PROMISES TO MATCH OR BEAT THE COMPETITION:
EVIDENCE FROM RETAIL TIRE PRICES

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ABSTRACT

Given the widespread adoption of low-price guarantees and discussion of their anti-competitive effects in the theoretical literature, it is unfortunate that there is little empirical evidence available on the subject. This chapter analyzes the effects of low-price guarantees on advertised tire prices, based on P185/75R14 retail tire prices collected from U.S. Sunday newspapers. We find that although a tire retailer's own price-matching or price-beating guarantee has no significant effect on the retailer's advertised tire price, an increase in the percentage of firms in the market announcing low-price guarantees tends to raise the firm's advertised tire price. In particular, we find that the predicted tire prices are approximately $4 higher (about 10 percent of the average advertised price of a P185/75R14 tire) in markets in which all firms advertise an LPG when compared to markets without any LPGs.

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I. INTRODUCTION

> *Tire Kingdom* advertised its tires in the *Orlando Sentinel* on November 10, 1996 and December 1, 1996. Comparing the price quotes in the two ads, thirty-five exact tire matches were found. For the November 10 issue, in which no LPG was advertised, the mean price of the thirty-five tire matches was $45.27 whereas in the December issue, in which *Tire Kingdom* advertised a price-beating guarantee, the mean price of the thirty-five tire matches was $54.71. This difference is significant at any conventional confidence level. In fact, all prices on the exact same tires were found to be equal or higher with the price-beating guarantee announcement.[1]

One can observe low-price guarantees (LPG) adopted in virtually any industry.[2] However, despite their widespread use, price-matching and price-beating policies are not well understood.[3] Many consumers gain a false sense of security and feel no need to look elsewhere if a firm claims to have the lowest prices.[4] But is it true that firms tend to advertise lower prices when they claim to match or beat any price? In this paper we ask: what are the effects of LPGs on prices? Are price-matching and price-beating guarantees similar in their effects on advertised prices? We attempt to answer these questions using the data from advertisements published by tire retailers in U.S. Sunday newspapers.

The competitive effects of LPGs have been widely debated in the theoretical literature. The classical argument runs as follows: if all firms in a market adopt price-matching guarantees, the price undercutting incentives of any single firm are eliminated. A price cutter does not receive a larger share of the market, but sacrifices its profit margin. Thus, in equilibrium, LPGs can lead to higher prices. The claim is originally made in Salop (1986) and it is further analyzed by Doyle (1988), Logan and Lutter (1989), Baye and Kovenock (1994), Chen (1995), and Edlin and Emch (1999).

Other authors point out the limitations of this view by showing that the tacit collusion result may not hold when the space of advertising messages is expanded to include price-beating guarantees based on lower advertised prices. That is, supra-competitive prices generally cannot be sustained in an equilibrium if firms can promise to beat competitors' prices since there is always an LPG-price combination that allows a firm to effectively undercut a competitor's supra-competitive price (see Hviid and Shaffer 1994 and Corts 1995 for the discussion). Hviid and Shaffer (1999) show that an introduction of hassle costs can also limit the ability of price-matching guarantees to support supra-competitive prices. In their model, prices are higher than they would be without LPGs, but the prices fall well short of the monopoly level. Interestingly, prices can rise in their model even if not all firms adopt LPGs. Hviid and Shaffer (1998) show that hassle costs can also limit the ability of price-beating guarantees to enforce supra-competitive prices, but in this case hassle costs partially restore, rather than reduce, this ability.

Following another direction, Png and Hirschleifer (1987) and Corts (1997) argue that price-matching guarantees should be viewed as price-discriminating rather than facilitating devices: under some conditions a price-discriminating firm charges

a higher price to all its customers and allows the more price sensitive (or more informed) consumers to obtain refunds based on a lower competitor's price they find elsewhere. In general, though, the effect of LPGs on the level of advertised prices in the market is ambiguous and it depends on the elasticities of demand for the different types of consumers.

The association between LPGs and the number of firms in the market has not been explored much. Edlin and Emch (1999) point out that the ability of price-matching guarantees to sustain supra-competitive prices allows for inefficient entry. Arbatskaya (1998) shows that certain types of price-beating guarantees enable the incumbent to deter entry into a perfectly contestable market while charging consumers their reservation value. In this chapter we make inferences about how LPGs affect prices while conditioning on the market structure. The impact of LPGs on the market structure itself is not explicitly considered.

