. We note that for the entire series since the beginning of 1994, KC had the leadership role (recall θ_{ij} is $\partial p_i / \partial p_j$, the derivative of price of *i* with respect to *j*'s price change). Therefore, the darker line (initially the bottom line) in the first panel represents how P&G reacts to the KC's price changes. After the merger event the CV parameter for P&G is higher than KC, and therefore KC now takes the price leadership role. The second point about this time series is the relative stability of the CV parameters prior to the merger. This adds validity to our choice of our "event window", particularly the pre-event observation series. If the pre-merger event window displayed CV variations that are too noisy, then it would be difficult to infer anything from the merger event itself. The exception to this point is what happened just around the time Al Dunlap was hired. Third, several interesting patterns emerge when comparing the estimated time-varying CV parameters across the three panels. After around November 1994, the way both P&G and KC tended to ignore (i.e. their CV parameters are both close to zero) the Scotts price movements. Scotts, on the other hand tended to react strongly to any of P&G's price changes, with an almost text-book case of Stackelberg competition evident over the first 6-9 months of 1995. The competition between KC and Scott, on the other hand was a textbook case of Bertrand-Nash competition (both CV parameters are zero).

Simultaneously, the two market share leaders were engaged in more coordinated behavior, but P&G was the clear price leader against KC over this time frame.

Summary and concluding remarks

We find that the Kimberly-Clark merger with Scotts Paper Products led to significant changes in market behavior, both on the supply and demand side. Our findings suggest that average prices for all facial tissues brands increase considerably after the merger. After controlling for cost-side impacts, the price increases were in the range of 9% to 13%. The merger also had a significant impact on merchandising activities of the three brands in this category, and a small and mixed impact on the breadth of products offered under each brand. We estimated a model of both supply and demand pre-merger, and compared that with post-merger behavior. We find that the substitution patterns in the facial tissues category changed considerably, especially for the fringe brand, "Scotts". More importantly, we find that competition post-merger changed in favor of KC, despite DOJs efforts to mitigate this effect. In terms of competition, our results suggest that competitive conduct does appear to be fairly strongly affected by the merger event. For example, P&G's appeared to react more towards KC's price changes after the merger, than before the merger. Indeed, our results suggest that the pricing leadership role of the two brands swapped around (from P&G as price leader to KC as price leader) after the merger. In other words, our results suggest that the P&G price leadership role was significantly challenged by the Kimberly-Clark merger with Scott Paper Products, at least in the facial tissues category.

In addition to the substantive empirical findings presented here, our study utilized the linear approximate "Almost Ideal Demand System" approach. This approach presents several modeling advantages. First, the flexibility of this model means we are able to approximate any underlying demand system. Second, the demand system can be used to infer very flexible cross-competitive effects of price changes (and merchandising activities) across competing brands. Third, in our GMM objective function, we couple

the standard AIDS demand system with a set of first-order conditions to help us infer competitive behavior, simultaneously with the demand behavior.

Some remaining methodological issues also exist within our study. For example, we do not consider dynamic or carryover effects on the share of each brand (e.g. Saloner's (1987) predation effect). We also aggregate across a number of possible structures in the differentiated goods market, (e.g. package sizes). We also do not adopt a random-coefficients model often used in the estimation of customer heterogeneity in the response parameters. Our study finds significant changes in market behavior post-merger. Other than the direct impact of the merger, many reasons could account for these changes. This study does not attempt to address these issues, but serves the purpose of providing a description of what actually happened after the merger. Overall, we believe that our study is a useful first attempt at examining how brand ownership changes resulting from a horizontal merger can impact competitive conduct as well as substitution patterns. While these changes are often conjectured, anticipated, or feared, we have attempted to clearly estimate these from data, something we hope will be seen as useful by researchers and practitioners.

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Appendix

Derivation of the CV parameters for the expenditure system

Demand, as described by market share, is:

$$s_{ijt} = \alpha_{rj} + \varphi_j \log \frac{E_{it}}{P_{it}} + \sum_{k=1}^{J} \beta_{jk} \log p_{kit} + d_{kit}\Gamma_{jk} + \varepsilon_{ijt} \tag{12}$$

with profits for manufacturer (brand) *j*:

$$\Pi_{jit} = \frac{s_{jit} E_{it}}{p_{jit}} (p_{jit} - c_{jit})$$

The second step is a result of assuming that the price change of an individual brand has a negligible impact on the primary demand. Note, however, that we do not make the assumption that the price index for the expenditure share equation is constant in prices of the individual brand. Note that an important component of this is the derivative of the expenditure share with respect to prices:

$$\frac{\partial s_{ijt}}{\partial p_{ijt}} = \left[\frac{-\varphi_j \dfrac{\partial P_{it}}{\partial p_{jit}}}{P_{it}} + \frac{\beta_{jj}}{p_{jit}} + \sum_{\substack{k=1 \\ k \neq j}}^{J} \frac{\beta_{jk}}{p_{kit}} \frac{\partial p_{kit}}{\partial p_{jit}} \right], \quad \forall j \in J \tag{13}$$

