

# On the Incidence and Variety of Low-Price Guarantees\*

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## Abstract

We provide evidence of the widespread use and variety of low-price guarantees (how common are they; on what products and services are they observed; and what forms do they take), using data obtained from newspaper advertisements in thirty-seven metropolitan areas in the United States. We also consider why firms adopt LPGs. Is it to facilitate tacit collusion, to price discriminate, or do firms have other motivations? Do price-beating guarantees serve the same purpose as price-matching guarantees? We infer the answers to these questions from (a) the extent to which firms place restrictions on their LPGs; (b) whether LPGs apply to advertised prices or actual selling prices, and (c) whether firms with LPGs have higher or lower prices than firms without LPGs. We also uncover aspects of LPGs that have not previously been studied, e.g., 43% of all LPGs allow post-sale search. Our findings suggest topics for future research.

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# 1 Introduction.

Casual observation suggests that low-price guarantees (LPGs), in which retailers promise not to be undersold, have become increasingly common. Whereas once they were adopted only by appliance and hardware stores, they are now observed in many diverse markets including books, toys, tires, office products, groceries, and consumer electronics. It is not surprising, therefore, that an extensive theoretical literature has arisen to debate their competitive effects. Beginning with Hay (1982), and continuing with Salop (1986) and Dixit and Nalebuff (1991), the dominant view in this literature is that LPGs facilitate tacit collusion. Recently, this view has been extended by Edlin (1998) and Edlin and Emch (1999), who argue that LPGs can in addition induce inefficient entry.

In contrast to the extensive theoretical literature, the only published empirical work on the topic is Hess and Gerstner's (1991) time-series analysis of supermarket pricing following the adoption of an LPG by one of the firms in their sample. Hess and Gerstner's study, which finds that prices rose slightly after the LPG was adopted, focuses on a single market (groceries) in which two firms promise to match the prices of a third firm. In an unpublished piece, using a different dataset, Manez (1999) finds evidence of the opposite effect. Supermarket prices in his study decreased following the adoption of an LPG by one of the firms. The data in the two studies are separated in time, span countries, and perhaps most importantly, apply to different kinds of LPGs.

In the dataset which is to be analyzed in this paper, we observe a wide variety of LPGs across many markets. Some promise to match a competitor's price, others promise to beat a competitor's price. Some LPGs apply to advertised prices only, some apply to legitimate prices, and others apply to a competitor's best deal. Some LPGs allow consumers to search for lower prices post-sale—anywhere from two days to the lifetime of the product; the majority do not. Of the ones that do allow post-sale search, some include their own future prices, others do not. Some LPGs require consumers to provide written proof of a competitor's lower price or to seek out a store manager; others restrict

the applicability of their LPGs to certain products, competitors, or geographic areas.

The literature has tended to gloss over these differences as if they were inconsequential.<sup>1</sup> However, we think these differences are important, and our primary goal is to show this using data from sixty-one Sunday newspapers. In all we have collected five-hundred fifteen low-price guarantees from retail outlets in thirty-seven metropolitan areas in the United States. Our analysis builds around several motivating questions. Why do firms adopt LPGs? Is it to facilitate tacit collusion, to price discriminate, or do firms have other motivations? Do price-matching and price-beating guarantees serve the same purpose, or are there differences between them that lead to different competitive outcomes? We infer the answers to these questions from whether or not firms allow post-sale search and from the answers to the following three questions motivated from theory.

First, we ask to what extent do firms place restrictions on their LPGs? We posit that restrictions mitigate risk on the one hand, but add to consumers' hassle costs on the other. Hviid and Shaffer (1999) have shown that hassle costs may undermine the ability of LPGs to support supracompetitive prices—at the same time, however, hassle costs may not be detrimental if firms adopt LPGs for other reasons, e.g., to price discriminate (because then hassle costs may help to induce self-selection). Thus, all else equal, we would expect firms that adopt LPGs to facilitate tacit collusion to have fewer restrictions than firms that adopt LPGs for some other purpose, e.g., to price discriminate.

Second, we ask do LPGs apply to advertised prices or selling prices? Corts (1995) and Hviid and Shaffer (1994) have shown that if LPGs apply to advertised prices only, then an overcutting strategy in which a firm raises its price and adopts a price-beating guarantee (thus lowering its selling price) undermines the ability of LPGs to support collusive prices. On the other hand, overcutting is not profitable if firms match or beat selling prices. Thus, all else equal, we would expect firms that adopt LPGs to facilitate tacit collusion to promise to match or beat rivals' selling prices.

Third, we ask do firms with LPGs have higher or lower prices than firms without

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<sup>1</sup>Sivakumar and Weigand (1996) have also noted differences in the wording of LPGs, but it is not their focus.

LPGs? We conjecture that, for any two firms in a market, if one firm has an LPG and the other does not, then the firm with the LPG should have a weakly higher price (strictly higher if the purpose is to price discriminate among consumers of the two firms). Thus, all else equal, we would expect firms that adopt LPGs to have weakly higher prices than firms in the same market that do not have LPGs.

Our findings suggest that price-beating guarantees are typically not adopted to facilitate tacit collusion. Price-beating guarantees tend to have more restrictions than price-matching guarantees and apply disproportionately more to advertised prices. In addition, on identical items, when we compare the prices of firms that have LPGs with the prices of firms that do not, (we collected advertisements from all tire dealers whether or not they had an LPG), we find that the firms with price-matching guarantees have an equal or higher price in 67% (24/36) of the cases, whereas the firms with price-beating guarantees have an equal or higher price in only 40% (40/99) of the cases.

Why then do firms adopt price-beating guarantees? Surprisingly, we find that whereas only 22% (72/325) of price-matching guarantees allow consumers to search for lower prices post-sale, more than 90% (147/163) of price-beating guarantees have this feature. Thus, we conjecture the answer may be linked to the answer of a second question: why do firms allow post-sale search?

We posit that firms allow post-sale search to induce consumers to ‘buy now rather than wait.’ One reason consumers may prefer to wait is if they expect a product to go on sale in the future. Another reason is if they are in the midst of searching the competition and believe they might find a lower price elsewhere. In both instances LPGs that allow post-sale search may induce consumers to accelerate their purchase decisions. However, we would expect the LPGs to differ in content, e.g., a firm might be more likely to combine its LPG with a most-favored-customer clause and allow for longer search time if it believes that consumers are concerned about the product going on sale in the future than if prices are relatively stable and consumers are reluctant to purchase because they have yet to finish their comparison shopping. The evidence supports this conjecture.

Our second goal is to document the widespread use and variety of LPGs (how common are they; on what products and services are they observed; and what forms do they take). We find that the LPGs in our sample apply to a large number of products and services, including big-ticket items (e.g., cars and computers), and small ticket items (e.g., books and office products). They apply to seasonal products (e.g., christmas decorations) and to year-round services (e.g., dry cleaning). Some of the items can easily be compared across stores (e.g., cameras and software), while other items (e.g., mattresses and hotel accommodations) are not as easily compared across stores. In all, there are more than fifty categories of products and services in our sample to which LPGs apply.<sup>2</sup>

Our third goal is to motivate future research in this area. First, the theoretical literature focuses on static one-period models in which the game ends when consumers make their purchases; however, we find that 43% of all LPGs allow consumers to search for lower prices post-sale. This suggests that, in these circumstances, a dynamic model might be more appropriate. In these dynamic models, the theoretical challenge is to explain (a) why such a large (small) proportion of price-beating (price-matching) guarantees allow post-sale search, and (b) why firms with these LPGs often have lower equilibrium prices than firms that do not have LPGs. Second, the literature has not considered why firms might combine LPGs with most-favored customer clauses. Is it, as we suggest in this paper, to induce consumers to buy now rather than wait for a future sale? Finally, we ask why do firms offer before-purchase LPGs that differ from their after-purchase LPGs.

Section 2 describes the data. Section 3 classifies the LPGs as either price-matching or price-beating. Section 4 identifies the various kinds of restrictions firms place on their guarantees. Section 5 considers whether LPGs apply to rivals' advertised prices or actual selling prices. Section 6 focuses on the role of post-sale search. Section 7 analyses the

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<sup>2</sup>Other products and services include: air-conditioning units, kitchen appliances, audio/video components, auto-parts, baths, beds, blinds, burials, carpets, cellular phones, compact discs, contact lenses, diamonds, golfing accessories, vacation tours, doors, draperies, electronics, eyeglasses, exercise equipment, furniture, game accessories, home heating, home gardening, housewares, jewelry, liquors, lumber, paintings, pharmaceuticals, pool tables, satellite TVs, shoes, tires, and toys.

tire data. Section 8 concludes.

## 2 Data Description.

The data was collected from sixty-one Sunday newspapers from cities throughout the United States. The dates of the newspapers, which were back issues of unsold stock of a national retailing chain, range from September 29, 1996 to December 8, 1996. The majority are from December 1, 1996.<sup>3</sup>

Table 1 shows the frequency distribution of LPGs per newspaper, e.g., we found between seventeen and twenty LPGs in 7% of the newspapers and five to eight LPGs in 44% of the newspapers. On average, we found 8.4 LPGs per newspaper, with a minimum of one and a maximum of twenty.