The main empirical questions raised by these theoretical studies are twofold. First, what are the LPG adoption patterns, that is, what kinds of LPGs are adopted, and second, what are the effects of LPGs on prices? In particular, does a firm announcing an LPG tend to advertise higher or lower prices than a firm in the same market without an LPG, and how do LPGs in a market affect the overall price level?

Arbatskaya and colleagues (1999) provide evidence on the first question, but stop short of fully addressing the second question. In particular, they analyze data on tire prices for exact tire matches, that is, pairs of price quotes for the same tire model and size by two competing firms in a market. However, the magnitude of the price differences is not the focus in their study. In the current chapter we employ regression analysis and thus we take into account the magnitudes of the price differences. Furthermore, we consider the effect of LPGs adopted by a firm's rivals on its price.

An empirical study by Hess and Gerstner (1991) concludes that the average market prices of products that come under a supermarket's price-matching guarantee tend to increase over a two-year period following the LPG adoption by the supermarket. However, the relative price increase is small; it is less than 2 percent in the year when the guarantee is adopted and less than 1 percent in the following year. As Hess and Gerstner note, the price increases could be due to the differences between the cost and/or demand dynamics for included versus excluded products. It may be also due to the fact that the promotional activities in the excluded products intensify over time, especially when these activities are restricted to fewer products.[5]

Compared to the three-year time-series data studied in Hess and Gerstner (1991), the present data span less than two and a half months and comprise observations on several firms across widely dispersed retail tire markets. In contrast to Hess and Gerstner, we compare prices advertised by firms adopting a price-matching, a price-beating, and no guarantee, that is, the LPG space in our study is extended to price-beating guarantees. The heterogeneity in our sample creates two different problems. One type of heterogeneity relates to the retail outlet where, for example, costs may differ across and even within states. The other type relates to differences

in tire characteristics and is more troublesome given the aim of the study. The low-price guarantees typically relate to similar if not identical products and we need to ensure that the guarantees are at all relevant. The more heterogeneity of this type, the less likely we are to observe any effect from the guarantees. We deal with the heterogeneity of the sample by using a set of control variables and by allowing the observations in each market to be correlated. However, there may still remain some heterogeneity in the data that we are not able to control for and we need to keep this in mind when interpreting the results.

The rest of the chapter is organized as follows. Section II describes the data. The estimation results from the feasible generalized least squares (FGLS) model are presented in Section III. There we also perform hypothesis testing. In Section IV, we summarize the results and conclude.

II. THE DATA

We extracted all newspaper advertisements published by tire retailers from a data set comprising 61 U.S. Sunday newspapers.[6] Choosing to focus on one of the most advertised radial tire sizes for a passenger car, P185/75R14, we retrieved all price quotes for this tire size from these advertisements (snow tires were not included in the sample).[7] Finally, we combined the pricing data with information about the LPG advertised by each tire dealer, for example, whether it was price-matching or price-beating.

The top three most advertised tire brands in our sample, Goodyear, Firestone, and Michelin, correspond to the shares of the top three tire brands in the U.S. replacement tire market[8] in 1996, as Table 1 demonstrates.

We have chosen to analyze the retail tire industry since tires can be easily identified using a standard code system and tire advertisers usually publish more price quotes than other newspaper advertisers, perhaps because the standard code reduces a per-quote cost of advertising. Unlike the search for many other durable goods, the search for new tires is often conducted under a tight time constraint since a large fraction of tire purchases are distress purchases due to a burst tire. Consumers purchase the product infrequently, and since purchase-related information is costly to acquire, they may be uninformed about retailers' locations, their prices and LPG policies, tire sizes, brands and services available, mileage warranty provided, or

Table 1. Top Brands According to Market Shares in 1996

Tire Brand	*Share in the Replacement Tire Market*	*Share of Price Quotes in the Sample*
GOODYEAR	16.0%	15.87%
FIRESTONE	9.0%	10.71%
MICHELIN	8.0%	8.73%

such characteristics of tires as speed rating, treadwear, and traction. For this reason advertisements may serve as a source of valuable information.[9]

The advertising media used by tire retailers include traditional ones such as television, radio, and newspapers, as well as a relatively recent one—the Internet. For example, *Tires Plus* publishes a list of tire prices on its web site.[10] Some tire dealers announce LPGs on the web. In this chapter, however, we restrict our attention to a more traditional media—newspapers. Tire retailers advertise heavily in the U.S. Sunday newspapers: we find as many as eight tire advertisements in a newspaper issue, with as many as six LPGs advertised.