Let $\theta_{ij} = \dfrac{\partial p_i}{\partial p_j}$, *this is the conduct parameter and measures how much the price of brand i will change given a change in the price of brand j.* (14)

The first order condition is obtained by differentiating the profit functions with respect to the price of brand j. For just brand *j*, and losing the time and city subscripts this is:

$$\frac{\partial \Pi_j}{\partial p_j} = E\left(\frac{\partial s_j}{\partial p_j} \frac{p_j - c_j}{p_j} + \frac{s_j c_j}{p_j^2} \right) = 0$$

$$\Rightarrow \left(\frac{\partial s_j}{\partial p_j} (p_j - c_j) + \frac{s_j c_j}{p_j} \right) = 0$$

where $\dfrac{\partial s_1}{\partial p_1}$ is as given in the terms in square brackets in (13). Note that in our GMM estimation, the non-linear first order condition is used as a moment condition. Market shares are observed. The cost function is estimated simultaneously within this model. We assume a log-linear cost function as follows:

$$f(c_{jit}) = \alpha_j + \alpha_j^{\text{distance}} \log(\text{milldistance}_{ij}) + \alpha_j^{\text{fluffpulp}} \log(\text{fluffpulp}_t) + \alpha_j^{\text{labor}} \log(\text{labor}_t)$$

Table 1. Timeline of events for the KCS merger. *Source*: Standard & Poor's Daily News and Business Wire from July 17, 1995 – August 12, 1996).

1995

July 17

Kimberly-Clark Corp. (KC) and Scott Paper Co. (Scott) announced merger. The merger transaction valued at approximately US$6.8 billion.

November 8

KC announced one-time restructuring charge of US$1 billion to US$1.5 billion for the acquisition of Scott.
The US Justice Department authorities raised product competition issues
KC and Scott offered to sell certain production facilities and license certain brand names in the U.S.

December 12

KC and Scott stockholders voted and approved the proposed transactions and the acquisition.
KC reached an agreement with the anti-trust division of the US Justice Department on a consent decree for the proposed acquisition of Scott. KC was required to divest "Scotties", sell 2 of 4 tissue mills in the U.S, and divest 3 brands of wipes and the plant where they were produced.
Scott is removed from the S&P 500 Index.

December 13

KC announced that it will sell 12 mills worldwide and cut 6,000 jobs as a result of the merger. KC also announced that their integration plan is expected to yield an annual cost saving of more than US$500 million by 1998.

1996

February 20

KC announced investment of $ 70 million in Chester Mill.

March 27

KC announced $ 172 million expansion of its Beech Island operations.

April 18

KC planned to sell its 50.1% interest in Scott.
KC E.P.S of $1.11 set new 1st quarter record. CEO Sanders cites merger benefits.

April 22

KC started price reductions for consumer tissue brands in the U.S.

May 23

Procter & Gamble reported that it will purchase the global "baby and child wipes business" of Scott from Kimberly-Clark for US$220 million.

June 4

KC announced agreement with Irving Tissue Inc. to sell its tissue mill in Fort Edward, New York, and to license the Scotties brand name for use on facial tissue in the US.

August 12

KC agreed to sell its Lakeview tissue mill in Neenah to American Tissue Mills of Neenah LLC.
KC reported third quarter 1996 loss due to the above transaction.

Table 2. Facial tissues category brand descriptions and combined sales (Aug 1992-Aug 1997)

