Marketing in a World with Costs of Price Adjustment

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Abstract

We suggest that consideration of costs of price adjustment in marketing offers a promising research direction. These costs can have substantial implications for research in pricing - from determining the magnitude and frequency of price changes to asymmetric pricing, pass-through in channels and price synchronization. Our understanding of the nature and scope of these costs has been undergoing an evolution recently, from simple menu costs to richer decision-making, organizational and customer-based costs. In this paper, we review the literature in marketing and economics to summarize what we know about the nature, magnitude and the broad impact of these costs. We then identify some areas of potential interest to both researchers and practitioners in marketing, where consideration of price adjustment costs are likely to yield greater insights into marketing decisions.

Key Words: *Pricing, Price Adjustment Costs, Menu Costs, Price Rigidity, Price Inertia, Price Pass-through, Asymmetric Pricing, Synchronization.*

I. Introduction

Pricing is one of the central decisions studied in marketing, and there is a wealth of research that has made substantial contributions to our understanding of this activity – from our understanding of price sensitivity, to competitive implications for pricing, to pricing in channels of distribution, to a variety of interesting pricing phenomena across a wide variety of markets.[1] Most of this pricing research has assumed that organizations are endowed with the ability to adjust prices costlessly in response to changes in the environment – allowing prices to adjust flexibly, and allowing firms, industries, markets and economies to function in the ways developed in classical economic theory. Indeed, this assumption is so deeply ingrained in our thinking that most of the existing literature in marketing, business and strategy takes this ability for granted, assuming this as a kind of inalienable ability inherent in organizations.

There is, however, another perspective that assumes there are limits to the organization's ability to adjust prices. Marketers have known about these limits for quite some time. These issues are raised in the first volumes of the Journal of Marketing, and the 1939 April volume has a section on "recent contribution to prices and price policies" where R.S. Tucker (1939, p.329) discusses the claim that "*the workings of price are obscured by custom – meaning not only the conventions of accounting and business practice but especially the habits of and social standards of customers.*" These limits are currently studied in the literature on the "costs of price adjustment", which suggests that pricing can be a complex and costly organizational problem. Caplin and Leahy (1995) emphasize that price adjustment is a "*very difficult, costly and time-consuming process*", Levy et al. (1997) suggest that changing prices "*is a complex process, requiring dozens of steps and a non-trivial amount of resources*", Dutta et. al. (2003) describe

[1] See Monroe, 1973; Rao, 1984; Moorthy, 1985; Wilson et al., 1990; Hoch et al, 1994; Wernerfelt, 1994; Simester, 1995; Lal and Rao, 1997; Bell et al., 1998; Ailawadi et al., 2001; Stremersch and Tellis, 2002.

the "*extraordinary complexity of the price setting process"*, Zbaracki et. al. (2004, p. 518) state that "*the price change process reveals a series of managerial activities of vast scope and complexity*".

Moreover, our understanding of the nature and scope of these costs have recently been undergoing an evolution in this literature. Some of the recent work has provided the first direct estimates of the magnitude of these costs, and a deeper exploration of the sources of these adjustment costs and their implications. This has moved the literature from simple menu costs to richer decision-making, organizational and customer-based costs. This evolution is increasing the value of "costs of price adjustment" literature for the marketing and economics disciplines, and bringing these costs back to the roots that Tucker suggested 70 years ago in the Journal of Marketing.

A key impact of these costs is price rigidity – the propensity of prices to remain unchanged in response to changes in the environment. Again, marketers have long been engaged in understanding issues related to price rigidity such as pricing thresholds (Kalyanaraman and Little, 1994), price inertia (Srinivasan et al. 2008), deal frequency (Krishna, 1994), and price pass-through (Moorthy, 2005). These costs can also have substantial macroeconomic implications. According to Blinder et al. (1998, p.21) costs of price adjustment have become "one of the main strands of New Keynesian theorizing" as many predictions of traditional Keynesian and more recent New Keynesian models crucially depend on the existence of some form of price rigidity. Price rigidity is also central to microeconomic theory, ranging from theories of the firm (Coase, 1937, Williamson, 1979; Cyert and March, 1963) to industrial organization (Carlton and Perloff, 1990). According to Carlton (1986) sources of price rigidity fundamentally alter the outcomes of models in microeconomics and industrial organization – the

very models which lie at the heart of our work in marketing, including such areas as pricing, channels of distribution, competitive strategy, etc. For marketers, this makes understanding the costs of price adjustment of fundamental interest.

Despite the importance of these costs and their implications, the broader literature in marketing has long tended to ignore the role of these price adjustment costs and their relation to pricing strategy. It is only in the recent years that marketing has seen a rising interest in the domain. Some recent papers that consider these costs are: asymmetric pricing (Ray et. al. 2006; Chen et. al. 2008); impact of Item Pricing Laws (IPL) on price levels (Bergen et al., 2008); price inertia (Srinivasan et. al. 2008); past price dependence (Nijs et. al., 2007); and price pass-through (Dutta et. al. 2002; Levy et. al. 2002; Ray et al., 2006; Müller & Ray, 2007).