**Table 1. Frequency of LPGs per Newspaper.**

Number of LPGs	1 – 4	5 – 8	9 – 12	13 – 16	17 – 20
Frequency	15%	44%	21%	13%	7%

There are thirty-seven cities represented in our sample. The names of the cities, and the mean number of LPGs found in each city’s newspapers, are shown in Figure 1. Some firms advertise LPGs in more than one metropolitan area (e.g., we have LPGs from *Circuit City* in sixteen different cities). A few firms advertise multiple LPGs on the same date in the same city (e.g., *Office Max*). In all we have five-hundred fifteen low-price guarantees from two-hundred thirty-four different firms.

For each LPG, we have collected information about the actual wording of the guarantee, e.g., does the LPG promise to *match* or *beat* rivals’ prices, is *post-sale search* allowed, and are *most-favored-customer clauses* included. We have also noted all the restrictions in the fine print, and taken care to record to what the LPG applies, *advertised* prices or *selling* prices.

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<sup>3</sup>We have twenty-nine newspapers from December 1, twelve newspapers from November 10, three newspapers from September 29, one newspaper from December 8, and four newspapers from each of the remaining Sundays.

Figure 1: Map of U.S. Indicating Cities for Which We Have Newspapers

One potential source of bias in the data is the representativeness of the included cities. To address this issue, we looked at the circulation figures in 1996 of the top fifty U.S. Sunday newspapers, of which twenty-seven are in our dataset, and the circulation figures in 1996 of the top twenty-five U.S. Sunday newspapers, of which eighteen are in our dataset.<sup>4</sup> As it turns out, the mean and variance of the circulation of the top twenty-seven (eighteen) newspapers in our sample are not significantly different from the mean and variance of the circulation of the top fifty (twenty-five) U.S. Sunday newspapers, with a value for the t-test of 0.824 and a value for the F-test of 1.128.

Another potential source of bias in the data arises because of the time of year covered by our sample. We have observations for several Sundays prior to the U.S. holiday of Thanksgiving (November 28, 1996) and for a few Sundays thereafter. Given that the Thanksgiving holiday marks the beginning of the Christmas holiday shopping season,

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<sup>4</sup>The missing top 25 newspapers (with their ranking by circulation in parenthesis) are: New York Times (1), New York Daily News (5), Long Island Newsday (13), San Francisco Examiner and Chronicle (14), Newark Star-Ledger (15), Cleveland Plain Dealer (18) and Chicago Sun-Times (25). See the Wall Street Journal Almanac, 1998.

it is reasonable to think that there may be some bias introduced by pooling the whole sample. Table 2 presents the mean and variance of the number of LPGs per newspaper for the period before and after the Thanksgiving holiday.

**Table 2. Seasonal variation in LPGs per newspaper.**

	Average	Variance	No. of Newspapers	F-test	t-test
Before Thanksgiving	8.42	20.25	31	1.02	-0.04
After Thanksgiving	8.47	19.84	30		

Neither test statistic is significant and, hence, we cannot reject the hypothesis that the two subsamples have the same mean and variance. Thus, we will use the full sample in what follows.

### 3 Classification of Low-Price Guarantees.

LPGs can be classified as either price-matching, **PM**, or price-beating, **PB**. Under **PM**, a firm promises to match any lower price by a competitor (refund 100% of the price difference). Under **PB**, a firm promises to beat any lower price by a competitor, or, in some cases, to beat *any* price.<sup>5</sup> Much of the literature focuses either on **PM**<sup>6</sup> or a particular kind of **PB**, price-beating by a percentage of the difference in prices.<sup>7</sup> But there are actually three types of price-beating guarantees:

- 1) **PB%dif**: Beat a competitor’s lower price by  $\lambda\%$  of the price difference.

“If, within 30 days of your purchase from Best Buy, you find a local competitor offering a lower price on an available product of the same brand and model, we’ll refund the difference plus another 10% of the difference.”

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<sup>5</sup>For now, we leave the word ‘price’ vague on purpose. Later we will distinguish between LPGs that apply only to advertised prices and LPGs that apply to a rival’s selling price.

<sup>6</sup>This was especially true of the earlier literature, e.g., Salop (1986), Kalai and Satterthwaite (1986), Png and Hirschleifer (1987), Doyle (1988), Logan and Lutter (1989). These articles showed that **PM** could lead to monopoly pricing in a variety of circumstances. More recently, Zhang (1995) extends these ideas to show that **PM** may restore incentives to minimally differentiate in Hotelling space, and Edlin (1998) and Edlin and Emch (1999) argue that the adverse welfare effects of **PM** merit antitrust attention. But see Hviid and Shaffer (1999) for a critique.

<sup>7</sup>Belton (1987) looks at competitor-based pricing formulas; his findings support the tacit collusion story. However, Corts (1995) and Hviid and Shaffer (1994), show that his results, and that of the **PM** literature, are sensitive to what firms promise to match or beat. Corts (1996) argues that LPGs are adopted to price discriminate among consumers.



2) **PB%**: Beat competitor prices by  $\phi\%$  (or beat any lower price by  $\phi\%$ ).

“Try to beat us—but you won’t. We guarantee to beat local competition by 3% for identical product. Price guarantee for non-sale retail prices only.”

3) **PB\$**: Beat competitor prices by  $\$X$  (or beat any lower price by  $\$X$ ).

“Search this newspaper for the best price you can find on a new Ford, because ... Person Ford/KIA will beat any advertised price by: \$500! Guaranteed!”<sup>8</sup>

The incidence of each type of LPG is presented in Table 3, where both the total and relative number of LPGs and number of firms offering a given type of LPG is shown.

**Table 3. Incidence of LPGs.**

	Price-Matching <b>PM</b>	Price-Beating			Total
		<b>PB%dif</b>	<b>PB%</b>	<b>PB\$</b>	
LPGs	325 (63%)	163 (32%)	21 (4%)	6 (1%)	515
Firms	182 (73%)	48 (19%)	12 (5%)	6 (2%)	248

As we might expect from the literature’s focus, the most common type of low-price guarantee is **PM**, which occurs in nearly two-thirds of the LPGs and is adopted by almost three-fourths of the firms, and the most common type of price-beating guarantee is **PB%dif**, which occurs in nearly one-third of the LPGs and is adopted by almost one-fifth of the firms. Either **PM** or **PB%dif** is adopted by 92% of all firms and account for 95% of all LPGs in our sample.<sup>9</sup>

In determining the total number of LPGs, we have not counted advertisements in which firms simply stated that their prices were unbeatable. Instead, we included in Table 3 only advertisements in which a firm either ‘promised’ low prices or ‘guaranteed’ low prices.

If the wording of the LPG was ambiguous, as when a firm promised to beat any rival’s price but did not say by how much, we classified the LPG as **PM**. Some LPGs

<sup>8</sup>Ads are for *Best Buy*, insert, Detroit News, October 13, 1996; *Micro Direct*, page 8A, Dayton Daily News, December 1, 1996; and *Person Ford/KIA*, insert, Los Angeles Times, December 1, 1996.

<sup>9</sup>Note that the total number of firms (248) in the last column of Table 3 differs from the total number of firms in the sample (234) because some firms’ LPGs differ by city and/or date.

had elements of both **PM** and **PB**. For instance, some firms promised to match a competitor’s lower price if requested by the consumer prior to purchase and to beat a competitor’s lower price if requested by the consumer afterward. Because an informed consumer can always buy the product before requesting a refund, thereby qualifying for the higher refund, we classified these LPGs by their after-purchase guarantee.

We assume firms honor their guarantees in good faith, provided all restrictions are satisfied. One issue discussed in Baye and Kovenock (1994) is the extent to which LPGs are legally binding and what the damages would be in the event of breach. We find thirty-eight cases in which firms try to clarify this by including a penalty clause in their LPG, e.g., “We guarantee to beat any deal from any local competitor on the name brand or model that we sell or give you a \$100 reward!”<sup>10</sup> All but one is **PM**. The penalties for breach range from \$50 to \$2000, one involves a \$400 donation to the consumer’s favorite charity, two involve a promise to buy back the merchandise (these involve car dealers), and three promise to give the good away for free if they fail to honor their guarantee.

### 3.1 More Detail on Price-Beating Guarantees

Price-beating guarantees vary widely in the extent to which firms promise to beat their competitors’ prices. We consider each type of price-beating guarantee separately below.

#### 3.1.1 **PB%dif: Refund $(100 + \lambda)\%$ of the price difference.**

Table 4 shows the variation of  $\lambda$  in **PB%dif**. The most popular price-beating percentages are 110% (which is adopted by 25% (12/48) of the firms) and 150% (which is adopted by 27% (13/48) of the firms). However, nearly half of all firms specify some other price-beating percentage—and the range is striking:  $\lambda$  varies from a low of 5 (2 firms) to a high of 210 (2 firms).

**Table 4. Variation in PB%dif.**

$(100 + \lambda)$	105	110	115	125	130	150	155	200	250	310	Total
LPGs	2	54	1	17	3	47	17	16	4	2	163
Firms	2	12	1	8	1	13	2	6	1	2	48

<sup>10</sup>An ad for *Steinberg*, taken from page B8, Lexington Herald-Leader, December 1, 1996.

