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Non-Price Advertising and Price Competition: a Theory, and Evidence from the Brazilian Beer Market

Renato D B Gomes
João M P De Mello

PUC RIO

DEPARTAMENTO DE ECONOMIA
www.econ.puc-rio.br

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Renato D B Gomes* and Joao M P De Mello†

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Abstract

By engendering horizontal differentiation, non-price advertising increases the incentives to accommodate on the price dimension. However, advertising also increases the size of the market and, consequently, the payoffs to price undercutting, which induces more aggressive price competition. We propose a theory in which advertising has a different effect on price competition according to the level of market maturity. In mature markets - where potential growth in low - only the price accommodation effect is present. In immature markets, both effects are present. Therefore, advertising is more pro-competitive (less anti-competitive) in immature markets. Evidence from several Brazilian beer markets corroborates the theory.

*Ph.D. Student, Department of Economics - Northwestern University.

†Assistant Professor, Departamento de Economia, PUC-RIO. phone (5521) 3114-1078. email: jmpm@stanford.edu.

1 Introduction

Advertising is an important dimension through which firms compete in several industries. Recently, increasing attention has been given to its effects on pricing decisions. Although several studies on the effects of advertising on prices were conducted, very few points are consensual. Are advertising and price substitutes or complements? If substitutes, in what kind of industries and markets should one fear anti-competitive effects of advertising? Needless to say, the answers to these questions bring important policy implications. In this paper, we propose a theory on how advertising affects prices on mature (low growth potential) *versus* immature (high growth potential) markets, and confront it with data from the Brazilian beer market.

Advertising is usually classified into two categories: *price* and *non-price*.[1] Price advertising conveys relevant information about the product, such as existence, quality and, of course, price. Non-price advertising tries to change consumers' preferences, associating products to trendy lifestyles, family feelings, and so on. There are plenty of models that evaluates the effects of both kinds of advertising on prices. Stigler [1961], Nelson [1970], Nelson [1974], Grossman and Shapiro [1984] and Milgrom and Roberts [1986] stress that price advertising reduces the costs consumers face to get informed. They conclude that price advertising increases demand elasticities, and bring prices down. Some empirical evidence corroborates these results: Kwoka [1984] and Milyo and Waldfogel [1999], for example, study in markets where price advertisement bans were overturned. In these cases, allowing price advertising reduces *final* prices, although the overall effect remains unclear.

In contrast, Sutton [1974], Dixit and Norman [1978], Shaked and Sutton [1982] and Economides *et al* [1994] argue that product differentiation induces concentration. Since non-price advertising are mainly to differentiate products, these papers predict a positive association between non-price advertisements and prices. Some empirical evidence support this view (Eskin [1985] and Cox *et al* [1987]).

Here, we focus on non-price advertising to tackle the following question: how should advertising affect the amount of competition *for a certain* level of *market maturity*?[2] Advertising produces consumer heterogeneity, creating

[1] Names may vary. Price advertising is also known as hard or informative advertisement. Non-price advertising are also labelled soft, persuasive or even goodwill advertising.

[2] From now on, advertising and non-price advertising are used interchangeably, unless

"clusters" of preferences for specific products. Through this channel (, since it creates clusters,) advertising (should) dampens incentives to compete in the price dimension and, therefore, raise prices.[3] On the other hand, there is a second effect: advertising changes the size of the market by bringing in new consumers. Thus, when firms advertise, they face higher demands, which increases the payoff to price undercutting, and therefore induces aggressive price competition. The "increasing demand" effect is determined by the potential growth of the consumer market. Therefore, in immature markets, where potential for growth is high, advertising induces more price competition than in mature markets, where potential growth is low. Indeed, in our empirical analysis this difference is documented. In markets where the potential sales growth is higher, advertising is not associated with higher prices, while in established, more mature markets, advertising is associated with higher prices. The difference is significant both economically and statistically, and it is robust to several controls and specifications.

The empirical literature has documented evidence that non-price advertising has, concurrently, both the "increasing demand " and the "differentiating products" effects. Seldon, Banerjee and Boyd [1993] document, for the cigarette industry, that non-price advertising by one firm increases both the firm-level demand, relative to competitors, and the market level demand. As argued above, these two aspects of non-price advertising have markedly different implications for aggressiveness in price competition, and whether advertising increases or decreases aggressiveness depends crucially on the balance between these two effects. Therefore, it is important to isolate them, and determine how market conditions affect their relative importance. This is precisely what this paper does, both theoretically and empirically. In particular, the distinction between mature and immature market made here may explain why the empirical literature on non-price advertising performed so poorly.

The paper is organized as follows. In section 2, we outline the model. The empirical strategy is described in section 3, and results are presented in section 4. Section 5 concludes, with focus on the important policy implications the results of this paper bring.

otherwise noted.

[3] This effect is well known by the literature cited above.

2 The Model

2.1 Preferences and Technologies

The goal is to analyze the different roles non-price advertising plays in mature and immature markets. First, however, it is necessary to define consumers make choices between competing brands and, secondly, how advertising affects consumer's choices. The model has one set of consumers and two firms, each offering on differentiated brand of a certain product.