We believe that consideration of costly price adjustment, and the subsequent rigidity it suggests, offers a promising interdisciplinary research opportunity for the field of marketing. Empirically, marketing sits in the ideal position to study the sources, and consequences of, these costs. The kind of data required to make headway in our understanding of these costs requires a richer range of data sources and techniques which lie at the heart of the marketing discipline – from transaction data to surveys, interviews, field work, and experiments. Theoretically, the marketing discipline has a wealth of managerial and behavioral theories that can be drawn upon to better understand these emerging organizational and customer-based sources of price adjustment, and their consequences. We believe that some of the most promising future work on the costs of price adjustment, and their implications, can occur in the field of marketing – allowing us to inform related fields such as economics, strategy and business. The marketing discipline itself can benefit from consideration of these costs of price adjustment – to better understand patterns of price adjustment and market dynamics, as well as increasing our

understanding of pricing phenomena such as pricing thresholds, asymmetric pricing, price pass-through, price points, promotion frequencies, pricing formats (e.g. EDLP or HI-LO), and the links between regulation, macroeconomic policy and market prices.

In this paper we first review the relevant literature in economics and marketing about what is known about the costs of price adjustment and its impact on different pricing decisions. We then relate to some issues of key interest to marketers and go on to discuss the implications for the marketing literature and future research in marketing, economics and the interdisciplinary boundaries between the two.

II. Literature Review

We start with a broad overview of the literature pertaining to the costs of price adjustments. We first discuss the nature and scope of these costs and then move on to a discussion of the implications of these costs primarily from a marketing perspective. For the first part, much of the literature is drawn from the "new-Keynesian" literature in economics.[2] For the second part we draw upon both the economics as well as the relevant marketing literature.

The nature of price adjustment costs: Sources, magnitudes, forms

Till recently, little was actually known about what the sources and magnitudes of these costs really are. This led to doubts about the usefulness of "costs of price adjustment" in economics. For example, Prescott (1987, p.113) suggested that theories of price adjustment costs "will never be taken seriously" until we know how to measure these costs directly. Similarly Blinder (1991, p. 90) emphasizes the importance of measuring these costs stating that in the absence of an ability to measure them, theories of price adjustment costs "can be tested at best indirectly, at worst not at all." And Kashyap (1995, p. 269) points out that the weaknesses of the

[2] See Blinder et. al. (1998), Ball and Mankiw (1994a,b), Rotemberg (1987), Gordon (1990) and Mankiw and Romer (1991) for a comprehensive discussion of this "New Keynesian" literature.

find that these adjustment costs "involve things other than printing new price lists, putting new price tags on goods, and so on", and uncover that concerns with "antagonizing customers" is another important dimensions of these adjustment costs.[3] In a similar vein, following interviews with over 300 managers, labor leaders and professional recruiters, Bewley (1999) finds that concerns with employee morale and willingness to support organizational objectives are important sources of wage rigidity.

Other researchers have also explored price adjustment costs in different contexts. Since the nineties, several of them have estimated these costs of adjustments by observing the pricing process at firms. Levy et al (1997) use a detailed time and motion study of the price change processes in six major chains in the United States to document the first direct measure of the physical costs of price adjustment (the so-called menu costs) in the retail grocery industry. They estimate these costs to be over $100,000 per store per year. This translates to an average of $0.39 per price change which is about 0.53 percent of revenues at the supermarket stores. Using the same methodology, Dutta et al. (1999) finds the average annual menu costs per store to be almost $25,000 for the chain drug store they study. This corresponds to very similar marginal figures as the supermarket study with estimated costs of $0.33 per price change comprising 0.59 percent of revenues. Zbaracki et al. (2004) also used a similar approach by deploying an ethnographic methodology to directly estimate the costs of price adjustments at a large industrial manufacturer. Using a combination of interviews, non-participant observations and detailed study of internal documents, they estimate the menu costs to be almost $44,000 per year. They further estimate the marginal cost of a price change to be in the range of $0.80-$4.34 accounting for 0.71 percent of net margins.

[3] See Blinder et. al. (1998) for an excellent presentation of the importance of price rigidity for economics, the main theories of price rigidity, more results on costs of price adjustment, and a wealth of other findings on price rigidity.

While the estimates of costs referred to in the earlier paragraphs relate to the direct physical costs of price adjustment

While the above papers used more direct measures of price adjustment costs, another promising direction to understand these costs comes from analysis of patterns of actual price adjustments made by retailers. Slade (1998) used this approach to estimate these costs indirectly, using a structural modeling approach with discrete choice dynamic-programming. Using scanner panel data on four brands of saltine crackers across four stores, she estimated the average price adjustment costs to be about $2.72 per price change.