In total, we have 427 price quotes on P185/75R14 tires. (Only 16 tire advertisements do not quote at least one price on P185/75R14 tires and only 17 price quotes do not specify a mileage warranty). Each of the observations corresponds to a firm and a market, which for the purpose of this chapter is defined as a newspaper issue. In total, there are 46 firms in the sample placing advertisements in 36 U.S. Sunday newspapers on eight distinct dates from September 29, 1996 to December 8, 1996.

The advertisements can be generally divided into three classes: those containing observations associated with no LPG, price-matching and price-beating guarantees. Table 2 reports the average tire price and mileage warranty across three LPG classes for the sample of price quotes that specified a mileage warranty. The last two rows of Table 2 present the number and the percentage of price quotes (for which the mileage warranty is not missing) obtained for each of the classes. Nearly half of price quotes (45.2 percent) are not associated with an LPG. Out of the rest, approximately two-thirds (64.1 percent) are associated with price-beating and one-third with price-matching guarantees (35.9 percent).[11] Table 2 suggests that price-matching firms tend to charge higher prices and at the same time provide a higher mileage warranty. More specifically, a price-matching firm on average advertises a price 49 cents higher than the overall average and it provides a mileage warranty 4.85 thousand miles

Table 2. Mean Tire Price and Mileage Warranty Across LPG Types

	No LPG	*PM*	*PB*	*All*
PRICE (in dollars)	42.35	42.73	41.83	42.24
	(13.54)	(13.04)	(11.42)	(12.71)
MILEAGE (in thousand miles)	52.20	57.20	49.83	52.35
	(13.18)	(14.15)	(11.75)	(13.13)
Number of Price Quotes	193	84	150	427
Percentage of Quotes	45.20%	19.67%	35.13%	100%

Notes: Standard deviations for PRICE and MILEAGE are reported for each LPG type in parentheses below the mean values.

higher than the average. Price-beating firms, on the other hand, advertise a price 41 cents lower than the overall average and a mileage warranty 2.52 thousand miles lower than the average.[12]

To further illustrate the differences between the mileage warranty and prices advertised by firms announcing different types of LPG, in Table 3 we report the mean tire price across three groups of mileage warranty: between thirty and forty thousand miles, between forty-five and sixty thousand miles, and between sixty-five and eighty thousand miles. In each of the categories, a price-matching firm, on average, advertises a price $3–$4 lower than a firm with no LPG, which constitutes a significant difference at the 5 percent level for the lowest and the highest groups. The price advertised by a price-beating firm is not significantly different from that announced by a firm with no LPG, except for the middle category of mileage warranty categories, where it is significantly higher at the 5 percent significance level (according to the one-sided test).[13]

In the next section we estimate the effect of LPGs on advertised tire prices by specifying tire price as a function of LPG policy announced by the firm and the share of price-matching and price-beating firms in the market. Even though all tires are of a particular size, there still remain several dimensions of product heterogeneity in our sample such as mileage warranty and tire brands. These variables are used as controls in the price equation we estimate. We take particular care to include in the price regression such observable characteristics from newspaper advertisements as: whether the fourth tire comes free, whether it is on sale, or whether mounting is provided free with the tire purchase. To control for the differences in the market structure, we also include into the regression proxies for the number of firms in the market.

Next we outline the endogenous and exogenous variables used in the analysis of the tire prices. The descriptive statistics for the variables are provided in Table 4.

Table 3. Mean Tire Price Across Mileage Warranty and LPG Classes

MILEAGE	*No LPG*	*PM*	*PB*	*All*	*N*
30–40 thousand miles	30.80	27.02	30.69	30.15	137
	(5.93)	(6.27)	(5.90)	(6.09)	
45–60 thousand miles	40.56	37.47	43.30	41.53	154
	(9.54)	(7.37)	(7.89)	(8.70)	
65–80 thousand miles	56.74	52.73	55.70	55.22	136
	(8.90)	(6.88)	(8.05)	(8.25)	

Notes: *N* is the number of observations in each category of mileage warranty. For each LPG class and category of mileage warranty, the standard deviations of tire prices are reported in parentheses below the corresponding mean values.

Table 4. The Descriptive Statistics for the Variables

Variable	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*
PRICE	42.24	12.71	17.5	68.00
CALCP1	40.96	12.20	17.5	67.95
PM	0.20	0.40	0	1
PB	0.35	0.48	0	1
LPG_SHARE	0.49	0.26	0	1
EXIST_LPG	0.93	0.25	0	1
ALL_LPG	0.09	0.29	0	1
ALL_LPG_RI	0.14	0.35	0	1
MAX_PB	0.26	0.44	0	1
RETAIL	0.32	0.15	0.06	0.73
RETAILPC	0.68	0.41	0.18	1.59
NFIRMS	4.44	1.80	1	8
FNADS	12.01	8.00	1	25
MILEAGE	52.35	13.13	30	80
FREE4TH	0.10	0.30	0	1
SERVICE	0.71	1.03	0	5
MOUNT	0.22	0.42	0	1
SALE	0.23	0.42	0	1
STSPEED	0.12	0.33	0	1
ALLSEASON	0.32	0.47	0	1

Note: The number of observations is 427.