Firms are labelled A and B. p^A and p^B are the prices of the brands produced by A and B, respectively. Consumers' personal preferences about each brand distort the perceived relative price. More specifically, let consumer i perceive prices as $p^A + \beta^i$ and p^B, where $\beta^i \in [-1, 1]$. If $\beta^i > 0$, consumer i prefers brand B to A, and conversely if $\beta^i < 0$. Additionally, there is a closely related product of price α which competes as an outside option for the two brands. This product may be thought as a near substitute or even an imported good which affects demand for the domestic brands.

For simplicity, price is the only dimension that matters for consumers. Hence, consumer i would buy brand A if and only if

$$\min\{p^A + \beta^i, p^B\} \leq \alpha. \tag{1}$$

We make the distributive assumption that the β's are uniformly distributed in $[-1, 1]$.

Clearly, if β^i is very high, the consumer i willing to pay a lot for the good. In this case, his demand resists to higher prices and even cheaper outside options. This is heaven for firms. In our model, advertising does precisely this: it concentrates the β's on more extreme values.

Before choosing prices, firms decide simultaneously if they advertise or not.[4] This decision is made in period $t = 1$, and determines the distribution of β's firms face when choosing prices. The price choices, made in period $t = 2$, are again simultaneous. After the prices are set, consumers make their choices, and profits are realized. The timing is:

[4] We make the advertising decision binary just for the sake of tractability. The results are far more general.

More formally, the strategies of firm $j \in \{A, B\}$ may be denoted as $\{ad, nad\}$ in period $t = 1$ and $\{p \in \mathbb{R}_+ | h_1\}$ in period $t = 2$, where ad stands for advertising, nad stands for non-advertising, and h_1 is the vector of choices firms made in the first period. For simplicity, both firms are assumed to have constant marginal costs set to c, and pay G if they decide to advertise. Letting $Q_j(h_1, p^A, p^B)$ denote the inverse demand function faced by firm j (after advertising choices are made), its profit function is: $\pi^j(h_1, p^A, p^B) = Q_j(h_1, p^A, p^B) \cdot (p^j - c) - \mathcal{X}^j(h_1)G$, where $\mathcal{X}^j(h_1)$ is an indicator function that equals 1 if firm j advertises in period $t = 1$.

Advertising changes the distribution of consumers feelings about each brand. If both firms advertise, it is expected that more consumers have more defined preferences over each brand. Thus, advertisement clusters consumers on the extremes of the preference distribution. For simplicity, the following density describes consumers' preferences when both firms advertise:

$$f(ad, ad) = \begin{cases} 1 & \text{if } \beta \in [-1, -1/2] \\ 0 & \text{if } \beta \in (-1/2, 1/2) \\ 1 & \text{if } \beta \in [1/2, 1]. \end{cases} \tag{2}$$

This simple distribution capture some interesting features. First, advertisement polarize consumers, engendering the "artificial" product differentiation described by Comanor and Wilson [1979]. Moreover, when consumers favor one brand, the price of the outside option must be even lower to overcome this new affection. Hence, advertising works to increase the size of the market, as described by Boyer [1974].

In the same spirit, if only one firm advertises, say firm A, a cluster of consumers favors her and less consumers prefer B, or are indifferent between both firms. Again, for tractability, the distribution is:

$$f(ad, nad) = \begin{cases} 1/3 & \text{if } \beta \in [-1, 1/2] \\ 1 & \text{if } \beta \in (1/2, 1). \end{cases} \tag{3}$$

The case when just firm B advertises is analogous. Finally, when no firm advertises, we suppose the initial uniform distribution remains in the second period.

The decision of advertising depends largely on the equilibrium prices that will prevail in the second period. These prices are constrained by the outside option price, which may seriously affect firms strategies. If α, the price of the outside option, is high enough, closely related products are not a big threat for firms A and B. In this case, except for very high prices, these brands would be a normal choice in consumers baskets. In other words, the aggregate demand for this product is well established in the sense that it does not vary sharply with prices. Of course, moderate prices are only possible as long as the unit cost of production is significantly less than outside option price. This motives us to deem as mature the markets in which $c + K \leq \alpha$, where K is a nonnegative constant. On the other hand, if the outside option price is small relative to firms unit costs, it would be virtually impossible to keep sufficiently low prices in order to avoid loosing customers. In this case, the market would be not well established relatively to closely related products, and the aggregate demand for the product would have a high growth potential as prices decrease. Hence, we define as immature markets those for which $c \geq \alpha + L$, where L is a nonnegative constant.

The effects of advertising on these two types of markets will be fairly different. First we describe the equilibrium output for mature markets. Subsequently, the same is done for immature markets, and then some empirical implications to be tested with Brazilian beer market data are derived

2.2 Mature Markets

This subsection deals with mature markets. As the name suggests, these markets have a well established demand for their products. Here, advertising works mainly to differentiate products, increasing market power for both firms.