Based on these field studies, the price adjustment costs can be seen as evolving from physical costs to a richer set of organizational and customer-based costs of price adjustment:

(a) *The physical (menu) costs*: The direct costs of changing prices physically. For instance, in a supermarket context, Levy et al. (1997) conservatively characterize the direct physical costs as being comprised of (1) labor costs of changing shelf prices, (2) the costs of printing and delivering new price tags, (3) the costs of mistakes made during the price change process and (4) the costs of in-store supervision of the price change process.

(b) *The managerial costs*: This includes the managerial time and effort required to decide and implement a price change. For instance, in the industrial marketing context, Zbaracki et al. (2004) found that the managerial costs comprised of (1) information gathering costs, (2) decision making costs and (3) communication costs.,

(c) *The customer costs*: This involves the opportunity costs of lost goodwill when customers are presented with a price change (*cf.* Blinder et al. 1998, p.313). Zbaracki et al. (2004) characterized these as comprising of the costs associated with (1) communication and (2) negotiation with customers, in the event of a price change.

Even as the debate around the *sources* and *magnitude* of these costs are being addressed there are questions about the *form* of these costs as well– specifically whether they are *convex* or

fixed. Convexity in this context refers to whether price adjustment costs are a function of the magnitude of price changes. For example, Rotemberg (1982) models these costs as a quadratic function of the price change. Others like Barro (1972), Sheshinski and Weiss (1977) and Caplin and Spulber (1987) consider these to be a fixed cost. The interest in the form of these costs is not merely a definitional issue. As Blinder et al. (1998) point out, convex costs could anchor multiple small price changes as opposed to larger but infrequent price changes anchored by the fixed form (p. 229). In the retail grocery context, Slade (1998) estimates the fixed components of the costs to be of much greater magnitudes (94%) than the convex ones (6%). In an industrial context on the other hand, Zbaracki et al. (2004) find that the convex components of these costs are of significantly greater magnitude than the fixed components.

The impact of price adjustment costs on prices

The most direct implication of costs of price adjustment is price rigidity. As mentioned earlier, price rigidity refers to the propensity of prices to remain unchanged in response to changes in market conditions. Some of the seminal work in this area was done on patterns of price rigidity in business to business markets which were carefully documented and analyzed by authors such as Stigler and Kindahl (1973), and Carlton (1986, 1989). There has also been work on price rigidity for administered prices in the 1930's (Means, 1935)

example, Cecchetti (1986) documented price rigidity in the newsstand prices of magazines, and Kashyap (1995) found price rigidity in goods sold through retail catalogs. Bils and Klenow (2004) used more disaggregated data from the Bureau of Labor Statistics to document wide ranging levels of price rigidity across over 350 categories of goods and services.

This micro level rigidity tends to be of particular interest to marketers. In this section, we discuss four forms of price rigidity that have been addressed in the marketing literature – (1) rigidity in terms of magnitude (i.e. the relative/absolute change in price levels), (2) rigidity in terms of frequency (i.e. the length of time between price changes), (3) rigidity in terms of pass-through (i.e. the proportion of upstream cost changes that is passed through as downstream price changes in a distribution channel) and (4) rigidity in terms of price synchronization (i.e. the degree to which the inter-temporal nature of rigidities are correlated across different products). As will be clear soon, despite the interest in rigidity, few papers in marketing directly relate rigidity to costs of price adjustments. Moreover, even in economics, price adjustment costs are not the only explanation of price rigidity (Blinder et al., 1998; Peltzman, 2000; Bils and Klenow, 2004 etc.). Therefore, we first review the relevant literature on rigidity in marketing and economics and then how the costs of price adjustment impact each of these four forms of price rigidity.

Magnitudes of price changes: Thresholds, asymmetric rigidities and price levels

One major form of price rigidity that marketers have uncovered is the existence of price change thresholds that elicit no consumer reaction. For example, some authors (e.g. Della Bitta and Monroe 1981; Gupta and Cooper 1992) suggest that any price decrease less that 15% would be ignored by customers and hence not result in the desired sales bump. In other words, prices should be rigid in domains of small price changes. In a direct approach DeSarbo et al. (1987) put

forward a descriptive model of price change that incorporates such regions of rigidity and study price change behavior. They calibrate their "friction" model, and conclude that pricing patterns are consistent with the notion that price changes occur only if the composite indices that determine prices exhibit movements beyond some high or low thresholds. And the strength of these movements, as stated in the article, has a positive relationship with the magnitude of the price change.