OUTLET TYPE	FOOD		DRUG		MASS MERCH.	
Brand	**$ Share**	**Price**	**$ Share**	**Price**	**$ Share**	**Price**
KLEENEX	0.184	0.768	0.247	0.791	0.226	0.654
KLEENEX BOUTIQUE	0.053	1.212	0.057	1.207	0.048	1.055
KLEENEX CASUALS	0.012	1.166				
KLEENEX CLASSIC FOIL	0.112	0.646	0.159	0.630	0.156	0.511
KLEENEX COLDCARE	0.056	1.460	0.051	1.375	0.033	1.274
KLEENEX COLDCARE ULTRA COMFORT	0.018	1.196	0.022	1.292	0.030	1.046
KLEENEX SOFTIQUE	0.048	0.897	0.060	0.842	0.019	0.782
KLEENEX ULTRA	0.068	1.277	0.078	1.198	0.059	1.121
KLEENEX VOGUE	0.008	2.615	0.007	2.868		
POSH PUFFS	0.020	1.239	0.009	1.229	0.015	1.149
PUFFS	0.121	0.722	0.089	0.690	0.156	0.616
PUFFS ADVANCED EXTRA STRENGTH	0.026	1.407	0.021	1.395	0.043	1.169
PUFFS EXTRA STRENGTH	0.029	1.364	0.026	1.337	0.045	1.156
PUFFS FREE	0.015	0.661	0.005	0.696	0.008	0.601
PUFFS PLUS	0.089	1.336	0.084	1.358	0.133	1.187
SCOTT	0.036	0.590	0.021	0.510	0.010	0.509
SCOTTIES	0.064	0.622	0.032	0.544	0.013	0.511
SCOTTIES ACCENTS	0.010	1.089	0.004	0.928	0.001	1.103
SOFT N GENTLE	0.014	0.727	0.007	0.592	0.001	0.554
Total (average)	*0.982*	*0.866*	*0.985*	*0.848*	*0.997*	*0.742*
Total $000 Sales	*4,647,828*		*363,391*		*1,365,104*	

Table 3. Descriptive statistics for merchandising activities, and assortment size (in number of items). Display and feature are measured as percentage of total volume sold.

Variable	*Mean*	*Std Dev*	*Mean*	*Std Dev*	*Mean*	*Std Dev*
	Kleenex		**Scotts**		**Puffs**	
Pre-merger						
Share	0.456	0.101	0.116	0.079	0.346	0.109
Price (vol)	0.816	0.074	0.621	0.080	0.863	0.101
Display	2.153	2.738	0.410	1.057	0.787	1.800
Feature	4.173	6.122	1.394	3.416	2.238	4.457
Fea+dsp	1.819	4.782	0.863	4.885	0.697	2.414
# Items	19.821	3.417	6.851	2.774	12.438	2.233
Post-merger						
Share	0.486	0.107	0.079	0.077	0.342	0.106
Price (vol)	0.951	0.085	0.687	0.084	0.970	0.102
Display	2.130	2.675	0.276	1.634	0.747	1.344
Feature	4.553	6.464	0.838	3.034	2.808	5.108
Fea+dsp	1.580	4.038	0.594	4.019	0.825	3.132
# Items	20.736	2.823	5.000	1.817	11.633	1.606

Table 4. Data sources.

Data series	*Source:*
Annual Personal Income for U.S. cities	Bureau of Economic Analysis, Regional Accounts Data
Demographics (such as Population, Income & Per Capita Income) of U.S. cities	U.S. Department of Commerce. Bureau of Economic Analysis
U.S. annual interest rates and GDP for 1992-1998.	EIU Country Data
distances between U.S. cities and nearest Kimberly-Clark, Scott and Procter & Gamble tissue mills	Mapquest : http://www.mapquest.com/directions/
Average Weekly Earning of Production workers for the Paper industry	U.S. Department of Labor, Bureau of Labor Statistics, section on National Employment, Hours and Earnings
Sales, prices, merchandising activities	IRI Infoscan
Pulp prices in the U.S. market	Datastream

Table 5. Estimation results for **pre-merger** differentiated products model, 46 Infoscan markets aggregated across UPCs within brand. Estimates in italics are not significant at 99% confidence level. The columns labeled "s.e." are asymptotic standard errors, and should be regarded as approximate.

Demand side

	Kleenex		*Scotts*		*Puffs*	
	Est.	*s.e.*	*Est.*	*s.e.*	*Est.*	*s.e.*
Intercept	-0.5795	0.0411	0.1409	0.0304	1.2188	0.0406
φ_j	0.0284	0.0006	*0.0005*	*0.0004*	-0.0210	0.0005
Region intercept: south	-0.1207	0.0016	-0.1598	0.0019	-0.1710	0.0018
Region intercept: northeast	0.0385	0.0013	0.0960	0.0015	0.0187	0.0012
Region intercept: midwest	0.1162	0.0015	0.0803	0.0017	0.1698	0.0018
Share price Kleenex	-0.0490	0.0007	-0.2833	0.0091	0.2471	0.0081
Share price Scotts	-0.1967	0.0084	-0.0438	0.0008	0.2595	0.0072
Share price Puffs	0.2331	0.0080	0.1643	0.0090	-0.3079	0.0066
Share display Kleenex	0.0053	0.0002	-0.0077	0.0007	-0.0046	0.0003
Share display Scotts	-0.0032	0.0002	0.0091	0.0004	-0.0009	0.0002
Share display Puffs	-0.0024	0.0003	*0.0010*	*0.0008*	0.0097	0.0004
Share feature Kleenex	0.0023	0.0001	-0.0041	0.0002	-0.0018	0.0002
Share feature Scotts	-0.0019	0.0001	0.0056	0.0002	*0.0001*	*0.0001*
Share feature Puffs	-0.0011	0.0001	-0.0013	0.0002	0.0030	0.0002
Share feature display Kleenex	0.0045	0.0001	-0.0031	0.0001	-0.0021	0.0003
Share feature display Scotts	-0.0023	0.0001	0.0065	0.0001	0.0005	0.0002
Share feature display Puffs	-0.0030	0.0001	-0.0006	0.0001	0.0038	0.0003