The model is solved by backward induction. First, prices and profits are derived for the case in which no firm advertises, in which only one (of them) does, and in which both do. Then, by comparing profits to the cost of advertising, one can establish which strategic profiles constitute a subgame perfect Nash equilibria. For technical purposes, let $K \geq 2$.

The benchmark is the (uninteresting) case in which no firm advertises. Here, firms compete in prices as in a standard Hotelling model. Assuming that no consumer chooses the outside option, the demand firm A faces is:

$$Q_A((nad, nad), p^A, p^B) = \int_{\{\beta^i : p^A - \beta^i < p^B\}} 1/2 \; d\beta = \int_{p^A - p^B}^{1} 1/2 \; d\beta = 1/2 - \frac{p^A - p^B}{2}. \tag{4}$$

By symmetry, it has to be that $Q_B((nad, nad), p^A, p^B) = 1/2 + \frac{p^A - p^B}{2}$. Profits are:

$$\pi_A((nad, nad), p^A, p^B) = (1/2 - \frac{p^A - p^B}{2}) \cdot (p^A - c) \quad (5)$$
$$\pi_B((nad, nad), p^A, p^B) = (1/2 + \frac{p^A - p^B}{2}) \cdot (p^B - c). \quad (6)$$

It is now easy to see that the Hotelling equilibrium prices are $p^A = p^B = c+1$, and profits are $\pi^A(nad, nad) = \pi^B(nad, nad) = 1/2$. Note that $p^A, p^B < \alpha$, and, indeed, no consumer will opt for the outside option.

Things are more interesting in the case in which both firms advertise. Here, consumers have strong feelings about each brand and firms face locally unresponsive demands to the competitors price. Nevertheless, firms may loose customers to the outside option if their prices are too high. Since firm A's consumers have $\beta^i \geq 1/2$, she looses market to the outside option when her price exceeds $\alpha + 1/2$. Demand and profit are:

$$Q_A((ad, ad), p^A, p^B) = \begin{cases} 1/2 - \int_{\{\beta^i : p^A - \beta^i > \alpha\}} 1 \, d\beta = 1 - p^A + \alpha & \text{if } p^A > \alpha + 1/2 \\ 1/2 & \text{if } p^A \leq \alpha + 1/2. \end{cases} \quad (7)$$

$$\pi_A((ad, ad), p^A, p^B) = \begin{cases} (1 - p^A + \alpha)(p^A - c) & \text{if } p^A > \alpha + 1/2 \\ 1/2(p^A - c) & \text{if } p^A \leq \alpha + 1/2. \end{cases} \quad (8)$$

Will firms set prices so high that some consumers leave the market? By noting that $\frac{\partial \pi^A}{\partial p^A}(\alpha + 1/2) = \frac{\partial \pi^B}{\partial p^B}(\alpha + 1/2) = c - \alpha < 0$, we see that the equilibrium prices must be $p^A = p^B = \alpha + 1/2$. Hence, both firms discriminate prices until the first consumer of each brand becomes indifferent between staying or leaving the market. The intuition is clear: since units costs are small relative to the outside option price, it is not worthy to increase profit margins at the expense of loosing customers. In mature industries, profit margins are high enough to stop price discrimination when outside competition binds. Finally, when both firms advertise, their profits are $\pi^A(ad, ad) = \pi^B(ad, ad) = 1/2 \cdot (\alpha - c + 1/2)$.

The remaining case is when just one of the firms advertises, say A, for example. Again, it is assumed that firm A does not loose customers to the outside option. Since consumers are not completely clustered around each firm (they are just more concentrated around A), there should be price competition between firms in equilibrium. The demand for firm A is:

$$Q_A((ad, nad), p^A, p^B) = \int_{\{\beta^i : p^A - \beta^i < p^B\}} f(ad, nad)\ d\beta = 1/2 + \int_{p^A - p^B}^{1/2} 1/3\ d\beta = \frac{2 + p^B - p^A}{3}. \tag{9}$$

And for firm B:

$$Q_B((ad, nad), p^A, p^B) = \int_{\{\beta^i : p^A - \beta^i > p^B\}} f(ad, nad)\ d\beta = \int_{-1}^{p^A - p^B} 1/3\ d\beta = \frac{1 + p^A - p^B}{3}. \tag{10}$$

The equilibrium prices are $p^A = c + 5/3$ and $p^B = c + 4/3$. Since $\alpha > c + 5/3$, in equilibrium no consumers will leave the market. Clearly, loyal customers allow firm A to do some price discrimination, but not at the levels permitted when both firms advertise. In fact, firms profits are now $\pi^A(ad, nad) = 25/27$ and $\pi^B(ad, nad) = 16/27$. Thus, if firm B advertises, not just her profits would rise, but firm A, although loosing customers, would increase her payoff. Indeed, there are spill over effects in advertising: eliminating competition benefits both firms because prices are set in even higher levels.