An additional complexity is in the asymmetric rigidities implied by the inherent nature of these thresholds - both asymmetric magnitudes of these thresholds (e.g. Kalyanaram and Little, 1994) as well as asymmetric elasticity beyond the thresholds (Krishnamurthi et al., 1992; Greenleaf, 1995; Kalyanaram and Winer, 1995 etc.). Mela et al. (1997) discuss an additional dimension of these asymmetric thresholds – where customers may behave strategically and lie in wait for a better price promotion. The exact nature of the rigidities depends on the context. Pauwels et al. (2007) for example, discuss the relative roles of "latitude of price acceptance" effects and "saturation" effects and how they might lead to contrasting rigidity outcomes.

The implications for rigidity notwithstanding, the literature above does not explicitly consider the role of price adjustment costs. If at all, the roles of such costs are only implicit. For example, DeSarbo et al. (1987) refers to the "inert areas" in prices being possibly caused by "(the) actual implementation costs or management effort" (p.300). A natural question therefore, is whether these costs play any direct role in the magnitude of price changes and especially, for such asymmetries?

Chen et al. (2008) find that there are far more "small" price increases than there are "small" price decreases. That is – the magnitudes of prices are far more rigid downwards than upwards – but only for "small" price changes. However, such asymmetric rigidity vanishes for

"large" price changes. They consider several possible sources of rigidity and speculate that this could be due to the rational inattention of consumers. If the cost-benefit tradeoff of processing the information pertaining to small price changes is unattractive, customers may ignore small price changes. This creates an incentive for the retailer to increase prices 'in the small.'

The existence of (asymmetric) thresholds has also been shown to exist in pricing models with costs of price adjustments. Sheshinski and Weiss (1977) for example explain how during inflation, in the presence of costly price adjustment, firms might wait for real prices to fall to a level *s*, before adjusting price back up to the target price level *S*. Ball and Mankiw (1994a) take a similar perspective and show how inflation in the presence of these costs may lead to asymmetric price adjustments. Slade (1999) included competition in her model to illustrate and empirically demonstrate that the (*s*,*S*) thresholds may be asymmetric. Instead of inflation however, she uses stocks of goodwill to motivate the reasons for such types of price rigidity. Similarly, Ray et al. (2006) show how these costs in a vertical channel of distribution may result in asymmetric price adjustments. Müller and Ray (2007) also report empirical evidence that suggests asymmetric rigidities may be consistent with a cost of price adjustment perspective. Nevertheless, there is still much to be learnt about the role of price adjustment costs in asymmetric price adjustments (Peltzman, 2000).Beyond the magnitude of price changes themselves, another intriguing question is whether higher costs of price adjustments result in higher prices for consumers. Bergen et al. (2008) report that these costs may indeed result in higher prices for consumers. In a natural experiment, they find that retailers that are subject to "Item Pricing Laws" (IPL), consistently charge prices that are almost 10% higher than prices at retailers that are not subject to IPL.[4] This result holds even after controlling for demographic, store and category factors.

[4] In its most basic form, item pricing laws (IPLs) require a price tag on every item sold by a retailer. Currently, IPLs exist in nine US states, in Quebec, Canada, in some European countries, and in Israel.

Since IPLs increase the retailer's costs of price adjustments, this is among the few documented evidences of the link between price adjustment costs and price levels. They also find that prices in stores that invest in Electronic Shelf Labels (ESL) are consistently lower than price at stores that do not. Since ESLs reduce the retailers' marginal costs of price adjustments, this result offers additional support for the effect of these costs on prices.

Frequency of price changes: Consumer perceptions, strategic considerations, price formats

The literature on frequency of price changes in marketing looks at both consumer perceptions of frequent price changes (and the consequences for firm's pricing) as well as the behavior of prices *per se*. For example, Krishna (1991) show how consumer expectations of future deal frequency is positively correlated with their perceptions of past deal frequency. Consumers would therefore delay their purchases if they expect a deal in the near future. Indeed a number of subsequent papers document the negative impact of frequent price reductions on future purchases (Krishna, 1994; Mela et al., 1997; Kopalle et al. 1999 etc.), offering a logic for greater rigidity for price reductions.

Another literature attempts to calibrate the inter-temporal variation of price rigidity by studying the behavior of market prices. There are several perspectives to interpret such variation. One perspective is articulated by DeSarbo et al. (1987). They interpret price rigidities as belonging to three types – (1) univariate time-series models which calibrate rigidities as past price dependence, (2) experience curve effects – which calibrates rigidities to product life cycle, and (3) informational cost effects – which calibrates rigidities to the complexities of managerial decisions and efforts.

Other perspectives offer more strategic interpretations. For example, in Varian's (1980) model firms randomly choose between high and low prices as a means to discriminate between

because they invite no demand penalties due to the same rigidity of retail prices. Ray et al. derive equilibrium conditions and present empirical evidence of such asymmetric adjustments being limited to only 'small' price changes.