The **PB%dif**s of the three office products superstores are interesting in that while they have similar price-beating percentages and specify a maximum refund, only *OfficeMax*'s **PB%dif** differentiates between “office products superstores” and “non-office products superstores”:

“If you find an identical item advertised by any other office products superstore for less, within seven days of your OfficeMax purchase, we will match their price and give you a credit for 55% of the difference (up to \$55). We'll match any other non-office products superstore's advertised price on an identical item or we'll refund the difference if the item was purchased from us within seven days of the competitor's ad.

Why does *OfficeMax* make this distinction? Is it concerned that non-office products superstores may use office products as loss leaders and cross-subsidize their lower prices in ways that it cannot?<sup>11</sup> If so, then why don't *Staples* and *Office Depot* also single out non-office products superstores?

Some firms vary the terms of their **PB%dif**s across products and for special events, e.g.,

“We'll match any store's advertised price at the time of your *Montgomery Ward* merchandise purchase! ... In Electric Avenue, Auto Express and for other specific items identified in our advertising and/or in our stores, we'll beat our competitor's price by crediting or refunding 110% of the difference—and during special events, for specified items, even greater amounts, up to 150%!”<sup>12</sup>

In this instance, *Montgomery Ward* specifies price-matching on some items, price-beating by 110% of the difference on other items, and, during special events, for some items, price-beating by up to 150%. Why? It may be that these differences are driven by competitive pressures. LPGs are often adopted by firms selling electronics, auto

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<sup>11</sup>Another possibility is that *OfficeMax* may believe that coordination difficulties are more easily surmounted among office-products superstores. We thank Kai-Uwe Kuhn for suggesting this possibility. Alternatively, competition may be more intense in non-office products and not all competitors can be trusted to follow ‘reasonably high prices’.

<sup>12</sup>The LPGs in this subsection come from, respectively, an ad for *OfficeMax*, insert, *Tulsa World*, November 17, 1996, and an ad for *Montgomery Ward*, insert, *The Detroit News*, October 13, 1996.

parts/services, and tires, whereas they are less commonly adopted by firms selling some of the other items carried by *Montgomery Ward*.

### 3.1.2 PB%: Beat competitor prices by $\phi\%$ (or beat lower prices by $\phi\%$ ).

There are twenty-one **PB%** (12 firms).<sup>13</sup> Nine **PB%** (5 firms) promise to beat by  $\phi\%$  any price by a competitor, e.g., “We’ll beat any competitor’s total price by 10%.” The other twelve **PB%** (7 firms) promise to beat a competitor’s price by  $\phi\%$  if the competitor has a lower price, e.g., “If you see a lower price on any item that we stock, even if it is an advertised sale, we won’t just meet it ... we’ll beat it by 10%.”<sup>14</sup> Table 5 shows the variation in  $\phi$ .

**Table 5. Variation in PB%.**

	3%	5%	10%	15%	Total
LPGs	2	4	14	1	21
Firms	1	2	8	1	12

Of the fourteen **PB%** (8 firms) that specify  $\phi = 10$ , seven (4 firms) promise to beat competitor prices while the other seven (4 firms) apply only if the competitor has a lower price. The two **PB%** (1 firm) that specify  $\phi = 3$  are contingent on the competitor having a lower price while the five **PB%** that specify  $\phi = 5$  (2 firms) and  $\phi = 15$  (1 firm) are not. One interesting case is that of *Brake World*, whose LPGs appear in two different columns in Table 5. One LPG promises to beat competitor prices by  $\phi = 10\%$ , and another promises to beat competitor prices by  $\phi = 15$ .<sup>15</sup>

Another interesting case is that of *Tire Kingdom*, whose four LPGs promise to beat a competitor’s lower price by 10% at the point-of-purchase and by 250% for up to thirty

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<sup>13</sup>Chen (1995) looks at a two-stage game in which firms choose LPGs in the first stage and prices in the second stage. He finds that **PB%** can arise in subgame perfect equilibria and support monopoly pricing.

<sup>14</sup>An ad for *Discount Tire Express*, page 12C; and *Hi-Gear*, insert, The Baltimore Sun, November 24, 1996.

<sup>15</sup>See the ads for *Brake World*, pp. 32,33, Fort Lauderdale Sun-Sentinel, November 10, 1996. Surprisingly, both LPGs appear in the same newspaper on the same date (they apply to different store locations). In addition, *Brake World* has two other ads also in the same newspaper (again different locations) that do not advertise an LPG.

days afterwards.<sup>16</sup> Its LPGs thus have elements of both **PB%** and **PB%dif**. We have classified these guarantees according to their after-purchase promise. By not including them in Table 5, we implicitly assume that *Tire Kingdom*'s price is more than 1.04 times the lowest price among its competitors.<sup>17</sup>

### 3.1.3 **PB\$**: Beat competitor prices by $\$X$ (or beat lower prices by $\$X$ ).

There are six **PB\$** (6 firms).<sup>18</sup> Two of the **PB\$** are triggered only if a competitor has a lower price. One is from an optician promising to match a lower price plus give an extra \$10. The other is from a computer store offering to match any lower price plus give a lump-sum of \$50. The other four **PB\$** (all from car dealers) promise to beat competitor prices, e.g.,

“For \$500 less guarantee bring in any other Ford dealers ad from any newspaper dated 11/7/96 or before and we will beat the lowest new vehicle advertised price on an identically equipped, in stock new vehicle. Excludes currently advertised vehicles.”<sup>19</sup>

Here we see two provisions that help to mitigate the riskiness of **PB\$**. First, although the advertisement is dated November 10, 1996, the LPG applies only to competitor prices dated November 7, 1996. Thus, the LPG is ‘backward-looking’. This reduces the possibility that the firm might have to beat an unexpectedly low price by a rival—it can check all competitor ads prior to running its own ad. Second, the LPG is based on advertised prices (as opposed to selling prices), thus ensuring that the ads do not trigger any “price-wars”—**PB\$**'s based on competitors' selling prices invariably lead to a downward spiraling of prices if two or more firms have such guarantees.

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<sup>16</sup>The ad reads “Before You Buy! Our Low Prices are Unbeatable. If You Can Find Lower Prices, We'll Beat 'Em By 10%!” “After You Buy! If You See Your Tires Advertised Locally For Less Than You Paid Within 30 Days of Your Purchase, We'll Refund You 250% of the Difference!”. (The Tampa Tribune-Times, December 1, 1996)

<sup>17</sup>Let  $P_x$  denote *Tire Kingdom*'s price and  $P_y$  denote the lowest price among its competitors. Then, a consumer who requests a refund from *Tire Kingdom* at the time of purchase obtains a net price of  $.9P_y$  while a consumer who requests a refund from *Tire Kingdom* after the purchase obtains a net price of  $P_y - 2.5(P_x - P_y)$ . Thus, the “after” deal is better for the consumer if and only if *Tire Kingdom*'s price is more than 1.04 times the competitor price.

<sup>18</sup>Baye and Kovenock (1994) show that **PB\$** can lead to monopoly pricing. Arbatskaya (1999) shows that certain kinds of **PB\$** and **PB%** can deter entry.

<sup>19</sup>An ad for *Bill Pierre's Ford City*, insert, Seattle Times, Nov. 10, 1996.

## 4 Restrictions on LPGs

In this section, we will continue to focus on how firms can choose the wording of their guarantees to mitigate risk, but we will henceforth ignore **PB\$** because of their small numbers.

Consider the following story from the *London Times*, February 3, 1998. *Tesco*, a supermarket chain in the U.K., was selling a certain brand of sport socks at a package price of £8 and had a **PB%dif** of 200%. The owner of *Essential Sports*, a small sporting goods store, was unhappy with *Tesco*'s price and decided to sell the same brand of sports socks at a package price of 10p. When consumers arrived at his store, the owner recommended to them that they buy their socks instead at the local *Tesco* store, where they could obtain a matching price plus claim a refund of £7.9. For its entire inventory of sport socks that day, *Tesco*'s incurred an out-of-pocket cost of -£7.8/package.

Had *Tesco* adopted instead **PM** or **PB%**, its package price would have been at or near 10p. While still below the original list price of £8 (what *Tesco* thought it was going to get per package), it would have been less than the actual out-of-pocket cost that *Tesco* ended up paying. In general, a firm that adopts **PB%dif** may face a greater risk in the event of an unanticipated price cut by rivals than a firm that adopts **PM** or **PB%**.<sup>20</sup> To see this, note that for two firms  $X$  and  $Y$ , if  $P_y < P_x$ , a unit decrease in  $P_y$  would cause firm  $X$ 's selling price to fall by less than one ( $1 - \phi$ ) if it has **PB%**, exactly one if it has **PM**, and by more than one ( $1 + \lambda$ ) if it has **PB%dif**.