We are now able to discuss the equilibrium solutions for this game. Recall that $\pi^A(nad, nad) = 1/2$ and $\pi^A(ad, nad) = 25/27$. Hence, as long as $G < 23/54$, (nad, nad) does not arise in equilibrium. For concreteness, let $\alpha - c = 2$. Thus, $\pi^A(ad, ad) = 5/4$. Since $\pi^A(nad, ad) = 16/27$, it follows that (ad, ad) may happen in equilibrium if and only if $G < 71/108$. These calculations are just to point out some very intuitive features of our model: for sufficiently cheap advertising, everybody does it. On the other hand, if advertising gets expensive, in equilibrium no one does it. Finally, for the intermediate case, there are coordination problems and multiple equilibria. We summarize our findings in the following proposition:

Proposition 1 *For mature markets, there exist $\overline{G}$ and $\underline{G}$ with $\overline{G} > \underline{G}$ such that:*

1. *If the cost of advertising G is less than $\underline{G}$, there is only one equilibrium where both firms advertise and set prices equal to $\alpha + 1/2$.*

2. *If the cost of advertising G is more than $\overline{G}$, there is only one equilibrium where no firm advertises and prices are set to $c + 1$.*

3. *If the cost of advertising G is between $\underline{G}$ and $\overline{G}$, there are two equilibria: one in which both firms advertise and set prices to be $\alpha + 1/2$ and*

another in which firms do not advertise and charge $c+1$ for their products.

Comparing advertising and non-advertising equilibria, we see that advertising increases prices in mature markets. In these markets, intra-brand competition is the relevant source of competition. Here, advertising works to insulate firms, neutralizing any competitive pressures. In summary, by polarizing consumers, firms gain market power and raise prices.

2.3 Immature Markets

We now turn to immature markets. Here, the aggregate demand has a high potential growth, being very sensitive to the outside option competition. Advertising now also works to increase demand and raise competition at the margin. The strategy to find equilibrium solutions is similar to the one employed above.

Once more, the benchmark is the non-advertising case. But now, in contrast to mature markets, firms face two potential sources of competition: between brands and between their product and the outside option. We guess the demand firm A faces are (will be):

$$
\begin{aligned}
Q_A((nad,nad),p^A,p^B) &= \int_{\{\beta^i:p^A-\beta^i<p^B\}} 1/2\ d\beta - \int_{\{\beta^i:p^A-\beta^i<p^B\}\bigcap\{\beta^i:p^A-\beta^i>\alpha\}} 1/2\ d\beta \\
&= \int_{p^A-p^B}^{1} 1/2\ d\beta - \int_{p^A-p^B}^{p^A-\alpha} 1/2\ d\beta \\
&= \int_{p^A-\alpha}^{1} 1/2\ d\beta = 1/2\cdot(1-p^A+\alpha). \qquad (11)
\end{aligned}
$$

If the demand specification above holds in the continuation game equilibrium, firms care only about their prices and the outside option price. To check that this indeed happens, the Hotelling prices must be computed. In fact, firm A's profit is $\pi_A((nad,nad),p^A,p^B) = (1/2 - \frac{p^A-p^B}{2})\cdot(p^A-c)$ and, hence, she sets p^A to be $1/2\cdot(1+\alpha+c)$. By symmetry, $p^B = 1/2\cdot(1+\alpha+c)$. To verify the demand above is correct, we must verify that both firms loose customers in equilibrium or, equivalently, that $p^A-\alpha>0$. Since the market is immature, $c>\alpha$ and the result follows. The firms profits are now given by $\pi^A(nad,nad) = \pi^B(nad,nad) = 1/8\cdot(1+\alpha-c)^2$. The lesson here is that, although firms offer different brands of the same product, in immature markets their primary threat is the outside option.

We now analyze the case where both firms advertise. The calculations made in the previous section still apply. In particular, the demand firm A faces will be given by equation (7) and her profits by equation (8). The difference is now that immature markets make $\frac{\partial \pi^A}{\partial p^A}(\alpha+1/2) = \frac{\partial \pi^B}{\partial p^B}(\alpha+1/2) = c - \alpha > 0$. Hence, firms loose customers in equilibrium. In this case, their cost structure pushes them to face outside competition. In other words, their market is not protected against close substitutes. It is straightforward to see both firms set their prices equal to $1/2 \cdot (1 + \alpha + c)$ and have profits $\pi^A(ad, ad) = \pi^B(ad, ad) = 1/4 \cdot ((1 - c)^2 - \alpha^2)$.

Finally, there is the case where just one of the firms advertises. Once again, let firm A be the advertiser. Guessing that both firms loose customers in the continuation equilibrium, the demands are:

$$Q^A((ad, nad), p^A, p^B) = 1/2 + \frac{1/2 - p^A + \alpha}{3} \tag{12}$$

$$Q^B((ad, nad), p^A, p^B) = \frac{1 + \alpha - p^B}{3}. \tag{13}$$

(We may again derive their profits to get) Prices are $p^A = \frac{2+\alpha+c}{2}$ and $p^B = \frac{1+\alpha+c}{2}$. Since $c > \alpha$, they both set prices above the outside option price. In particular, (it) this verifies that (we chose) the demands were chosen correctly. Straightforward calculations show that $\pi^A(ad, nad) = \frac{(2+\alpha-c)^2}{12}$ and $\pi^B(ad, nad) = \frac{(2+\alpha-c)^2}{12}$.