Price synchronization across different product lines

Coordination of prices across the different products carried by a multi-product firm has been of great interest to marketers. With the growing interest in category management, these have become of even greater importance (see Zenor, 1994; Basuroy et al., 2001; Moorthy, 2005 for more on the subject). At issue often is whether prices of different products will change at the same time (synchronized), or will they change at different time (staggered). Shankar and Bolton (2004) use the term "price-promotion coordination" to empirically investigate the same issue. They find that the level of synchronization across the retailer's brands depends on a number of factors spanning competition, as well as store and product factors.

While the marketing literature above does not consider the role of price adjustment costs in the synchronization of prices, it tends to be of great interest to economists because the impact synchronization may have on aggregation of inter-temporal price rigidities. Sheshinski and Weiss (1992) for example consider a model of price coordination under inflation and price adjustment costs. They illustrate how the extent to which prices are staggered and synchronized, not only depends on the degrees of demand complementarities but also on the nature of the price adjustment costs, especially whether there are increasing returns in the adjustment costs. They point to the critical role the form of such costs can play as well – i.e. whether the costs are mostly the physical costs or have a large component of "decision costs" similar to the managerial costs discussed earlier.

III. Discussion

We hope this paper helps serve as a call to the marketing discipline to focus more attention on price adjustment costs and their implications in price setting process. The time is right, as this literature evolves from physical (menu) costs to richer organizational and behavioural costs, and broadens its horizons to consider richer sources of micro pricing data. These shifts suggest that marketing may have a great deal to offer, as well as learn from, this developing literature on the costs of price adjustments. Among the business disciplines, marketing is perhaps best situated to make headway on the critical issues resting at the heart of this literature. The marketing discipline has a broad range of data sources, empirical tools and models that can be used to contribute to the work on price adjustment costs. Empirically this ranges from a long history in ethnographic methods, to direct access to managers and firms, to survey methods to develop the scale and scope of price rigidity and its sources, to large pricing data sets and emerging empirical techniques that could study price rigidity and its antecedents. Theoretically, this ranges from models of consumers, managers, channels, organizations and strategy that may be effective ways to model these sources of price rigidity and their implications for markets. Given the central role of managers in price adjustment that is arising in the literature, our marketing understanding of organizations and how they make business decisions offers an opportunity to make fundamental contributions to price theory, and all the disciplines that rely on it. Marketing also has a lot to learn from the literature on the costs of price adjustment and price rigidity. Incorporating these costs of adjustment and price rigidities into our thinking and models enlarges our toolkit for understanding the role and limitations of pricing in the marketplace, and improve our guidance on difficult managerial problems. Given marketers' keen interest in price changes, it presents a particularly fertile area of research with potentially

significant payoffs both for theory as well as practice. We identify some of these areas and discuss them in the following paragraphs.

Need to know more about the nature of these costs and their implications

Take first the basic issues surrounding the nature and scope of price adjustment costs. Given the nature of these costs *per se*, our ability to easily measure and categorize these costs has been quite limited. As future researchers attempt to bridge this knowledge gap we see a crucial role for more descriptive studies (Zbaracki et. al. 2004) alongside structural models like that of Slade (1998), and encourage the use of a wide variety of marketing tools and techniques to gather more information about these costs, and their consequences for price rigidity.

This empirical research should focus on the nature of these costs of price adjustment. Despite the growing interest in the area and increasing evidence of the significance and importance of these costs, we are just beginning to gain an understanding of the sources, magnitudes and forms of these costs. This is especially true of the emerging organizational and customer-based dimensions of these costs, which offer some of the most significant and interesting sources of price rigidity. This is also true of *convexity* of these adjustment costs. While a number of authors (e.g. Rotemberg, 1982; Sheshinski and Weiss, 1977; Blinder et al., 1998; Zbaracki et al. 2004) illustrate the important role of such convexity, only a few (e.g. Slade, 1998; Zbaracki et al. 2004) even attempt to calibrate them. For marketers this is area of interest. Perhaps more than any other marketing mix decision, magnitudes and frequencies of price changes frame the marketer's response to the dynamics of consumer tastes and competition. Given the impact convexity can have on the magnitude and frequency of price changes (Blinder et al., 1998), a greater understanding of the form of price adjustment costs is a promising area to explore. Marketing offers a wealth of behavioral theory and knowledge that can be used to

unlock the nature of these organizational, customer and convexity issues, as well a rich array of empirical methodologies to uncover the empirical significance of these as sources of price rigidity.

In terms of the scope of these costs, while there is some empirical work that estimates these costs in retail supermarkets (Levy et al. 1997; Slade, 1998; Dutta et al., 1999), there is not much research in other contexts. Zbaracki et al. (2004) is one of the few that studies price adjustment costs in an industrial context. More empirical research into the nature of these costs in various contexts is necessary to creating a more robust framework.