Industry expenditure function

		Est.	*s.e.*
λ		0.4876	0.0225
δ		-1.4905	0.0497
City fixed effects (μ_i)	min	-1.4236	0.0209
	max	2.3385	0.0136
	median	0.1632	0.0205

Supply side

	Kleenex		*Scotts*		*Puffs*	
Conduct parameters	*Est.*	*s.e.*	*Est.*	*s.e.*	*Est.*	*s.e.*
θ_{12}, θ_{13}			-0.1329	0.0079	0.5054	0.0200
θ_{21}, θ_{23}	-0.0354	0.0018			0.6607	0.0341
θ_{31}, θ_{32}	0.1006	0.0034	0.0941	0.0038		
dP/dpj	-0.0008	0.0001	*-0.1262*	*0.1032*	-0.0113	0.0007
Cost function:						
Constant	-0.6905	0.0960	1.1891	0.3747	11.1722	1.0202
Log(fluffpulp)	0.0299	0.0029	-0.0361	0.0107	-0.3333	0.0308
Log(distance)	0.0001	0.0000	-0.0017	0.0001	0.0091	0.0004
Log(labor)	-0.2905	0.0403	0.4881	0.1576	4.6658	0.4278

Table 6. Fit statistics for system of equations, both pre- and post-merger models.

Fit statistics		
	Pre:	*Post:*
Number of parameters	119	119
Equations	7	7
Observations:	3,082	3,358

	Kleenex share		*Scotts share*		*Puffs share*	
Conduct parameters	*R2*	*adj R2*	*R2*	*adj R2*	*R2*	*adj R2*
Model fit – pre	0.7291	0.7279	0.7125	0.7111	0.7272	0.7260
Model fit – post	0.7148	0.7136	0.6959	0.6946	0.6889	0.6876

	R2	adj R2
Log(Q) - pre	0.9548	0.9541
Log(Q) - post	0.9408	0.94

Table 7. Comparison of estimated price elasticities, pre versus post-merger.

	On share of:	Price of:		
		Kleenex	Scotts	Puffs
Pre-merger	Kleenex	-1.376	-0.678	0.340
	Scotts	-1.932	-1.428	2.075
	Puffs	0.490	0.436	-2.029
Post-merger	Kleenex	-1.395	-0.165	0.386
	Scotts	-2.586	-2.414	5.355
	Puffs	1.529	0.126	-1.792

Table 8. The point elasticities calculated for merchandising activities.

		Elasticity, effect of merchandising activity of:					
On share of:		**Pre-merger**			**Post-merger**		
		Kleenex	*Scotts*	*Puffs*	*Kleenex*	*Scotts*	*Puffs*
Display	*Kleenex*	0.025	-0.007	-0.008	0.012	-0.001	-0.010
	Scotts	-0.059	0.032	-0.006	-0.071	0.028	0.019
	Puffs	-0.015	0.001	0.022	0.005	-0.001	0.022
Feature	*Kleenex*	0.021	-0.013	-0.009	0.019	-0.005	-0.008
	Scotts	-0.068	0.068	0.002	-0.071	0.059	0.064
	Puffs	-0.013	-0.005	0.019	-0.012	-0.002	0.012
Fea+Dsp	*Kleenex*	0.018	-0.006	-0.003	0.007	-0.002	-0.005
	Scotts	-0.036	0.048	0.003	-0.052	0.052	0.013
	Puffs	-0.016	-0.001	0.008	-0.006	-0.003	0.009

Table 9. Estimation results of the prices and merchandising activities, pre and post-merger. Estimates and standard errors in italics not significantly different from zero, at $\alpha = 0.05$, two-tail test.