We may now discuss equilibrium solutions. For concreteness, let $c = 3$ and $\alpha = 1$. In this case, when no firms advertise, profits are $\pi^A(nad, nad) = \pi^B(nad, nad) = 1/8$. If one of the firms deviates and advertises, say A, she would get $\pi^A(ad, nad) = 0$. Hence, no matter how much it costs to advertise, (nad, nad) may always happen in equilibrium. Moreover, if both firms advertise, their profits are $\pi^A(ad, ad) = \pi^B(ad, ad) = 3/4$. If firm A deviates and decides not to advertise, she would get $\pi^A(nad, ad) = 1/12$. We then conclude that (ad, ad) may happen in equilibrium if and only if the cost of advertising is less than $2/3$. More generally, we may state:

Proposition 2 *For immature markets, there exists $\hat{G}$ such that:*

1. *If the cost of advertising G is less than $\hat{G}$, there are two equilibria: one in which both firms advertise and another in which no firm advertises.*

2. *If the cost of advertising G is more than $\hat{G}$, there is only one equilibrium where no firm advertises.*

In any of these equilibria, both firms set prices to be $p^A = p^B = 1/2 \cdot (1 + \alpha + c)$.

2.4 Empirical Implication

In the last section, the model produced one striking result: if the market is immature, in equilibrium, prices are not affected by the level of advertising. In fact, no matter the equilibrium predicts both firms to advertise or not, prices remain to be $1/2 \cdot (1 + \alpha + c)$. This result stems from the fact that the demand that firms face when they advertise (equation (7)) is twice the demand they face when they do not (equation (11)). Indeed, in immature markets, firms always loose customers to the outside option. This means that A's infra-marginal consumer, for example, is indifferent between brand A and the outside option, and strictly prefers any of them to brand B. Hence, intra-brand competition is never binding in equilibrium. Now notice that the role of advertising is to cluster consumers in the extremes of preference distribution. Since brands will not steal consumers from each other, the amount of consumers who prefer A to β doubles if both firms advertise. This explains the proportional demands, which induce proportional profit functions and, thus, equal prices in both equilibria.[5] In summary, the precedence of outside competition over brand competition in immature markets is the defining feature of our result.[6]

Similarly to other exercises in economic theory, this analysis should only be thought of as a parable illustrating a general principle. The lesson here

[5] The strict proportionality result is certainly not robust. The assumption of piecewise uniform distributions and constant marginal costs are essential for it. Nonetheless, these hypotheses only emphasize the intuitive content of this paper. The result that prices react much less to advertising in immature markets is robust to other (troublesome) distributions and cost structures.

[6] More competition within the market would only strengthen our results. Imagine, instead of two, three firms competing in the market. In immature markets, demands with or without advertising would still be proportional and prices would not change. In mature markets, in an advertisement equilibrium, firms would still set prices to be $\alpha + \frac{1}{2}$. On the other hand, the Hotelling model with no advertising would have more players and, hence, its equilibrium prices should be lower, approaching the competitive levels. The price difference between advertising and non-advertising equilibria in mature markets would indeed be larger.

is that, in immature markets, besides differentiating brands, advertising also brings competitive pressures when it raises aggregate demand for the product. In our model, the pro and anti-competitive effects of advertising in immature markets are such that they cancel out. More generally, however, findings may be summarized in the following empirical implication:

Empirical Implication 1 *Advertising is more pro-competitive (less anti-competitive) in immature markets than in mature markets.*

In the next section, we propose a test for this model. We use Brazilian beer market data to corroborate our theory.

3 The Empirics: The Case of the Brazilian Beer Market

3.1 From Theory to Data: the Implication

The model in section 2 provides one sharp prediction: the effect of advertising competition on price competition should differ between mature and immature markets. In the former, advertising only increases horizontal differentiation, which decreases the competitive appetite on the price dimension. This effect is analogous to the switching cost effect in Klemperer [1987]. In immature markets, additionally from the differentiation effect, advertising increases the size of the market. This, in turn, *increases* the competitive appetite on the price dimension, simply because there is more to gain from price undercutting.

The empirical implication described in the model section is fairly ethereal. Mature and immature markets are different because the cost of producing the good, relative to the price of the outside option, is different. In practice, this implies that, while advertising brings in new consumers in immature markets, it does not so in mature ones. For our empirical purposes, this is tantamount to interpreting immature markets as those with relatively high growth potential. The next two subsections describe the empirical application, with special emphasis on why the Brazilian beer market presents several interesting features for testing the theory presented. These features are: 1) product differentiation; 2) advertising and price as competition devices; 3) presence of a relevant outside good; and 4) variation in "market maturity".