In fact, there may be substantial variation in price rigidity patterns across product sizes, categories, brands and channels (Gordon 1990). Different sectors vary in factors that can impact price adjustments. This could not only be on the basis of end-products (e.g. manufacturing versus services) but also in the nature of channels – the diversity of members, number of different levels, degrees of decentralization etc. Newer technological advances (e.g. ERP systems, RFID), practices (e.g. category management and outsourcing) and economic realities (e.g. globalization) may also fundamentally impact the costs of price adjustments and hence the way prices are set in diverse sectors. As an example, Nijs et al. (2007) explore variation in past price dependence, and possible explanations for these patterns of price rigidity. There is much to be learned from documenting these variations in price rigidity, and understanding the explanations for this rigidity (Stigler and Kindahl, 1970, Bils and Klenow, 2004, Dutta et. al. 2002, Nijs et al. 2007). Therefore we call for a sustained effort to map the nature of these costs and their consequences in different contexts - such as B2B markets, service industries, international markets, throughout entire supply chains, etc.

Drawing Insights from Economic Modeling

Price rigidity has been widely studied in the macroeconomics literature (Sheshinski and Weiss, 1977; Gordon, 1990; Ball and Mankiw 1994a,b; Carlton and Perloff, 1994). This literature has been developing to incorporate the evolving understanding of the costs of price adjustment, offering new ways to model price rigidity. For example, Mankiw and Reis (2002) and Ball, Mankiw, and Reis (2005) explore how modeling the price adjustment costs as the costs of managerial decision can yield a more plausible Phillips Curve relation. There is also a literature exploring the use of organizational rules of thumb and their implications for economic activity (Galí and Gertler, 1999; Amato and Laubach, 2003). Rotemberg (2005) explores the implications of customer costs of price adjustment for macroeconomic policy. These costs can also have implications for the debate on time-dependent versus state-dependent models of nominal price rigidity Basu (2005).[5] This organizational evolution also suggests exploring the span of control models (Prescott and Visscher 1980; Lucas 1978), recasting these towards the ability of firms to adjust prices (as well as manage production and other activities) may be a promising direction for marketers to explore. All of these literatures provide interesting theoretical insights into the complexities and implications of these adjustment costs and their implications – which can be of substantial benefit to the marketing literature as it explores these costs in the future and their implications for pass-through, price tiers, and other dynamic pricing issues.

Managerially, one can also view the emerging literature on six sigma pricing and other process improvement methodologies being brought into the field of pricing as outgrowths of this deeper understanding of the costs involved in price adjustment. For example, the work of Sodhi and Sodhi (2008), articulates a view of pricing processes that is fraught with costs, and helps

[5] See also Sheshinski and Weiss (1977).

managers apply six sigma and other statistical and process control techniques to improve the efficiency and effectiveness of their pricing processes.

Small versus large price changes

We can benefit from a greater understanding of how price adjustment costs affect not only large but small price changes (Kashyap, 1995). There is an intriguing juxtaposition of perspectives in the domain of small price changes. The presence of frequent small price changes in the presence of price adjustment costs has been puzzling to some economists like Kashyap (1995). The relation between small price changes and the convexity of price adjustment costs have been speculated upon as a possible explanation (Kashyap; 1995; Blinder et al., 1998; Zbaracki et al., 2004). On the other hand, for marketers small price changes are intuitively appealing given a long history of Just Noticeable Differences (JND) and related literature (Monroe, 1973; Lichtenstein et al. 1988; Kalyanaraman and Little, 1994 etc.). Ray et al. (2006) and Lach & Tsiddon (2007) are among the few that applies a price adjustment perspective to small price adjustments. We believe greater attention to how small price changes and price adjustment costs relate to each other will yield a rich set of insights for both theory and practice. The discussion above illustrates that managers have to take into account the regions of price changes that customers pay less attention to when changing prices. As price changes beyond those ranges especially for price increases, this large price change can increase the cost that a firm has to incur to convince the customers that the new price still provides value to them. The firm may have to therefore, pay more attention to the importance of customer costs. The price rigidities in these thresholds can then be explained by the costs that customers and managers incur in an effort to move prices beyond the thresholds. This is supported by evidence found in the industrial context, where the firm incurs significant managerial and customer costs associated

with a pricing decision – especially if they have to be large price changes (Zbaracki et al., 2004). It also points to how marketers in certain contexts might deal with the competing concerns of costly price changes and the business prerogative of making a temporary price change. As documented in Levy et al. (1997, 1998) and Dutta et al. (1999), a vast majority of the price changes in the supermarkets and drug stores they study, were temporary promotions, not the more permanent changes in the list or regular prices. Presumably, changes in the list prices (given their more permanent nature) would hold more significant long term implications for the firm and hence would require greater consideration and higher managerial costs of price adjustment.