Alternatively, *Tesco* could have mitigated its losses by adding 'fine print' to its LPG. Among the possibilities, it could have required that the products be identical (this might apply if there were differences in packaging), that the offer not be 'one of a kind', and that the item be in stock. The latter restriction, in particular, could have been combined with a requirement that consumers bring written proof of the rival's lower price (if *Tesco*

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<sup>20</sup>Another consideration that may affect the choice of LPG is that with **PB%dif** and **PM** a firm has some control over the amount of its refund: it can always charge the same price as its rival and then there will be no refund due. With **PB%**, a firm cannot fully control its refund: it is determined by the rival's price.

requires that the lower price be advertised in advance, then its employees can be on hand at the start of the day to buy out *Essential Sport's* entire stock, thus rendering the latter's LPG invalid). Moreover, with sufficient foresight, Tesco could have prevented its losses altogether by excluding *Essential Sports* and/or the offending sport socks from the list of competitors and products to which its LPG applied.

By its choice of LPG, and the restrictions it places on the LPG, a firm can mitigate its losses in the event of an unanticipated price cut by rivals. If **PB%dif** is associated with greater risk than **PM** or **PB%**, then, all else equal, we would expect it to have a larger number of restrictions.

To test this hypothesis, we have systematically gone through the fine print of all LPGs in our sample and identified nine types of restrictions, which we organize into three groups. The first group consists of restrictions that impose extra time costs on consumers.

- (1) The consumer must supply proof of a competitor's lower price in 30.1% (155/515) of the LPGs, e.g., an LPG might state "bring us the ad", or "must supply written proof of a lower price."
- (2) Customers are instructed in 30.7% (158/515) of the LPGs to seek out particular employees in the store when requesting refunds, e.g., (a) a "customer services representative"; (b) the "service desk"; (c) a "manager"; (d) the "pharmacist", or (e) "trained experts".

In the first case, the firm requires consumers to provide proof of a competitor's lower price before granting the refund. In the second case, a store employee verifies that the conditions of its LPG have been satisfied, e.g., it might call the rival firm for a price quote. We find that 54.4% (280/515) of all LPGs have at least one of these two restrictions; 6.4% (33/515) of LPGs have both.

The next three restrictions are aimed at competitors, products, and/or geographical areas. We find that 65.2% (336/515) of all LPGs have at least one of these three restrictions.

- (3) Restrictions on which goods are covered by a firm's guarantee are mentioned in 49.3% (254/515) of the LPGs, e.g., "turkeys" or "Michelin Tires". Alternatively,

a firm might single out a specific item for exclusion from its LPG, e.g., “cellular phones.”

- (4) Restrictions on which competitors are covered by the firm’s guarantee are mentioned in 40.4% (208/515) of the LPGs, e.g., “authorized retail store only”.
- (5) Restrictions on the geographical area to which a firm’s guarantee applies are mentioned in 35.5% (183/515) of the LPGs, e.g., “a three-mile radius.”

Restrictions ‘6’ through ‘9’ are of a more miscellaneous nature, with the store manager often being the arbiter. At least one of four restrictions occurs in 53.4% (275/515) of all LPGs.

- (6) The products have to be identical in 31.7% (163/515) of the LPGs.
- (7) The product has to be in the competitor’s stock in 23.1% (119/515) of the LPGs.
- (8) Exceptions such as “floor samples”, “bonus offers”, “one of a kind offers”, and “special rebate offers” are made explicit in 35% (180/515) of the LPGs.
- (9) The firm absolves itself of any errors in its ads in 20.6% (106/515) of the LPGs.

Table 6 gives the percentage occurrence of each restriction by type of guarantee, e.g., restriction “1” (consumer must supply proof of a competitor’s lower price) occurs in 22.2% of **PM**, 43.6% of **PB%dif**, and 38.1% of **PB%**. No restriction occurs in every guarantee. The two most common restrictions are the limitations on competitors, restriction “3”, and the limitations on geographical areas, restriction “5”, which occur in 74.2% and 70.6% of all **PB%dif** respectively.

**Table 6. Percentage of LPGs with the Various Restrictions.**

	Restriction Number									# Obs.
	“1”	“2”	“3”	“4”	“5”	“6”	“7”	“8”	“9”	
All LPGs	30.1	30.7	49.3	40.4	35.5	31.7	23.1	35.0	20.6	515
<b>PM</b>	22.2	23.7	36.9	33.5	19.7	23.7	17.8	23.7	18.5	325
<b>PB%dif</b>	43.6	46.0	74.2	56.4	70.6	49.1	35.6	60.1	23.9	163
<b>PB%</b>	38.1	28.6	38.1	19.0	14.3	14.3	0.0	19.0	33.3	21



The **PB%dif** percentages are highest on eight of the nine restrictions and, in many instances, they are more than twice as large as the **PM** and **PB%** percentages. In fact, aside from restriction “9”, the *least* common restriction among **PB%dif** occurs almost with the same frequency as the *most* common restriction among **PM** and **PB%** (35.6% vs 36.9% and 38.1%, respectively). These results are consistent with the hypothesis that **PB%dif** is associated with the most risk.<sup>21</sup>

#### 4.1 Hassle Costs and Why Firms Adopt LPGs

It may seem puzzling that the percentages are not higher; if restrictions limit a firm’s risk then why don’t firms impose them without bound? The problem is that, at some point, there is a tradeoff between mitigating risk and diminishing the effectiveness of the LPG. For example, an LPG can become meaningless if the number of restrictions is large enough, e.g., a firm can promise to match prices but then exclude every one of its competitors. Thus, a more interesting question is what determines where this tradeoff occurs? We think the answer depends on why firms adopt LPGs.

In addition to mitigating risk (to the benefit of firms), restrictions in an LPG also add to consumers’ hassle costs (to the possible detriment of firms). From a consumer’s perspective, whether to request a refund is a cost-benefit calculation. The expected benefit is equal to the promised refund if all restrictions are satisfied times the likelihood of obtaining it—which is decreasing in the number of restrictions. Restrictions on the competitors, products, and geographical areas to which a firm’s LPG applies, and requirements that the products be identical and in the competitor’s stock, for example, decrease the likelihood that a refund request will be granted, and thus reduce a consumer’s expected benefit. The expected cost of requesting a refund is increasing in the number of restrictions. For example, having to supply written proof of a competitor’s lower price imposes costs on consumers similar to that imposed on consumers when they

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<sup>21</sup>The mean number of restrictions for the entire sample of LPGs is 2.96. The mean is lower for **PM** (2.20) and **PB%** (2.05) and higher for **PB%dif** (4.60). The difference between the subsample means for **PB%dif** and **PM** and between **PB%dif** and **PB%** are both significant at the 1% level with *t*-statistics of 11.28 and 5.18 respectively. The difference between the subsample means for **PM** and **PB%** is not significant.

use coupons, and requiring consumers to seek out a store manager instead of allowing consumers to request refunds at the check-out counter lengthens the time consumers can expect to spend at the store.

In short restrictions increase consumers' hassle and make it less likely that consumers will want to request refunds. Another way of saying this is that, for a given hassle, there exists a price difference small enough such that we would not expect consumers to request refunds. As Hviid and Shaffer (1999) show, this can undermine the ability of LPGs to support tacit collusion. To see this, suppose one firm advertises a price of \$100 and another firm—selling an identical product—undercuts by a penny, i.e., advertises a price of \$99.99. Unless consumers are willing to buy from the higher priced firm and incur hassle costs in requesting their one penny refund (i.e., unless hassle costs are less than one penny), the price-cut will be profitable. Each firm thus has an incentive to undercut the other, implying that in equilibrium prices will be driven down to marginal cost.

From the firms' perspective, therefore, the optimal number of restrictions absent risk concerns is zero—if LPGs are adopted to facilitate tacit collusion. However, if firms adopt LPGs for some other purpose, e.g., to price discriminate among consumers (those who request refunds pay lower prices), then zero hassle costs may not be optimal even if there is no risk. The reason is that some hassle costs may be needed to induce self-selection among consumers, so that only the more price-sensitive consumers end up requesting refunds. For example, only the more price-sensitive consumers will be willing to take the time to supply written proof of a competitor's lower price and to spend the extra time required to seek out a store manager. Thus, the same restrictions that create hassle costs to the detriment of firms above, may also create hassle costs to their benefit.

However, even if LPGs are adopted for price discrimination purposes, a firm still does not want to increase hassle costs without bound (because then no one will request refunds), and so at some point the firm must face a balancing between risk considerations on the one hand (for which a firm would want to increase its restrictions without bound)

and hassle cost considerations on the other. We conjecture that where this line is drawn may offer clues about an LPGs intended purpose. In particular, for a given level of risk, we would expect LPGs that are adopted to facilitate tacit collusion to have fewer restrictions than LPGs that are adopted for some other purpose.

Thus, our finding in Table 6, that **PB%dif** tend to have significantly more restrictions than **PM** and **PB%**, has more than one explanation. First, **PB%dif** may be inherently riskier independent of purpose. If this is correct, then presumably **PB%dif** have some offsetting advantages that compensate for the increased risk. Second, independent of risk, **PB%dif** may on balance be serving a different purpose. If this is correct, then we can conclude that the majority of **PB%dif** are not being adopted to facilitate tacit collusion. Of course, both explanations can be true. It may be that **PB%dif** are both riskier and serve different purposes than **PM** and **PB%low**.