Variable	Kleenex		Scotts		Puffs	
	Estimate	*std err*	*Estimate*	*std err*	*Estimate*	*std err*
Prices:						
Intercept	-7.040	0.355	-4.658	0.447	-5.460	0.405
δ	0.123	0.002	0.082	0.003	0.093	0.003
% $\Delta\delta$ prices = exp(δ)-1	13.1%		8.5%		9.7%	
DW	1.840		1.785		1.689	
Adjusted R^2	0.357		0.162		0.312	
N-k	7,279		7,279		7,279	
Merchandising activities:						
displays only: δ	*-0.014*	*0.071*	-0.090	0.037	*0.002*	*0.038*
Adjusted R^2	0.182		0.048		0.230	
features only: δ	*0.230*	*0.156*	-0.328	0.081	0.338	0.128
Adjusted R^2	0.185		0.175		0.070	
features and displays: δ	*-0.166*	*0.113*	*-0.014*	*0.116*	*0.067*	*0.074*
Adjusted R^2	0.119		0.056		0.077	
Assortment:						
Items: δ	0.035	0.003	-0.226	0.006	-0.044	0.003
% $\Delta\delta$	3.6%		-20.2%		-4.3%	
R^2	0.568		0.763		0.709	

Table 10. Estimation results for **post-merger** differentiated products model, 46 Infoscan markets aggregated across UPCs within brand. Estimates in italics are not significant at 99% confidence level. The columns labeled "*s.e.*" are asymptotic standard errors, and should be regarded as approximate.

Demand side	*Kleenex*		*Scotts*		*Puffs*	
	Est.	*s.e.*	*Est.*	*s.e.*	*Est.*	*s.e.*
Intercept	-0.8197	0.0318	0.4105	0.0269	1.8620	0.0317
φ_j	0.0258	0.0005	*0.0008*	*0.0004*	-0.0268	0.0005
Region intercept: south	-0.1128	0.0016	-0.1681	0.0019	-0.1921	0.0020
Region intercept: northeast	0.0468	0.0011	0.1216	0.0016	0.0630	0.0012
Region intercept: midwest	0.0920	0.0015	0.0668	0.0019	0.1532	0.0018
Share price Kleenex	-0.2345	0.0032	-0.0892	0.0072	0.1563	0.0084
Share price Scotts	-0.2116	0.0073	-0.1130	0.0026	0.4156	0.0068
Share price Puffs	0.4766	0.0079	0.0332	0.0067	-0.3056	0.0059
Share display Kleenex	0.0027	0.0003	-0.0023	0.0004	-0.0066	0.0005
Share display Scotts	-0.0026	0.0002	0.0079	0.0004	0.0020	0.0003
Share display Puffs	0.0008	0.0003	-0.0012	0.0003	0.0103	0.0004
Share feature Kleenex	0.0020	0.0001	-0.0030	0.0002	-0.0014	0.0001
Share feature Scotts	-0.0012	0.0001	0.0055	0.0002	0.0018	0.0001
Share feature Puffs	-0.0009	0.0001	-0.0009	0.0002	0.0015	0.0001
Share feature display Kleenex	0.0023	0.0002	-0.0020	0.0001	-0.0028	0.0002
Share feature display Scotts	-0.0026	0.0001	0.0069	0.0001	0.0012	0.0001
Share feature display Puffs	-0.0013	0.0002	-0.0015	0.0001	0.0039	0.0002

Industry expenditure function

		Est.	*s.e.*
λ		0.8080	0.0296
δ		-0.7709	0.0673
City fixed effects	min	-1.3705	0.0210
	max	2.2800	0.0142
	median	0.2268	0.0326

Supply side	*Kleenex*		*Scotts*		*Puffs*	
Conduct parameters	*Est.*	*s.e.*	*Est.*	*s.e.*	*Est.*	*s.e.*
θ_{12}, θ_{13}			-0.3732	0.0204	0.3049	0.0071
θ_{21}, θ_{23}	-0.2923	0.0310			2.3994	0.4468
θ_{31}, θ_{32}	0.7861	0.0410	0.3850	0.0257		
dP/dpj	-0.0079	0.0004	-0.1224	0.0671	-0.0042	0.0004
Cost function:						
Constant	2.6231	0.2073	6.4707	0.6219	2.7947	0.2879
Log(fluffpulp)	*0.0027*	*0.0017*	-0.0732	0.0057	-0.0248	0.0027
Log(distance)	0.0012	0.0002	0.0026	0.0008	0.0026	0.0004
Log(labor)	1.1240	0.0910	2.8058	0.2727	1.1737	0.1263

Figure 3. Time series of estimated CV parameters for the three competitors in the facial tissues. The three vertical lines correspond to the events of Al Dunlap (4/19/1994) hired as CEO for Scotts Paper Products, and the merger announcement and share-holder agreement, respectively.