Price

Four-hundred twenty-seven price quotes report price (PRICE) and mileage warranty. In some cases the fourth tire comes free with a purchase of three tires. A dummy FREE4TH is equal to one in such cases.

Number of Firms

To account for the level of competitiveness in the cities where the newspapers were distributed, we take number of retail establishments, RETAIL, and divide it by the total population of the city, in millions. The resulting variable, RETAILPC, is further normalized to represent the number of retail establishments per thousand people.[14]

For each of the fifty-nine markets (newspaper issues) in our sample, we compute the number of retail tire dealers, NFIRMS, including only those firms that advertise in the newspaper. Since there may be non-linearity in the effect of an additional

firm on the market conduct (see, e.g., Bresnahan and Reiss, 1991), we introduce dummy variables F_k for the number of firms in the market; F_k equals one if k firms advertise in the newspaper and zero otherwise, $k = 1, \ldots, 8$, with approximately 2 percent, 9 percent, 28 percent, 18 percent, 11 percent, 17 percent, 9 percent, and 6 percent of observations falling in each category.

Amount of Advertising

The firms are not equally represented in the sample. We count the number of ads a firm places in our sample, FNADS. This variable characterizes the firm's propensity to advertise. Since the amount of advertising correlates with the firm's presence in several markets, FNADS can be viewed as a proxy for the extent of the firm's multi-market operations and its size. For instance, Goodyear and Firestone are among the top advertisers in the sample, and they also happen to have the highest market shares in the replacement tire retail market.

LPG Strategy

The ads are broadly divided into three categories: those containing no guarantee, price-matching, and price-beating guarantees. Price-matching (PM) and price-beating (PB) dummy variables are introduced to test the hypotheses that price-matching and price-beating are associated with significantly different announced prices. If price coordination is enhanced by a widespread adoption of LPGs, then the share of firms that have a price-matching or price-beating guarantee in the market (LPG_SHARE) may play an important role in the price formation.

Mileage Warranty

The most obvious determinant of a tire price, apart from its brand, is the mileage warranty (MILEAGE) advertised by the firm.

Tire Dummies

Three tire-brand dummies are introduced—Goodyear (GOODYEAR), Firestone (FIRESTONE), and Michelin (MICHELIN) branded tires. We also collected information about the kinds of tires advertised in the newspapers: S or T-speed rated (STSPEED) and all-season (ALLSEASON).[15] When the tire is advertised as being on sale, the dummy variable SALE takes the value 1 for this tire. If tire mounting is provided free of charge with a tire purchase, a dummy variable MOUNT is assigned value 1.

The price equation is specified and estimated in the next section. There we also report the results from the hypotheses tests of the effects of price-matching and price-beating guarantees on prices, after controlling for the differences in mileage warranty and other product-specific and market-specific characteristics.

III. ESTIMATION RESULTS

The literature briefly reviewed in the introduction suggests that advertised prices may depend on the low-price guarantee adopted by the retailer[16] as well as on the LPGs announced by the competing firms.[17] The advertised price may also depend on the industry structure, as measured, for example, by the number of retailers in the area selling a similar product.

The general specification for the price equation is

$$PRICE_i = \beta_0 + \beta_1 PM_i + \beta_2 PB_i + \beta_3 LPG\_SHARE_i + \beta_4 MILEAGE_i + \beta_5 RETAILPC_i + \gamma Z_i + \varepsilon_i \quad (1)$$

where $\varepsilon_i \sim i.d.(0, \sigma^2)$ and Z_i is a vector of other control variables with associated vector of coefficients, γ, $i = 1, \ldots, N$.[18]

In equation (1), we describe the advertised tire price, *PRICE*, as dependent on the *LPG* policies adopted by the firms, controlling for important market and product characteristics. The regressors include mileage warranty, *MILEAGE*; the number of retail establishments per thousand of people in the city where the newspaper was circulated, *RETAILPC*; dummy variables for price-matching guarantee, *PM*, and price-beating guarantee, *PB*; and the fraction of firms announcing *LPG*s in the market, *LPG_SHARE*.