Frequency of promotional price changes

There are a number of perspectives that drive the frequency of price changes. One of the more prominent one is store positioning, broadly categorized as EDLP or HI-LO. Despite the general interest in these forms (Hoch et al., 1994; Bell and Lattin, 1998 etc.) few papers exist to study the implications of price adjustment costs for such pricing formats. While EDLP stores engage in few promotional price changes, HI-LO stores undertake frequent promotions. As such these formats present an opportunity to understand how price adjustment costs may operate in two very different scenarios. Deal sensitivity is yet another perspective that drives frequency of price changes (Krishna, 1994; Mela et al., 1997; Kopalle et al. 1999 etc.). The idea here is that frequent price changes may lead consumers to only buy when there is a sufficiently attractive price promotion. This may not be good news for the retailer's bottom line. Nevertheless, promotional pricing is often interpreted from a competition lens. What is not clear is how the existence of price adjustment costs across different competitors may impact the outcomes regarding frequency of price changes. This is another area where marketing is uniquely poised to

contribute to our understanding of how price adjustment costs affect prices. Managerially, adjustment costs offer a new set of variables to consider when setting broader pricing strategies such as an EDLP strategy, than the ones suggested in the existing marketing literature (e.g., Hoch et al. 1994; Lal and Rao 1997; Bell and Lattin, 1998; Bell et al. 1998; Ailawadi et al. 2001). The existence of these costs of price adjustment suggest that in the short run any complex pricing scheme like bundling or usage based pricing will have to take into account the firm's existing costs to adjust prices, and consider the costs to change the strategy itself. Essentially this suggests another level of costs of price adjustment – adjustment in the form of pricing, as a promising research direction to explore.

Asymmetric price adjustments

Chen et al. (2008) show there is an asymmetry between positive and negative retail price changes in the small – with small increases vastly outnumbering small price decreases. This asymmetry however, vanishes for large changes. Such asymmetric price adjustments have always been of great interest. Nevertheless, as per Peltzman (2000), there are no compelling explanations of the phenomenon yet. While it has always been part of the consideration set, the empirical evidence of the role of price adjustment costs on asymmetric adjustments are mixed in both the economics and marketing literature (Ball and Mankiw, 1994a, Peltzman, 2000; Ray et al., 2006; Müller & Ray, 2007). Certainly, the outcomes would be intuitive if the costs themselves were asymmetric i.e. price decreases were more costly than price increases. However, even when asymmetric costs were referred to (e.g. in Blinder et al. 1998; Zbaracki et al. 2004) they have usually been in different directions (price increases more costly than price decreases).

Interestingly, some recent work shows that even if these costs *per se* are not asymmetric, strategic interaction between market players could still lead to asymmetric adjustments (see Ray et al., 2006). There are only a handful of papers in this area. Among them, Slade (1999) look at how price adjustment costs impact horizontal interactions (competition) and Basu (1995) look at how price adjustment costs impact pricing and production outcomes in a vertical context (channels).

A related literature from behavioral economics offers another lens to interpret asymmetric price adjustments, whose existence as a retail pricing practice is often puzzling from a consumer fairness perspective. Certainly, if the practice was considered patently unfair, the firm's ability to profit from it would be limited. To this end, Kahneman et al. (1986a,b) propose the "dual-entitlement principle" to explain why such asymmetric pricing may still be considered fair by consumers and hence sustainable from the firm's point of view. However, their perspective anchors on the manner in which prices respond to input costs but make no explicit allowance for the costs of price adjustments, or the retailer's ability to make price changes. Despite the clear managerial implications, there is little to no research that explores this area.

Given the rich set of tools and perspectives available to marketers to study consumer, channel and competitive interactions, we believe marketing is uniquely situated to yield valuable insights for both theory and practice in this domain. These insights could draw not only from formal economic oriented approaches but also more cognitive and behaviorally oriented methodologies.

Price points and Price Rigidity

A similar line of reasoning can also be applied to the interpretation of price point rigidities (Levy et al., 2007) .The phenomenon of nine cent ending for example, have been of

continuing interest to both economists and marketers (see Twedt, 1965; Stiving and Winer, 1997; Schindler & Kirby, 1997; Basu, 1997; 2006 etc.). The traditional explanation of nine cent endings suggests that retailers strategically leverage the limits of consumers' cognitive abilities. Nevertheless, the widespread deployment of such price points may in fact point to a pricing routine at the retail level as opposed to a more deliberate strategic decision (see the work on "customary prices" – Ginzberg, 1936). This would also suggest that moving from nine cent endings could have its own organizational costs. Hence we call for additional research to expand our understanding of price point rigidities by incorporating costs of price adjustments.

Price coordination across competition and across brands

Price coordination has always been a major consideration for marketers. At an inter-retailer level, such coordination can range from explicit collusion to simple price-follower strategy where a retailer merely readjusts its prices following the price leader's adjustment. In another variation of this, a non-strategic cost plus rule may see all retailers in the industry automatically adjust prices following an industry-wide cost shock (as is often observed in retail gasoline prices).