## 5 Advertised Prices vs Selling Prices

In this section, we will attempt to distinguish among these explanations. The logic we will use is as follows. We will hypothesize that all LPGs serve the same purpose, and in particular, we will hypothesize that all LPGs facilitate tacit collusion—so that any differences in the number of restrictions are due to risk factors. We will then form a test to confirm or reject this hypothesis.

The issues are best understood in the context of *Newmark & Lewis*' rivalry with *Crazy Eddie*, as reported in Dixit and Nalebuff (1991). *Crazy Eddie* is contemplating a price cut despite *Newmark & Lewis*' having an LPG which reads: "If after your purchase, you find the same model advertised or available for sale for less ... we, *Newmark & Lewis*, will gladly refund (by check) 100% of the difference, plus an additional 25% of the difference." Dixit and Nalebuff ask whether *Crazy Eddie*'s price cut might be profitable, and note that if *Crazy Eddie* were to lower its price consumers would simply buy from *Newmark & Lewis* at the higher price and claim their refund worth 125% of the difference. Hence, they conclude "*Crazy Eddie* is worse off than where he started.

So why bother?”

Corts (1995) and Hviid and Shaffer (1994) argue that *Crazy Eddie* should bother if *Newmark & Lewis*’ LPG applies to advertised prices only because then, instead of undercutting, *Crazy Eddie* can profitably ‘overcut’ (adopt his own **PB%dif** and raise his advertised price). With overcutting, it is *Newmark & Lewis* who face the loss of their customers, since in doing so, *Crazy Eddie* has effectively lowered his selling price while ensuring that *Newmark & Lewis*’ LPG is not activated.<sup>22</sup>

On the other hand, if LPGs apply to selling prices, then overcutting does not work. To see this, suppose *Newmark & Lewis* advertises a price of \$100 and *Crazy Eddie* attempts to overcut by advertising a price of \$120 and adopting a **PB%dif** of 125%. Then, initially *Crazy Eddie*’s selling price drops to \$95. However, this now activates *Newmark & Lewis*’ guarantee, causing its selling price to drop from \$100 to \$93.75, which, in turn, causes *Crazy Eddie*’s selling price to fall to \$93.44, and so on, until a common final selling price of \$93.33 is reached. In this case, *Crazy Eddie* fails to obtain a lower selling price than its rival and overcutting is unprofitable.<sup>23</sup> Thus, theory suggests that tacit collusion can be supported if LPGs apply to selling prices but not otherwise.

To address this issue, we would ideally like to partition the LPGs in our sample into one or the other category. However, many of the LPGs are ambiguously worded, e.g., “We guarantee to have the lowest prices in town,” without saying more. In addition, there is no instance in which a firm uses the words “selling prices” in its LPG. Instead, of the LPGs that are not ambiguously worded, firms either use the words “*Advertised Prices*,” “*Best Deal*,” or “*Legitimate Prices*,” to indicate to which competitor prices its LPG applies. Of the latter two, the words *Best Deal* would seem to be closer in meaning to selling prices. The words *Legitimate Prices* would seem to give a firm more flexibility

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<sup>22</sup>For example, if *Newmark & Lewis*’ advertised price is \$100 and *Crazy Eddie* would like to have a price that is \$5 lower, he should advertise a price of  $\$(100 + F)$  and adopt a **PB%dif** of  $(100 + \alpha)\%$ , where  $F > 0$  and  $\frac{\alpha F}{100} = 5$  (alternatively, adopt a **PB%** of 5% or a **PB\$** with a \$5 lump-sum). The initial \$F difference in advertised prices coupled with the implied refund gives *Crazy Eddie* a selling price that is lower by \$5.

<sup>23</sup>Given two advertised prices  $P_A > P_B$  and a common **PB%dif** that refunds  $(100 + \lambda)\%$  of the difference between selling prices, where  $\lambda < 100$ , the common final selling price is given by  $P_B - \frac{\lambda}{100 - \lambda} (P_A - P_B)$ .

to respond as it wishes. Table 7 gives the breakdown of each type.

**Table 7. Advertised Prices vs. Selling Prices.**

	Advertised Prices	Best Deal	Legitimate Prices	Ambiguous	Total
All LPGs	220	58	49	188	515
<b>PM</b>	116	40	24	145	325
<b>PB%dif</b>	94	9	25	35	163
<b>PB%</b>	6	8	0	7	21

Of the five-hundred fifteen LPGs, 43% (220/515) apply to advertised prices. The percentage is lower for **PM** and higher for **PB%dif**: of the three-hundred twenty-five **PM** guarantees, 36% (116/325) apply to advertised prices, and of one-hundred sixty-three **PB%dif** guarantees, 56% (94/163) apply to advertised prices. We think these numbers are difficult to reconcile with a belief that LPGs are adopted solely for the purpose of facilitating tacit collusion.

Others disagree. Some argue that most firms have a tacit policy of honoring refund requests from consumers if a rival adopts an overcutting strategy, regardless of what its LPG may say. Thus, if *Crazy Eddie* advertises a higher price and adopts **PB%dif**, consumers can buy from *Newmark & Lewis* and obtain a refund even if *Newmark & Lewis*' LPG allegedly applies to advertised prices only. In terms of supporting collusion, therefore, it makes no difference under this view whether a firm promises to match or beat a competitor's advertised price, best deal, or legitimate price.

Others argue that the Corts (1995) and Hviid and Shaffer (1994) critique is vitiated if enough consumers are uninformed of prices because then even if a firm captures all of the informed customers with its overcutting strategy, the uninformed customers who drop out of the market due to the firm's higher advertised price may more than offset the gains.<sup>24</sup> In this case, firms have to match or beat a competitor's selling price only when

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<sup>24</sup>Suppose all consumers have a reservation price of  $V$ , and that half know the prices of both firms in the market, while the other half know the prices of only the firm they patronize. If, at equal prices, the informed and uninformed consumers are divided equally between the two firms, then it is an equilibrium for both firms to advertise a price of  $V$  and adopt a price-beating guarantee that applies to advertised prices only. Overcutting is not profitable in this case because the uninformed consumers who used to patronize the overcutting firm would drop out of the market, more than offsetting the gain to the firm from capturing the informed consumers who used to buy from its rival.

consumers tend to be informed of prices (i.e., when overcutting works best) because then they have no other choice if they want to support collusive prices. However, in markets with many uninformed consumers, firms can choose (in this view) the wording of their LPG using some other criteria. If they choose to match or beat advertised prices, then presumably it is because this wording subjects them to the least amount of risk.

This suggests the following test. The latter two views imply that LPGs that apply to advertised prices should have a relatively small number of restrictions. By contrast, if the LPGs that apply to advertised prices are not adopted to facilitate tacit collusion (and the others are), then, all else equal, we would expect them to have a relatively high number of restrictions. In what follows, we consider first the sample of all **PM** and **PB%** guarantees. Table 8 gives the percentage occurrence of each restriction broken down by which competitor prices the firms promise to match or beat.

**Table 8. Percentage of PM and PB% with the Various Restrictions.**

	Restriction Number									# Obs.
	"1"	"2"	"3"	"4"	"5"	"6"	"7"	"8"	"9"	
All <b>PM</b> and <b>PB%</b>	32.7	24.0	37.0	32.7	19.4	23.1	16.8	23.4	19.4	346
Advertised Prices	52.5	22.1	56.6	52.5	23.8	41.8	27.0	38.5	20.5	122
Best Deal	16.7	10.4	29.2	16.7	4.2	2.1	0.0	4.2	8.3	48
Legitimate Prices	100	100	91.7	100	100	91.7	100	100	0.0	24
Ambiguous	11.2	17.8	15.1	11.2	7.9	3.9	0.7	5.3	25.0	152

The data does not support the view that all **PM** and **PB%** are adopted to facilitate tacit collusion. If we ignore ‘Legitimate Prices’, the row with advertised prices has the highest percentages on eight of the nine restrictions, which is inconsistent with the notion that ‘Advertised Prices’ is the wording of choice when firms want to collude and don’t have to worry about overcutting.<sup>25</sup>

Table 9 gives the percentage occurrence of each restriction for **PB%dif**. Here the differences among rows is not significant.<sup>26</sup> Nonetheless, it still does not support the

<sup>25</sup>The mean number of restrictions in Table 8 for ‘Advertised Prices’ is 3.30, for ‘Best Deal’ 1.04, for ‘Legitimate Prices’ 6.83, and for ‘Ambiguous’ 0.93. Except for the difference between ‘Best Deal’ and ‘Ambiguous’, the differences between subsample means are significant at the 1% level.

<sup>26</sup>The mean number of restrictions in Table 9 for ‘Advertised Prices’ is 4.48, for ‘Best Deal’ 4.22, for

view that all **PB%dif** facilitate tacit collusion. If there were no differences in risk, then we would expect the firms’ choice of wording to be skewed towards promising to beat selling prices (it should be uniform among the rows in Table 9 for markets in which overcutting is not a concern and otherwise firms should apply their **PB%difs** to selling prices), and it is not. For example, of the one hundred three **PB%difs** which apply either to advertised prices or best deal, 91% (94/103) apply to advertised prices.