If the observations were serially uncorrelated, we could efficiently estimate the price equation by a standard OLS procedure. However, the assumption may not be appropriate if, for example, there are some important market-specific factors that we do not observe, which make the observations in each market correlated. In this case, a feasible generalized least squares (FGLS) procedure should be used to allow for correlation between observations for a market. As a result the standard errors for some, but not all, of the covariates become substantially bigger than those obtained in the OLS regression. Hence, FGLS is a more cautionary estimation and inference method.

Table 5 reports the estimates of the coefficients and the corresponding standard errors for the price regression estimated by FGLS. From Table 5 it follows that, as expected, *MILEAGE* has a positive and significant effect (at the 5 percent significance level) on advertised tire prices. Each extra thousand miles of mileage warranty increases the price by about seventy cents.[19] The number of retail establishments per thousand of people, *RETAILPC*, has a significant negative effect on prices, all other things equal. An extra tire retail establishment per thousand of people lowers the tire price by $3.92. The estimated coefficient for the number of advertising firms in the market, *NFIRMS*, is not significant.[20]

Importantly, whether a firm announces a price-matching or price-beating guarantee is not significant in determining the tire price a firm advertises, although price-matchers tend to charge lower prices than firms with no LPGs while price-

Table 5. FGLS Estimates

Regressors	*Estimate*	*FGLS Std. Err.*
PM	−1.57	1.01
PB	0.97	1.05
LPG_SHARE	4.04**	1.43
RETAILPC	−3.92**	0.58
NFIRMS	−0.26	0.20
MILEAGE	0.70**	0.03
MICHELIN	17.37**	0.92
GOODYEAR	7.99**	0.99
FIRESTONE	3.44**	0.96
FREE4TH	2.99**	0.80
MOUNT	1.87*	0.82
STSPEED	−4.53**	0.95
ALLSEASON	2.14**	0.64
CONST	2.86	1.85
R^2	0.83	

Notes: The dependent variable is PRICE. $N = 427$. FGLS standard errors are the standard errors for the feasible generalized least squares model with the correlation between the observations in each market. * significantly different from zero at the 5 percent level. ** significantly different from zero at the 1 percent level.

beaters charge higher prices. In contrast, an increase in the share of firms announcing LPGs (instead of advertising no guarantee) has a positive and significant impact on the advertised price at the 1 percent level. In particular, all other things equal, the tire price is about $4 higher when we compare the markets without any LPGs and the markets in which all firms advertise an LPG. Thus, the maximum possible effect of the share of LPG firms on the advertised tire price is equal to about 9–10 percent of the mean advertised tire price ($42.24) for the whole sample (or of the predicted value of price when no firm in the market advertises an LPG, $40.25). This effect is relatively modest, but is entirely consistent with the predictions in Hviid and Shaffer (1999) that the presence of hassle costs together with an asymmetry among firms caused by differences in location, imply that both price-matching and price-beating guarantees can lead to positive but modest effects on prices.

Such tire-specific variables as whether the tire is all-season (ALLSEASON) and whether it has an S or T speed rating (STSPEED) have expected signs. All-season tires are priced about $2.14 higher than other tires, while S/T-speed rated tires are on average sold at a discount of around $4.53. Free mounting service commands a $1.87 higher tire price.[21] A free fourth tire is not actually free of charge—the advertised price is increased by $2.99 on average if the forth tire comes free with

a purchase of three tires. It follows from Table 5 that Michelin, Goodyear, and Firestone brand tires are premium-priced compared to other branded and unbranded tires.

Next we test hypotheses about the impact of LPGs on advertised tire prices. The null hypotheses that a price-matching (or price-beating) guarantee has no effect on the firm's advertised price cannot be rejected using our data, even at the 10 percent level. On the other hand, at the 1 percent significance level we can reject the null of no effect of the share of LPGs adopted in the market on the advertised tire price (the corresponding p-value is 0.7 percent). We also test for the equality of the effects of price-matching and price-beating guarantees on the advertised tire prices and find that these effects are significantly different from each other at the 5 percent level.

We consider several alternative specifications. For example, we re-run the regression using a feasible generalized least squares procedure that allows for correlation between observations for a firm, with very similar results (the observations for a particular firm may be correlated if the firm follows a similar pricing and advertising strategy across markets).

The linear regression may be too restrictive in assuming that the impact of the LPGs is the same, regardless of the product characteristics, such as mileage warranty, or the number of firms in the market. For example, we know that price-beating guarantees are associated with relatively low values of mileage warranties, whereas price-matching is associated with higher values of mileage warranty. (Mileage warranty may be thought of as a proxy for the quality of the tire.) In practice, the high degree of correlation between the interaction terms and other regressors does not allow us to proceed with the estimation.