3.2 The Data and the Recent Industry Developments

The take our theory to the Brazilian Beer Industry Data. We observe the share, price and Gross Rating Points (GRP) of the two largest brewers, AMBEV and SCHINCARIOL, who represent 70% of the industry on average during our sample period (January 2002 to January 2005) for seven regional markets (Belo Horizonte, Brasília, Curitiba, Recife, Rio de Janeiro, Salvador and São Paulo).

The Brazilian beer market is an interesting market for testing the ideas presented. First, there is evidence that consumers view different beers it as a differentiated products, which is *sine qua non* for a the phenomenon studied to exist. Indeed, plain observation of the recent marketing strategies from AMBEV and SCHINCARIOL suggest that. SCHINCARIOL, a small fringe brewer until the beginning of this period, successfully bid for a substantial increase in its market share. Part of the marketing strategy involved renaming its main brand, from SCHINCARIOL to NOVA SCHIN, the latter meaing literally "NEW SCHIN". Not surprisingly, the advertising effort tried to build the imagine that SCHIN was something new. AMBEV, on the other hand, placed one its main beers, ANTARCTICA, which is the closest competitor to NOVA SCHIN, as the BOA, that is, the "GOOD ONE". Its advertising campaign actually brought a motto that said "if it's good, it doesn't have to be new!", clearing mentioning the closest competitor and also differentiating ANTARCTICA from NOVA SCHIN. It is not inconceivable, then, that these two brands appealed more to different profiles of consumers, one more conservative and the other more innovative.

Another interesting feature of the data is the huge variation, over time and across regional markets, in advertising effort and price. Our measure of advertising, GRP, is the number of times during a certain period of time (a week) a sample of households had their television turned on during the time a TV advertising was shown. It is indeed a better measure then advertising expenditures because it actually captures exposition due to a campaign. It turns out that GRP behaves erratically, with big surges and periods of no activity. Real prices also vary substantially in our sample.

The single most important development in the Brazilian beer market over the sample period (2002-2005) is the bid for growth made by SCHINCARIOL, a fringe firm, right at the middle of the sample period, August 2003. Figure 1 shows the evolution of SCHINCARIOL's share and price over the period, for the whole Brazilian market (price is on the right axis, share on the left). Figure 3 shows total SCHINCARIOL GRP over the period. This bid involved a large marketing and advertising effort, including the relabelling of its most popular brand, from SCHINCARIOL Pilsen to NOVA SCHIN. Figures 1 and 2 indicate that the vehicle for acquiring market share was advertising: the big surge in market share is accompanied by an *increase* in prices and a significant increase in advertising.

The dynamics of competition in the market must have changed. AMBEV did respond, specially with its brand ANTARCTICA. As figures 3 and 4 show, both price and advertising of ANTARCTICA reacted to the SCHINCARIOL surge. Right after SCHINCARIOL's bid, in August 2003, ANTARCTICA prices went down and advertising went. However, advertising reaction was much stronger. ANTARCTICA's prices start going down only in November of 2003, after SCHINCARIOL effectively gained market share. The decrease is around 4.3% from its 3.24 peak in November 2003 to 3.1 in May 2004. Advertising, however, reacts much faster and steeper. Comparing the six months preceding August 2003 to the six subsequent months, advertising (as measures by GRP) almost doubled, from an average of 814 to an average of 1509, an 85.2% increase.

Figures 3 to 8 indicate that AMBEV responded to SCHINCARIOL's bid with all three relevant brands: ANTARCTICA, BRAHMA, and SKOL.[7] For all three brands, one observe what appear to be advertising responses to SCHINCARIOL's bid. The largest sustain response was ANTARCTICA's (BRAHMA and SKOL increased advertising by 76.1% and 66.8%, respectively). In terms of prices, only ANTARCTICA's response seem relevant. For these reasons we focus our analysis in only two products: ANTARCTICA and SCHINCARIOL.[8]

These features provide for an interesting empirical application for testing the theoretical ideas in section 2. There is, specially after SCHINCARIOL's bid, a relevant rivalry in the industry. Firms are apparently competing in both price and advertising dimensions, although advertising seems even

[7] ANTARCTICA, BRAHMA and SKOL had, during the sample period, an average of 10.34%, 19.98% and 31.59%, respectively.

[8] Regression results with all three AMBEV brands are qualitative similar to those with only ANTARCTICA. Precision, however, decreases. Our conjecture, partially backed by data on figures 3 to 8, is that this is precisely because BRAHMA and SKOL are not perceived as close competitors to SCHINCARIOL, or that AMBEV responded more strongly with ANTARCTICA.

more important as a competition vehicle. The question, then, is: there any difference, between different regional markets, in the effect of this intense advertising competition on prices?

3.3 Market Maturity

We have data on seven Brazilian metropolitan areas, which can be fairly considered different markets. Out of these seven market, four of them are located in the richer southeast and south regions of the country (Belo Horizonte, Curitiba, São Paulo, and Rio de Janeiro), one is the Federal capital (Brasília), and two are Northeastern capitals (Salvador and Recife), the poorest region of the country.