**Table 9. Percentage of PB%dif with the Various Restrictions.**

	Restriction Number									# Obs.
	“1”	“2”	“3”	“4”	“5”	“6”	“7”	“8”	“9”	
All <b>PB%dif</b>	43.6	46.0	74.2	56.4	70.6	49.1	35.6	60.1	23.9	163
Advertised Prices	46.8	35.1	64.9	62.8	69.1	43.6	34.0	56.4	35.1	94
Best Deal	88.9	22.2	66.7	55.6	55.6	55.6	11.1	33.3	33.3	9
Legitimate Prices	0.0	96.0	100	100	0.0	100	100	100	0.0	25
Ambiguous	54.3	45.7	82.9	74.3	62.9	25.7	0.0	48.6	8.6	35

Tables 8 and 9 are consistent, however, with the view that LPGs that apply to advertised prices are not adopted to facilitate tacit collusion—because these guarantees tend to have a larger number of restrictions than LPGs that are ambiguously worded or that apply to best deals. Moreover, the same might be said of LPGs that apply to legitimate prices (they are not adopted to facilitate tacit collusion) because these LPGs are associated with the most restrictions (see footnotes 24 and 25). This suggests that, at least with **PM** and **PB%**, there tends to be a difference of purpose between LPGs that apply to advertised prices or legitimate prices on the one hand, and LPGs that on the other hand are ambiguously worded or that apply to a competitor’s best deal.

## 6 LPGs With Post-Sale Search

In addition to classifying LPGs as **PM** or **PB**, we can also classify them by whether or not they allow consumers to search for lower prices post-sale. We find that 57% (294/515) of all LPGs do not allow post-sale search. In these cases, the LPG becomes

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‘Legitimate Prices’ 5.96, and for ‘Ambiguous’ 4.03. The mean number of restrictions for ‘Legitimate Prices’ is significantly higher at the 1% level than the mean number of restrictions for each of the other three subsample means. The differences between all other subsample means are not significant at the 1% level.

**Table 10. Post-Sale Search and Type of Guarantee.**

	<b>PM</b>	<b>PB%dif</b>	<b>PB%</b>	<b>PB\$</b>	Total
30+ Days	50	119	2	0	171
8-29 Days	1	5	0	0	6
1-7 Days	21	23	0	0	44
No Search	253	16	19	6	294

void once a consumer buys the product. In the remaining cases, a firm promises to honor its LPG for a period of time even after a sale is made if a consumer subsequently finds a lower price. The period of time ranges from two days to the lifetime of the product, with thirty days (158 LPGs) and seven days (38 LPGs) being the most popular. These two search times account for 89% (196/221) of all LPGs with post-sale search.

Table 10, which looks at post-sale search by type of LPG, yields a striking result. More than 90% (147/163) of **PB%dif** allow post-sale search, whereas no **PB\$**, only 9.5% (2/21), and only 22% (72/325) of **PM** have this feature. Of the LPGs that allow search for thirty or more days, 70% (119/171) are **PB%dif**; of the LPGs that allow search for less than thirty days, 56% (28/50) are **PB%dif**; and of the LPGs that do not allow search, only 5% (16/294) are **PB%dif**.

Some might argue that too much can be made of Table 10 because (they claim) most firms will honor their LPG post-sale, if the merchandise was newly purchased, regardless of whether it is expressly stated in its LPG policy. The problem with this view, however, is that it cannot then explain why post-sale search is skewed towards **PB%dif** or why there are significant differences in the number of restrictions found in LPGs that allow post-sale search relative to LPGs that do not.

Table 11 gives the percentage occurrence of each restriction by the number of search days allowed. The row of ‘30+ days’ has the higher percentage on all nine restrictions compared to the row of ‘No Search’ and, in many instances, these percentages are more than four times as large. In fact, aside from restriction “9”, the *least* common restriction among ‘30+ days’ occurs with greater frequency than the *most* common restriction among ‘No Search’ (36.1% vs 29.0%). Similar results are obtained in comparing the row



of ‘1-7 days’ with the row of ‘No Search.’

**Table 11. Percentage of Post-Sale Search LPGs with the Various Restrictions.**

	“1”	“2”	“3”	“4”	“5”	“6”	“7”	“8”	“9”	# Obs.
30+ days	36.1	47.6	71.1	62.0	83.7	51.8	39.2	66.3	16.9	171
8-29 days	100	83.3	100	100	100	0.0	0.0	83.3	0.0	6
1-7 days	25.0	81.8	88.6	77.3	6.8	86.4	75.0	79.5	65.9	44
No search	24.9	11.3	29.0	21.2	10.2	11.6	5.5	8.9	16.0	294

This raises the question: do LPGs that allow post-sale search have a large number of restrictions because they are composed of a relatively large number of **PB%dif**, or do **PB%dif** have a large number of restrictions because they are composed of a relatively large number of LPGs that allow post-sale search? We find that when we control for the type of guarantee, the mean number of restrictions on LPGs with post-sale search is always significantly more than the mean number of restrictions on LPGs without post-sale search.<sup>27</sup> By contrast, when we control for post-sale search, the mean number of restrictions on **PB%dif** is not significantly different than the mean number of restrictions on **PM** and **PB%**—although this could be due to the small numbers of **PB%dif** in the sample of LPGs without search.<sup>28</sup> However, differences between ‘Advertised Prices’ and ‘Best Deal’ remain, suggesting that LPGs serve different purposes even in the absence of search.<sup>29</sup>

<sup>27</sup>In the sample of **PB%dif**, the mean number of restrictions on LPGs with post-sale search is 4.92 (#Obs=147) and the mean number of restrictions on LPGs without post-sale search is 1.88 (#Obs=16), with a t-value of 6.38. Similarly, in the combined sample of **PM** and **PB%**, the mean number of restrictions on LPGs with post-sale search is 5.47 (#Obs=72) and the mean number of restrictions on LPGs without post-sale search is 1.26 (#Obs=253), with a t-value of 20.15. The relevant tables are available from the authors on request.

<sup>28</sup>In the sample of LPGs without post-sale search, the mean number of restrictions on **PB%dif** is 1.88 (#Obs=16) and the mean number of restrictions on **PM** and **PB%** is 1.26 (#Obs=253), with a t-value of 1.34.

<sup>29</sup>In the sample of LPGs without post-sale search, the mean number of restrictions on ‘Advertised Prices’ is 2.40 (#Obs=99), for ‘Best Deal’ 1.20 (#Obs=49), and for ‘Ambiguous’ 0.79 (#Obs=146). The differences between subsample means of ‘Advertised Prices’ and ‘Best Deal’ (t-value 4.92) and between ‘Advertised Prices’ and ‘Ambiguous’ (t-value 9.87) are both significant at the 1% level, while the difference between ‘Best Deal’ and ‘Ambiguous’ (t-value 2.37) is significant at the 5% level.

## 6.1 Post-Sale Search and Why Firms Adopt LPG

It seems intuitive that LPGs that allow post-sale search would have more restrictions than LPGs that do not allow post-sale search. However, we would have expected the number of restrictions to be increasing in the length of search allowed. This turns out not to be the case. Comparing the row of ‘30+ days’ with the row of ‘1-7 days’, for example, we see that the latter has higher percentages on seven of the nine restrictions. This suggests that there may be a different motive behind LPGs that allow short search times (1-7 days) and LPGs that allow long search times (30+ days).<sup>30</sup>

We conjecture that firms allow post-sale search to induce consumers to accelerate their purchase decisions (buy now rather than wait), and that one of the deciding factors in determining the length of search is how often products are marked down. Suppose the firm is mostly concerned with inducing consumers to buy from it before they would otherwise be finished searching the competition. Then offering post-sale search may help, but there is no need to offer a long search time nor to include one’s own future prices in one’s LPG. Alternatively, suppose the firm is mostly concerned with inducing consumers not to wait for a sale. In this case, having an LPG that allows post-sale search may also be an effective selling strategy, but, relative to the former case we would expect the LPG to be associated with a longer period (searching the competition may only take a few days, and so allowing up to seven days to search may be more than adequate, whereas seven days might not be adequate if consumers anticipate that a product is likely to go on sale but are uncertain as to when) and to include the firm’s own future prices, as in *Circuit City*’s LPG:

“We’ll beat any legitimate price from a local store stocking the same new item in a factory-sealed box. Even after your purchase, if you find a lower price within 30 days, including our own sale prices, we’ll refund 110% of the difference.”<sup>31</sup>

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<sup>30</sup>The mean number of restrictions for ‘30+ days’ is 4.75 and for ‘1-7 days’ it is 5.86. The t-value is 3.38.

<sup>31</sup>Ad for *Circuit City*, insert, Philadelphia Inquirer, December 1, 1996.

This suggests that LPGs that allow longer search times should also include their own future prices (i.e., have most-favored-customer clauses (MFCs)).<sup>32</sup> Table 12 provides confirming evidence.