The estimated equation include a number of dummies and while we have good reasons for including them in the regression, they may also pick up other effects as well. For example, STSPEED and to a lesser extent PM are associated with high mileage warranties. If the relationship between price and mileage warranty is non-linear, this may be picked up by these variables.

There were other explanatory variables, related to the characteristics of the LPG rather than to some feature of the tire which might invalidate the LPG, which it would have been interesting to include. For example, we know from Arbatskaya and colleagues (1999) that whether consumer search is allowed after the purchase of a product may depend on the motivation for the LPG. In our data, 84 percent of the price-beating guarantees allow search. (Only price-beating guarantees allow search, which in all cases is restricted to 30 days.) Similarly, it may matter whether the LPG relates to a competitor's advertised price, because in that case a firm may be able to use a price-beating guarantee to lower its actual selling price by increasing its advertised price. In 91 percent of the price-beating guarantees the LPG refers explicitly to the advertised price of its competitors. We decided against including these explanatory variables and others because of the strong correlation between

these additional LPG characteristics and the major LPG classes and because of the ambiguity in some of the LPG statements.

Finally, as a check on the robustness of the estimation results, a calculated price (per tire) of a set of four tires, CALCP1, is used as an alternative measure of the price. We compute it from the price quote on one tire by multiplying by four if the fourth tire is not free and by three when it is free; when the price of a set of four tires is advertised, we take the lowest price at which four tires can be purchased. As a result, the number of observations increase from 427 to 482 but the magnitude and the significance of the LPG variables are not largely affected, as compared to the FGLS estimates of the price equation presented in Table 5.

To summarize, we do not observe a significant direct association between the LPGs and prices advertised by a firm. However, the positive impact of the extent to which LPGs are widespread (LPG_SHARE) in a given market is highly significant. When we take into account the problems with estimating the effects of low-price guarantees on the type of data we have available, this lends some support to the theories which predict that low-price guarantees lead to modestly higher prices.

IV. CONCLUSIONS

The primary goal of this paper is to assess the impact of price-matching and price-beating guarantees on advertised tire prices. This is accomplished by specifying a price equation in which an advertised price is a function of the LPG policy announced by the firm and of the share of price-matching and price-beating firms in the market. The price equation is estimated by the feasible generalized least squares (FGLS) method, using the data on prices and characteristics of P185/75R14 tires collected from U.S. Sunday newspapers. Several hypotheses are stated and tested.

We find that price-matching and price-beating guarantee dummy variables do not have a significant direct impact on retail tire prices when feasible generalized least squares estimation is used. Nevertheless, the effects are significantly different from each other; relative to each other, price-matching guarantees tend to be associated with lower advertised tire prices while price-beating guarantees tend to be associated with higher advertised tire prices.

Comparing prices across firms in the same market, it would be easy to conclude that LPGs do not affect prices. The inability of LPG dummy variables to explain the price differentials does not mean, however, that LPGs do not lead to higher prices. If LPGs do help firms to raise their prices to supra-competitive levels, then one would observe a generally higher level of prices in the markets where they are widely adopted. In fact, there is a significant and positive effect on a firm's price from the share of the firms in the market announcing price-matching and price-beating guarantees. The effect of all firms adopting an LPG in a market is found to

be an increase in prices of about 10 percent. Although not trivial, this effect is modest which is in line with the predictions made in Hviid and Shaffer (1999).

When looking at the effects of LPGs it is clearly important that we are comparing like with like. Most guarantees do explicitly state that they are only valid for similar products. This implies that heterogeneity of the sample may cause problems and when assessing the evidence presented in the paper it is important to keep in mind that although we have controlled for some of the heterogeneity, we cannot control for all. Thus it may be the case that the low-price guarantees only affect a very small subset of the data in which case any significant effects may be difficult to pick up. Keeping in mind these problems, the fact that we find a strong positive effect from the percentage of firms in a market that have adopted a low-price guarantee is surprising, and offers some (but not conclusive) evidence that these guarantees are associated with high prices.

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NOTES

1. *Tire Kingdom* promises to beat a lower price by 10 percent before the tire purchase and to refund 250 percent of the price difference after the purchase. There are 99 price quotes in *Tire Kingdom*'s ad published in the November issue and 229 price quotes in the December issue.

2. A low price guarantee is a promise made by a firm to meet (price-matching guarantee) or beat (price-beating guarantee) a competitor's price on a similar product.