From the theory, it is natural to define maturity by the overall market growth potential. Since we do not observe the total size of the market for the period, there is no direct measure of growth potential. Our strategy, then, is to classify markets as mature and immature was based on two dimensions: GDP per capita and inequality. The assumption is that beer is a least a normal good, and therefore poorer markets should have larger growth potential.

In Brazil, the most consumed alcoholic beverage is *cachaça*, a hard liquor made of distilled sugar cane. It is significantly cheaper than beer, even if not controlled for alcohol content. And it is a substitute for beer, although not as close as other brands of beer. Movements towards more sophisticated products such as beer and wine tend to accompany increases in income. Therefore, we have a setting in which there is potential for substitution into beer due to increases in income. The identification (of maturity) assumption is that, in richer regional markets, this substitution between beer and *cachaça* has occurred more than in poor ones. Therefore, the potential for growth is higher in poorer markets.

Given the significant income distribution disparity, both within and between regions, market-level income distribution is also taken into account when deciding which markets are mature. The identification assumption here is that, for a given level of income, a worse income distribution implies a poorer potential market and, therefore, a higher growth potential. Table 1 shows GDP per capita and income distribution measure for the seven regional markets. Recife and Salvador , as expected, are both the poorest capital, although the difference between Recife (second poorest) and Belo Horizonte and Curitiba is not that large (only 5% between Recife and Belo Horizonte).

Income distribution, as measured by the difference in total income between the 10% richer and 40%, is significantly worse in Recife and Salvador than in the other metropolitan areas except Brasília, which has, by far, the highest level of GDP per capita.

Since the difference between Belo Horizonte and Recife is so small on the GDP per capita, we split markets into mature and immature in two different ways. First, we define Salvador and Recife as immature, and the other five markets as mature. Second, we exclude both Recife and Belo Horizonte from the sample. In the later classification, only Salvador is immature, and São Paulo, Rio de Janeiro, Brasília and Curitiba are mature.

3.4 The Specification

Let i be a market, j be a brand of beer (ANT and SCHIN) and t be point in time (a month). We estimate several different versions of the following model:

$$
\begin{gathered}
p_{ijt} = \beta_0 + \beta_1 ADV_{it} + \beta_2 ADV_{it} \times DUMMATURE_i + \\
\sum_{m=1}^{2} \alpha_m p_{ijt-m} + \sum_{j=1}^{2} \phi_j s_{ijt-m} + \sum_{j=0}^{2} \phi_j p_{i-jt-m} + \sum_{j=0}^{2} \phi_j s_{i-jt-m} + \\
+ DUMPRODUCT_j + \Psi DUMPERIOD_t + \Pi DUMMARKET_i + \varepsilon_{ijt}
\end{gathered}
\tag{14}
$$

where ADV_{it} is the average of SCHIN and ANT GRPs over the current period and the last two periods (therefore does not have a j subscript). $DUMMATURE_i$ is a dummy for mature markets (assumes the value 1 for São Paulo, Rio de Janeiro, Brasília, Belo Horizonte, and Curitiba, and 0 otherwise). p_{ijt-m} are own price lags, p_{i-jt-m} are the competitor's price and the first two lags. s_{ijt-m} are the own share lags, and s_{i-jt-m} are the competitor's. Prices are either in logs or in first difference, depending on the model (see discussion below).

One specification choice is worth explaining in further detail. We opted for the sum of advertising efforts of ANT and SCHIN, which amount to using "industry advertising". In terms of the model, there is little loss of generality in doing so because the advertising equilibrium always involves both firms advertising. Summing the advertising efforts mitigates the effect of outliers produced by big spikes in one brand's advertising. Additionally, since advertising both by the brands move together, it is hard to capture firm level advertising effects. The averaging out of advertising in three periods is made to avoid capturing outlier effects of advertising, which seem very relevant in this dataset, given the erratic short-run behavior of GRP. Inclusion of time dummies controls for pure-times effects. We have to drop one market dummy among mature and one among immature markets because otherwise there is perfect collinearity with $DUMMATURE_i$.

The main coefficient of interest is β_2. If our theory has empirical merit, than β_2 should be positive, that, is a higher level of advertising should be associated with higher prices in mature markets. compared to immature ones..

As an attempt to avoid capturing undue variation, we include several market controls. Advertising efforts may well respond to current - and past - growth of the competitor's market share. Additionally, this response may differ between mature and immature markets. Perhaps the dominant firm (AMBEV) cares more about loosing ground on immature markets, which are still more "up for grabs" than mature ones. Or perhaps she has strong preferences for not loosing strongholds. Unfortunately, we are cognizant about the workings, and the dynamics, of these strategic responses. Therefore, an agnostic approach is taken, and current and lags of both own and competitor's shares are included. Similarly for prices. Own price lags are included because there is persistence in the time-series dimension, which could lead ADV_{it} to capture undue variation generated by the dynamics of strategic interaction. The period dummies ($DUMPERIOD_t$) control for pure time effects, which are relevant in this dataset, given the apparent structural break caused by SCHINCARIOL's bid to increase her market share in August 2003 (see figure 1).