**Table 12. LPGs with Most-Favored Customer Clauses.**

	<b>PM</b>	<b>PB%dif</b>	<b>PB%</b>	Total
30+ days	38	59	2	99
8-29 days	0	0	0	0
1-7 days	4	1	0	5

Of the one-hundred four LPGs that have an MFC, 95% (99/104) of them allow post-sale search of thirty days or more. Moreover, of the two-hundred twenty one LPGs that allow post-sale search, LPGs that allow search for thirty or more days are more than five times as likely to have an MFC than LPGs that have a shorter search time (99/171 compared to 5/50).

## 6.2 Before-After Guarantees

Firms offer before-purchase guarantees that differ from their after-purchase guarantees in 20% of the LPGs that allow post-sale search, e.g., **PM-PB%dif**, where the before-purchase guarantee is listed first in the sequence. Table 13 provides a breakdown by type of guarantee, length of search, and whether or not an MFC is included. In this table we see that all forty-three before-after guarantees allow thirty or more days of search, and in addition, 81% (35/43) of them have MFCs.

**Table 13. LPGs with Different Before-After Guarantees.**

	<b>PM-PB%dif</b>	<b>PB%-PB%dif</b>	Total
30 or more days	39	4	43
Less than 30 days	0	0	0
MFC	31	4	35
No MFC	8	0	8

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<sup>32</sup>For a discussion of MFCs as a facilitating practice, see Cooper (1986) and Schnitzer (1994). For a discussion of MFCs as an efficiency enhancing provision in long-term contracts, see Crocker and Lyon (1994).

These guarantees pose a challenge to theory because it would seem that having a separate before-purchase guarantee is redundant. Consumers who are uninformed of lower prices elsewhere at the time of purchase by definition will not avail themselves of a firm’s before-purchase guarantee (if they happen to become informed of lower prices within the time allotted for post-sale search, these consumers will request refunds under the after-purchase guarantee), nor will consumers who are informed of lower competitor prices at the time of purchase, since they can always buy the product before requesting a refund, thereby qualifying for the higher after-purchase refund. Thus, we would not expect any consumer to request a refund under the before-purchase guarantee.

## 7 Effects on Prices — Tire Dealers

In this section, we look at the effects of LPGs on the retail prices of tires, and ask do firms with LPGs have higher or lower prices than firms without LPGs? We chose the tire market because tire dealers advertise frequently (we have two-hundred thirteen tire ads) and each ad typically contains a large number of price quotes (in one newspaper, the six tire ads averaged fifty-eight price quotes). In addition, the model numbers on tires are standardized, allowing easy comparison among quotes.

All tire ads were collected from the sixty-one Sunday newspapers, whether or not an LPG was offered (there are one-hundred fifteen ads without an LPG, 54% (115/213) of the sample). All but three newspapers had at least one ad from a tire dealer, and all but seven had two or more ads. The breakdown of the tire LPGs by type of guarantee and wording is shown in Table 14 below.

**Table 14. Tire LPGs by Type of Guarantee and Wording.**

	Advertised Prices	Best Deal	Ambiguous	Total
All Tire LPGs	56	6	36	98
<b>PM</b>	9	3	26	38
<b>PB%dif</b>	48	3	4	55
<b>PB%</b>	0	0	5	5

Compared to all LPGs, the tire LPGs have a larger fraction of price-beating guarantees (61% (60/98) are **PB**). There are no **PB\$**, and no tire LPGs apply to ‘Legitimate Prices’.

About half (50/98) of the tire LPGs allow post-sale search. Interestingly, all are **PB%dif** and all allow a search time of thirty days. The other forty-nine LPGs do not allow search.<sup>33</sup>

## 7.1 Tire Prices

We consider only ‘tire matches,’ defined as a pair of price quotes from two competing tire dealers (same city and same date) on the same tire make and model. Although this severely restricts the number of observations (tire dealers typically sell a wide variety of tires and advertise only selected prices), it should go some way towards controlling for local differences in market structure, costs and demand. In addition, we have taken care to ensure that the tire prices reflect only the cost of the tires and not the cost of other services, such as mounting. In all, we found two-hundred eighty-two tire-matches, with an average price of \$65.05, and an average price difference of \$2.62.

Given the limitations of the data, a direct test of whether LPGs facilitate tacit collusion (support supracompetitive prices) is not possible. For example, we do not have time series data that would allow us to assess whether prices tend to increase or decrease following the adoption of LPGs. Nor do we have data on marginal costs that would allow us directly to infer abnormally high prices. However, by comparing the *relative* prices in each tire-match, we can indirectly test for collusion. For example, we can ask whether LPGs lead to identical prices between firms, as most of the literature on LPGs and tacit collusion would predict. This breakdown is given in Table 15.

If neither firm in the tire-match has an LPG, we denote the case ‘No-LPG - No LPG’. If one firm in the tire-match has an LPG and the other does not, we denote the case as ‘No LPG - **PM**’ or ‘No LPG - **PB**’ depending on whether the LPG was **PM** or **PB**.

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<sup>33</sup>The tire LPGs with search have significantly more restrictions than the tire LPGs without search. The mean number of restrictions for ‘30 Days’ is 3.39, while for ‘No Search’ it is 1.57. The t-value is 6.89.

**Table 15: The Tire-matches.**

	Observations	Identical Prices
All Tire-Matches	282	34
No LPG - No LPG	82	4
No LPG - <b>PM</b>	36	8
No LPG - <b>PB%dif</b>	99	20
LPG - LPG <sup>max</sup>	52	1
Identical LPG	13	1

If both firms in the tire-match have an LPG, and the LPGs are identical (except for the fine-print), we denote the case ‘Identical LPG.’ If both firms in the tire-match have LPGs, and the two LPGs are not identical, we let LPG<sup>max</sup> denote the LPG that would offer the larger refund if there were a price difference.

The evidence in Table 15 is mixed. The proportion of tire-matches with identical prices is 5% (4/82) when neither firm has an LPG, whereas it is 21% (28/135) when one firm has an LPG. This difference is significant at the 5% level and suggests that LPGs may play some role in facilitating collusion. However, the proportion is still well below 100%, and it is only 3% (2/65) when both firms have LPGs. The latter finding in particular is surprising, since most of the theory that follows Salop (1986) predicts that all firms must adopt LPGs if tacit collusion is to be supported.

It may be that a test for identical prices in tire-matches is too strong. For instance, the evidence in Table 15 is consistent with the models of Logan and Lutter (1989) and Hviid and Shaffer (1999), who look at cases in which only a subset of firms in a market adopt LPGs. In these articles, LPGs can support supracompetitive prices even if prices are not identical, if firms have asymmetric demands or costs. Thus, in what follows we propose a weaker test of tacit collusion.

Consider the following two situations in which one firm has an LPG (**PM** or **PB%dif**) and the other does not. In the first situation, the firm with the LPG has a price of \$65 and the firm without the LPG has a price of \$60. In the second situation, the names of the firms are changed; the firm with the LPG has a price of \$60 and the firm without

the LPG has a price of \$65. What can we conclude about the ability of the LPG to support tacit collusion in each case?

In the first case, the firm whose price is \$65 is unconstrained in its pricing (because the rival does not have an LPG), but the firm whose price is \$60 *may* be constrained. If hassle costs are large enough such that no consumer is requesting or wants to request a refund from the higher priced firm, then it is not constrained. Otherwise, this firm cannot lower its price without its rival's price also falling to those consumers who request refunds. Thus, we are unable to reject the hypothesis that the LPG of the first firm is supporting supracompetitive prices. In the second case, however, neither firm is constrained for local changes in prices. The firm whose price is \$60 can lower its price with impunity, and the firm whose price is \$65 can lower its price up to \$5 before its rival's LPG can be invoked (assuming **PM** or **PB%dif**).<sup>34</sup> In this case, we can reject the hypothesis that the LPG is supporting tacit collusion.

In general, we propose the following test for tacit collusion: if **PM** or **PB%dif** are to support supracompetitive prices, then, in any tire-match in which only one firm has an LPG, the firm with the LPG should have the weakly higher price. We now apply this test to the one-hundred thirty five tire-matches in which only one firm has an LPG. We begin by comparing **PM** and **PB%dif**.

### 7.1.1 **PM** vs. **PB%dif**

In section 4, we conjectured that because **PB%difs** have significantly more restrictions than **PM** or **PB%**, they might be serving a different purpose. Table 16 organizes the data on tire-matches to shed more light on this conjecture. The column headings refer to whether the price of the firm with the LPG is lower, the same, or higher than the price of the firm without the LPG.

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<sup>34</sup>If the lower priced firm has **PB%** then depending on its promise, it may be required to beat the higher priced firm by some fixed percentage. This type of guarantee was not found in our tire data.

**Table 16: Price Differences by Type of Guarantee.**

	Lower	Same	Higher
No LPG - <b>PM</b>	12	8	16
No LPG - <b>PB%dif</b>	59	20	20

A firm with **PM** has the weakly higher price in 67% (24/36) of the cases in which it is compared with a firm that does not have an LPG. By contrast, a firm with **PB%dif** has the weakly higher price in only 40% (40/99) of the cases. This provides some support for the conjecture that **PB%difs** may be adopted for different reasons than **PM**. According to a chi-square test, we cannot reject the null hypothesis of no significant difference (under the null the prices are lower or higher with equal probability) in the cases with No LPG - **PM**. On the other hand, firms that have **PB** are significantly more likely to have lower prices than firms with no LPG (p-value is less than .1%). Perhaps more importantly, the fact that the firm with the LPG does not always have the weakly higher price suggests that neither **PM** nor **PB%dif** is adopted solely to facilitate tacit collusion.