It seems intuitive that to the extent price adjustment costs impact rigidity of prices, it would also impact the type of price coordination being referred to here. Nevertheless, it is not clear what would be the nature of such an impact. Certainly, if the price-change process is routinized to the extent that no new decisions are involved at the time for a price change, the outcome could be vastly different from if each change point is an occasion for a new decision. Research on price competition and competitive response in marketing, has looked at the nature of competitive interactions using scanner data (e.g., Kadiyali et al. 1999; Leeflang and Wittink, 1996) or game theoretic models (e.g., Moorthy 1985). The existence of these costs of price

adjustment suggests more subtle modeling and empirical issues as to how they affect competition. To the best of our knowledge there is little work in this area and we believe that the marketing literature will greatly benefit from more research in this domain.

The nature of price coordination may differ as well. At the inter-brand level a single retailer may consider all the brands in a category collectively in its price adjustment decisions. The outcome could be synchronized price changes (multiple brand prices change at the same time) or staggered price changes (the price changes do not happen simultaneously). Such price coordination is considered a key part of category management, (see Basuroy et al. 2001, Shankar and Bolton, 2004). Nijs et al. (2007) document the profit impact of a category management perspective. Costs of price adjustment have a particular resonance to category management. It is not clear whether the complexity of the decision making would be necessarily greater than a more brand management focus. However, one would think that the nature of the costs would be a critical consideration. In particular, if there are such economies as increasing returns to scale to these costs, retailers would be more prone to coordinate price changes across multiple brands. At the same time, it is unclear if these economies would necessarily lead to price coordination in the sense of synchronization. For example, it may be possible for retailers to incur a fixed decision cost which would dictate whether the synchronized or the staggered patterns would be deployed. As Sheshinski and Weiss (1992) point out – price synchronization (or lack thereof) could very well depend on whether the nature of the costs is dominated by the physical or the managerial components.

Our perspective also suggests that in the short run, the ability of manufacturers or retailers to rely on pricing strategies to engender tacit collusion may depend on these costs. For instance, Lal (1990) suggests that trade promotions can be an instrument for tacit collusion

across national brand manufacturers. This assumes that all the firms do not face substantial costs of price adjustment otherwise this may not be feasible. Similarly, the mechanism of price matching guarantees to engender tacit collusion (Hess and Gerstner 1991;Chen et al. 2001) relies on minimal costs of adjustment to make this strategy feasible.

Despite the apparent implications for pricing decisions, we know very little about the role of price adjustment costs in the price coordination decisions. We therefore call for more investigations – both empirical research to map the descriptive parameters of the relationships, as well as theoretical research to create a framework to interpret the direct and indirect effects of these costs on price coordination outcomes.

Interaction with other marketing mix adjustments

In the preceding paragraphs, we have highlighted some of the key tactical domains where price adjustment costs may impact the marketer's pricing decisions. But pricing is only a part of the broader marketing strategy and cannot be calibrated in isolation. The notion that the marketing mix variables are correlated is well-accepted in marketing. Given the historically scant attention given to price adjustment costs in marketing, our knowledge of how price adjustment costs interact with the other marketing variables is also very limited. Specifically, how price adjustment costs impact rigidities in product introductions/innovations and/or channel structure is not explored.

It stands to reason that if price is a main marketing tool in the value exchange process, any rigidity in prices would impact other marketing mix decision. Examples of such interactions abound. When Virgin Mobile introduced their new product in America, the key value proposed was a non-complex, no-contract pricing plan. The more established incumbents in the mobile market were not able to change their price format to compete with Virgin, because of the

managerial and customers costs they would have had to incur to make that change. Similarly, changes from HI-LO pricing to EDLP pricing may call for major changes in the channel arrangements (e.g. EDLPP – Every Day Low Purchase Price – see Hoch et al. 1994). As Sears found out much to their grief such a move is not just a matter of changing price forms.

IV. Conclusion

In this paper, we review the literature in marketing and economics to summarize what we know about the nature, magnitude and the broad impact of price adjustment costs. We then identify some areas of pricing that are of particular interest to marketers where considerations of price adjustment costs are likely to yield insight. Our basic conclusion is that there are significant domains of pricing decisions that are under-researched from the perspective of price adjustment costs. We believe more explicit consideration of these costs will lead not only to greater understanding of pricing but to better pricing decisions as well. We also believe that this offers an exciting interdisciplinary research opportunity of fundamental importance to the business and economics disciplines, where marketers can play a leading role. Therefore, we urge marketers to pay more attention to the evolving literature on the costs of price adjustment.

At the same time, we do not mean to suggest that the study of these costs is a panacea or the only route to study pricing in the marketing literature. Many issues are better studied without consideration of these complexities. Moreover, while price rigidity is a key outcome of price adjustment costs, these costs are only one explanation for price rigidity in the literature. Our goal here is to generate consideration of these costs and their implications for researchers interested in studying the dynamics of pricing. We feel the research in marketing, economics and many related business disciplines will benefit greatly from such an approach.

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