3. Occasionally cases are brought against such retailers as Office Depot, Circuit City, or Montgomery Ward & Co charging that the firms make confusing LPG claims. So far the cases have either been dismissed due to insignificant damages imposed on consumers, or the firms have agreed to re-word their claims, though usually without admitting any wrongdoing.

4. On March 4, 1998, the New York City Department of Consumer Affairs issued a notice warning that low-price guarantees could discourage consumers from comparison shopping. *Newsday*, April 5, 1998, p. F03.

5. We thank Michael Baye for making this observation. In a recent paper, Manez (1998) confirms the previous finding that price coordination improved after an LPG was adopted by Tesco, one of the top-market-share superstores in Coventry, UK. (Tesco promised: "Lowest Local Value or We'll Refund You DOUBLE the Difference.") Nevertheless, Manez finds that a trend in the relative market price of products included under the LPG changes from positive to negative after the LPG adoption, contrary to the findings by Hess and Gerstner (1991).

6. See Arbatskaya and colleagues (1999) for the description of the original data on 515 LPGs retrieved from newspaper advertisements of retailers in more than 50 categories of products and services.

7. P185/75R14 tire size is the standard tire size for many mid-size passenger cars, such as 1994 Chevrolet Cavalier or 1994 Pontiac Grand AM. There are many more price quotes for P185/75R14 tire size than, for example, for P205/65R15 tires, which go with the Ford Taurus, the 1994–1996 top-selling passenger car in the United States.

8. We consider the replacement tire market (as opposed to the market for original equipment passenger tires) since we are interested in the consumer retail markets to which the newspaper advertisements are largely directed.

9. On the other hand, since the choice of a tire requires technical knowledge, consumers may rely more on retailers' advice in their purchase decision.

10. The web address is http://www.tiresplus.com.

11. This is in accord with the corresponding percentages documented in Arbatskaya and colleagues (1999) for the tire retailers but in contrast with the percentages obtained for all the industries in their sample (63 percent price-matching and 37 percent price-beating guarantees out of 515 LPGs). That is, price-beating guarantees (as compared to price-matching guarantees) are relatively more widespread in the retail tire industry than in other industries.

12. The differences in average prices advertised by firms adopting no LPG, price-matching and price-beating guarantees are not significant at the 10 percent level, while the differences in the mileage warranty across LPG types are significant at the 1 percent level (except for the difference between firms with no LPGs and price-beating firms, which is significant only at the 10 percent level). For instance, the t-statistics for the two-sample test of equality of the mean mileage warranties advertised by price-matchers and price-beaters is 4.05 (equal variances not assumed), which allows us to conclude that price-matching firms tend to choose higher mileage warranties than price-beating firms (the p-value is much less than 1 percent).

13. To reconcile Table 2 and 3, we note that while for the no-LPG subsample the observations are evenly distributed across the three mileage classes, 80 percent of the price-beating guarantees fall in the two lower categories and over half of the price-matching guarantees fall in the top category. Thus price beating appears to be associated more with the low end of the mileage warranties while price matching with the high end.

14. Economic Census on Retail Trade 1992 is the source of the data on the number of Auto and home supply stores (SIC 553) which is taken as a proxy for the number of tire retail establishments in the metropolitan statistical area. The data for the population comes from 1990 Census Counts for Cities.

15. Speed rating is the maximum speed that the tire can safely sustain. A dummy variable STSPEED equals one for an S or T-speed rated tire (with the speed rating of 112 m.p.h. or 118 m.p.h.) Note that the performance tires have the speed rating of at least 130 m.p.h. All-season (ALLSEASON) tires, in contrast to conventional passenger car tires, have a tread designed to provide better performance under varying driving conditions.

16. It is implicitly assumed that LPGs adopted by the firms are exogenous to the price equation. To show that price-matching and price-beating guarantees can indeed be assumed exogenous to the tire retailers' choices of the advertised prices, we use Wu-Hausman's test, which is based on the comparison of OLS and 2SLS estimates. As the instruments for dummy variables PM and PB we use the time trend and a dummy ALL_LPG_RI, which equals one when all of the firm's rivals in the market announce an LPG, as well as all the regressors from the price equation. The test allows us to conclude that we cannot reject the null hypothesis of exogeneity of PM and PB dummy variables in the price equation since the F-statistic of 1.63 is much lower than the critical F-value and the associated p-value is 0.20 (for details on the exogeneity test see, e.g., Hausman, 1978).

17. Since we found that the effects of the shares of firms announcing price-matching and price-beating are not significantly different from each other, we use the share of LPG firms in the market as an explanatory variable.