### 7.1.2 ‘Advertised Prices’ vs. ‘Best Deal’ vs. ‘Legitimate Prices’

In section 5, we conjectured that LPGs that apply to advertised prices might be serving a different purpose than LPGs that apply to a competitor’s best deal. In particular, we conjectured that the latter might be adopted to facilitate tacit collusion since, unlike the former, they are based on selling prices and tend to be accompanied by few restrictions. The evidence in Table 18 is supportive.

**Table 17: Price Differences by Wording of the Guarantee.**

	Lower	Same	Higher
No LPG - Advertised Price LPG	54	6	20
No LPG - Best Deal LPG	0	20	3
No LPG - Ambiguous LPG	17	2	13

In every case of ‘Best Deal’, the firm with the LPG has the weakly higher price. By contrast, the firm with the LPG has the lower price in 68% (54/80) of the cases with ‘Advertised Prices’. The ambiguously worded LPGs are somewhat surprising, since these



LPGs typically have few restrictions (conducive for tacit collusion) but are nonetheless associated with weakly higher prices in less than 50% (15/32) of the cases. Thus, aside from LPGs that apply to ‘Best Deal’, the data suggest that majority of firms with LPGs are not adopted to facilitate tacit collusion.

### 7.1.3 Post-Sale Search

In section 6, we found that LPGs that allow post-sale search tend to have a large number of restrictions, and that while the differences between **PM** and **PB%dif** become insignificant when we control for search, the differences between ‘Advertised Prices’ and ‘Best Deal’ do not. Table 18 organizes the data by post-sale search—recall that, for tire dealers, all search is 30 days. It should also be noted that we have no instances of post-sale search in which tire dealers adopt **PM**.

**Table 18: Price Differences by Post-Sale Search.**

	Lower	Same	Higher
No LPG - 30 Days Search; <b>PB%dif</b>	48	19	4
No LPG - No Search; <b>PM</b>	12	8	16
No LPG - No Search; <b>PB%dif</b>	11	1	16

The data suggest that LPGs with post-sale search are typically not adopted to facilitate tacit collusion—unless the LPG applies to a competitor’s best deal (because this resulted in identical prices in all fifteen cases in which it occurred with post-sale search).

Why do firms with LPGs that allow post-sale search have lower prices in 68% (48/71) of the cases (if the LPGs with ‘Best Deal’ are removed, then the percentage rises to 86% (48/56)), whereas firms that do not allow post-sale search have weakly higher prices in 64% (41/64) of the cases? We have conjectured that LPGs that allow post-sale search are adopted to induce consumers to buy now rather than wait. The theoretical challenge is to explain (a) why such a large (small) proportion of price-beating (price-matching) guarantees allow post-sale search, and (b) why firms with these LPGs often have lower equilibrium prices than firms that do not have LPGs.

In the absence of post-sale search, LPGs with **PB%dif** look similar to LPGs with **PM**; each has the higher price in sixteen cases, **PM** has the lower price in twelve cases,

and **PB%dif** has the lower price in eleven cases. This implies that the phenomena of firms with LPGs having lower prices than firms that do not have LPGs is not confined to LPGs that allow post-sale search.

#### 7.1.4 Price Discrimination

The second most common explanation of why firms adopt LPGs is that they allow price discrimination between informed and uninformed consumers, e.g., see Png and Hirschleifer (1987), Corts (1996), and Edlin (1998). It is useful, therefore, to discuss to what extent our findings accord with this theory. Unfortunately, a direct test of price discrimination is not possible, as we do not have data on the incidence of consumers requesting refunds. Absent this data, we must resort to inference. Our data on tire-matches is useful in this respect, although it is by no means definitive.

If there are only two firms, each selling one product, then the price discrimination story predicts that the firm with the LPG will have a higher price (if the price is the same or lower, then no consumer would request a refund and there could be no price discrimination) than the firm without an LPG. Thus, in the case of two firms, price discrimination can be ruled out as a motive in 55% (20/36) of LPGs with **PM** and in 80% (79/99) of LPGs with **PB%dif**. It can also be ruled out in 86% (67/71) of LPGs with post-sale search, and in 50% (32/64) of LPGs without search.

These percentages are higher than what we would have expected, and should be interpreted in light of at least two caveats. First, price discrimination can arise as long as there is one firm in the market charging a lower price. Ideally, then, one must compare the price of the firm with the LPG to the lowest price in the market, which may not be feasible in our data if the lowest price firm does not advertise. Even if the lowest price firm does advertise, the data from the tire-matches can underestimate the extent of price discrimination. Consider, for example, a three-firm market, in which the only firm with an LPG has the middle of the three prices. When compared to the price of the two firms without LPGs, there will be two data points, with the LPG firm having

the higher price in one data point and the lower price in the other data point. It would then appear (erroneously) as though 50% of the time price discrimination could be ruled out as a motivation.

Second, firms typically sell many products and the price discrimination motive need not apply to all of them; the firm's price may be higher on some products and lower on other products. Even for a given product, if prices fluctuate over time, a firm's price may sometimes be higher than its rival's price and sometimes lower. In those instances in which its price happens to be higher, a firm's LPG may be protecting against the loss of informed customers.

Thus, the best way to interpret the data on tire-matches with respect to the importance of price-discrimination as a motive for why firms adopt LPGs may be to make relative comparisons, e.g., the numbers suggest that price discrimination may be less important with **PB%dif** than with **PM**, and less important with LPGs that allow search than with LPGs that do not allow search.

## 8 Conclusion

We set out in this paper to document the incidence and variety of LPGs using a unique data set obtained from Sunday newspaper ads. From our data set it is evident that the use of LPGs is widespread with no obvious missing retail sectors. Moreover, we observe a wide variety of LPGs both across and within sectors and across time and geographical space. This offers a puzzle for the existing literature. Since the guarantees are easy to copy, why does this not appear to be happening to a larger extent? LPGs have been around for a long time and one would have expected that if there were an "optimal" LPG, or at least a menu of "optimal" LPGs, these would have dominated the sample. Why is it, for example, that both price-matching guarantees and in addition several forms of price-beating guarantees are observed? Why might one firm have an LPG while its rival has no LPG? And why is the variation within each type of guarantee so large, e.g., the percentages on **PB%dif** range from 105% to 310% and the percentages

on **PB%** range from 3% to 15%?

We find that firms promise to match prices in over 60% of the LPGs. Among price-beating guarantees, the most popular is **PB%dif**, which take the form of offering to refund a percentage of the difference in price. This class of **PB**'s very different from both other **PB**'s and from **PM** guarantees, not only in having significantly higher hassle costs, but also in being less likely to apply to selling prices, and more likely to allow consumers to search after purchase.

In fact, whereas post-sale search is allowed in 43% of the LPGs, more than 90% of **PB%dif** have this feature. Thus, it would in general appear from the data that dynamics are very important in understanding the differences among LPGs. Yet virtually all the models of LPGs to date are static. The theoretical challenge is to explain why such a large (small) proportion of price-beating (price-matching) guarantees allow post-sale search, and (b) why firms with these LPGs often have lower equilibrium prices than firms that do not have LPGs. There is also a clear need for models that allow for most-favored customer clauses as a part of the LPG itself. We conjectured that one reason firms may allow post-sale search is to induce consumers to buy now rather than (a) wait for a product to go on sale, or (b) continue searching the competition for price quotes.

The data highlight the importance of hassle costs (as proxied by the number of restrictions in an LPG) and whether the LPG relates to advertised prices or selling prices. Since a firm can choose whether and how many restrictions to impose, and since it can always restrict its LPG to apply only to advertised prices, whether or not firms do so should be modelled rather than assumed. One way to restore the power of **PM** and **PB%dif** to support collusive prices is to keep hassle costs as close to zero as possible and relate it to the actual price offered by the competitor rather than to the advertised price. Thus, for the tacit collusion story to be convincing as the dominant explanation for LPGs, one needs to show that a substantial number of LPGs have few restrictions and are defined on selling prices rather than advertised prices. Our sample does not support this.

Our sample also does not provide strong support for the price discrimination story of LPGs. If the price discrimination motive were always to hold between any two firms where one had an LPG and the other did not, then the firm with the LPG should have the strictly higher price. But, in our data on tire-matches, we found that firms with **PB%dif**, and firms with LPGs that allow post-sale search tended to have significantly lower prices than firms with no LPG.

We conclude by noting that theoretical models differ in their assumptions about the timing of moves. Some assume that LPGs are chosen before prices, whereas others assume that the choice is simultaneous. The data does not offer strong support for either of these two modelling strategies. However, the fact that some firms appear willing to change their LPG over a short time period, and even within newspaper, and that some limit the time period for which the LPG itself is valid, e.g, until December 24, suggest a weak support for the simultaneous move approach.

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