18. In our preliminary analysis we experimented by including additional regressors in the price equation. A dummy variable for the most generous price-beating LPG in the market, MAX_PB, did not have a significant effect on prices. We also found that the existence of at least one LPG in a market, EXIST_LPG, was not statistically significant. A dummy variable ALL_LPG, which equals one if all firms in the market advertise a LPG, could account for the ability of firms to sustain supra-competitive prices in an equilibrium. It turned out to be not significantly different from zero and therefore was omitted from further analysis. Whether a firm has a high propensity to advertise or not, as measured by FNADS, had no significant impact on the tire prices it advertises. Whether the advertised tire was on sale (SALE) and the negative time trend were not significant either at the 5 percent level.

19. The coefficient for the mileage warranty squared is not significantly different from zero when it is added to the regressors and so we report the estimates from the linear specification of the price equation with respect to the mileage warranty.

20. When variable *NFIRMS* is replaced by six dummy variables for the number of firms in the market, F_k, $k = 1, \ldots, 6$, only the dummy variable F_5 is significant at the 5 percent level. The test of the joint significance of all the dummy variables results in F-statistic of 1.61, which means that the F_k variables are not significantly different from zero. The estimates for other variables in the regression are very similar to those reported in Table 5 and therefore they are not reported here.

21. A free-service index (SERVICE) is constructed for each firm as a sum of free services that the firm usually provides with a tire purchase. These include mounting, balancing, valve stems, rotation, replacement, flat repair, and tire disposal. When the service index is included into the regression instead of mounting, almost no changes in the estimates result.

REFERENCES

Arbatskaya, M. 1998. "Can Low Price Guarantees Deter Entry?" Unpublished manuscript.

Arbatskaya, M., M. Hviid, and G. Shaffer. 1999. "On the Incidence and Variety of Low-Price Guarantees." Unpublished manuscript.

Baye, M., and D. Kovenock. 1994. "How to Sell a Pickup Truck: 'Beat-or-Pay' Advertisements as Facilitating Devices." *International Journal of Industrial Organization* 12: 21–33.

Bresnahan, T. F., and P. C. Reiss. 1991. "Entry and Competition in Concentrated Markets." *Journal of Political Economy* 99: 977–1009.

Chen, Z. 1995. "How Low is a Guaranteed-Lowest-Price?" *Canadian Journal of Economics* 28: 683–701.

Corts, K. 1995. "On the Robustness of the Argument that Price-Matching is Anti-Competitive." *Economics Letters* 47: 417–421.

———. 1997. "On the Competitive Effects of Price-Matching Policies." *International Journal of Industrial Organization* 15: 283–299.

Doyle, C. 1988. "Different Selling Strategies in Bertrand Oligopoly." *Economics Letters* 28: 387–390.

Edlin, A. S. 1997. "Do Guaranteed-Low-Price Policies Guarantee High Prices, and Can Antitrust Rise to the Challenge?" *Harvard Law Review* 111: 528–575.

Edlin, A. S., and E. R. Emch. 1999. "The Welfare Losses from Price-Matching Policies." *Journal of Industrial Economics* 47: 145–167.

Hausman, J. A. 1978. "Specification Tests in Econometrics." *Econometrica* 46: 1251–1272.

Hess, J., and E. Gerstner. 1991. "Price Matching Policies: An Empirical Case." *Managerial Decision Economics* 12: 305–315.

Hviid, M., and G. Shaffer. 1994. "Do Low-Price Guarantees Facilitate Tacit Collusion?" University of Michigan Working Paper, 94-02.

———. 1998. "Do Low-Price Guarantees Facilitate Tacit Collusion?" Mimeographed, University of Warwick.

———. 1999. "Hassle-Costs, the Achilles Heel of Price Matching Guarantees." Forthcoming in *Journal of Economics and Management Strategy*.

Logan, J., and R. Lutter. 1989. "Guaranteed Lowest Prices: Do They Facilitate Collusion?" *Economics Letters* 31: 189–192.

Manez, J. A. 1998. "Unbeatable Value: Analysis of a Low Price Guarantee." Unpublished manuscript.

Png, I. P. L., and D. Hirschleifer. 1987. "Price Discrimination Through Offers to Match Price." *Journal of Business* 60: 365–383.

Salop, S. 1986. "Practices that (Credibly) Facilitate Oligopoly Coordination." Pp. 265–290 in *New Developments in the Analysis of Market Structure*, edited by J. Stiglitz and F. Mathewson. Cambridge, MA: MIT Press.