Our data contains several complications due to uncontrolled for dynamics, which produces both problems and opportunities. It is well known that the presence of serial correlation when the lag of the dependent variable belongs to the equation produces bias, even when cross-section fixed effects are accounted for (see Arellano and Bond [1990]). Furthermore, the serial correlation on the error term contains information that can be used to estimate the coefficients. Additionally, the panel nature also opens the possibility of heteroskedasticity between groups of observations belonging to different panels, which is a further opportunity for using additional information for estimation.

We use several different procedures that account for some or all these features of the data. A GMM procedure is used to account for biases due to serial correlation and lag dependent variables (see Arellano and Bond [1991]). A fixed-effect procedure is used to account for: 1) within panel serial-correlation (AR(1) in this case; 2) for panel-specific serial-correlation (also AR(1)); and 3) between panels heteroskedasticity. Results are presented in the next section.

4 Results

Tables 2 to 4 contain the main empirical results.

Start with table 2, which presents the simple OLS estimates. When all regions are considered (column (1)), the estimated coefficient on the interaction $ADV_{it} \times DUMMATURE_i$ (β_2 in equation (14)) is 0.011, and it is reasonably well estimated (p-value $= 6\%$). In other words, the difference, between mature and immature markets, in the effect of an 1% increase in ADV_{it} (sum of ANT and SCHIN) on prices is 1.1%. Is that relevant economically? The mean of the variable ADV is 2,812, with a standard deviation of 1,533, which means that an increase of one standard deviation in ADV_{it} is associated with an increase in price of 54% more in mature than in immature markets.[9]

One troublesome estimate is the effect of changes in the competitor's prices on own price. Decreases in rival's prices are associated with *increases* in own prices, as if prices were strategic substitutes. This fact is less puzzling if one considers the dynamics of the SCHINCARIOL bid for market share. The bid was mainly a tremendous advertising effort, with an *increase* in price (see figures 1 and 2). AMBEV, through its brand ANTARCTICA, responded by both increasing advertising *and lowering* prices. Therefore it is not surprising that the regression results showed this surprising feature. It is outside the scope of this paper to rationalize entry with high advertising and *high* price, although it is certainly an interesting topic for future research.

When Recife and Belo Horizonte are excluded, results are even *stronger*. The estimated coefficient of interest (β_2) is both larger and slightly more precisely estimated (p-value $= 6\%$). All other estimated remain qualitatively similar.

When the (potential) bias produced by serial correlation and inclusion of lags of dependent variable is accounted for (table 3), results are again

[9] $54 \cong \frac{2812}{1533} \times 1.1$.

stronger. Now the model is estimated in first-difference instead of logs.[10][11] Again, results are economically significant, and even more precisely estimated. Consider, for example, the estimation excluding Recife and Belo Horizonte. The difference, between mature and immature markets, of the effect of one standard deviation in ADV_{it} (1,533) is 70 cents of real. This is roughly 24% of the mean price (R$ 2.86), or 1.75 standard deviations of price (R$ 0.41).

Finally, when the information on both between market heteroskedasticity and within market serial correlation is used to estimate the model, results are again stronger. See table 4.

4.1 Discussion

There is no claim of estimation of structural parameters. We simply estimate controlled correlations to evaluate whether there is a significantly different - among markets with different maturity - association between advertising and price. Evidently, there are several other determinants of price contained in the error term ε_{ijt} that might also affect advertising which we do not observe.

One such determinant is the cost of advertising. If costs of advertising differ systematically among markets, then it is possible that the coefficient associated with $ADV_{it} \times DUMMATURE_i$ captures this difference, instead of the strategic effect we want to estimate. This effect is more pronounced the more regionalized the advertising decisions are. It turns out that the advertising captured by GRP, TV commercials, is done mainly on the national level, with a significant amount of TV time bought on open-channel-nationwide broadcast programs. Figures 9 and 10 show the ANT and SCHIN GRPs series for all seven regions. Visual inspection shows the GRP is highly correlated across markets, which is indicative that advertising campaigns are indeed nationwide.[12] This fact mitigates significantly the possibility that $ADV_{it} \times DUMMATURE_i$ captures different cost structures of advertising across markets.

Another possibility is the degree of competition. Evidently, market power

[10] This is why there is no estimate for the mature market dummy: it does not vary over time.

[11] This is not relevant. It is a feature of the statistical package used, STATA. If fixed effect dummies were to be used, results would be similar.

[12] More especifically, the average correlation coefficient between region is 0.77 and 0.92 for ANT and SCHIN, respectively.

is contained in the error term. Indeed, one might expect the effect of advertising on prices to differ among market with different degrees of supplier market power. The relevant question, however, is how market power determines the effect of advertising, and how market power and maturity are related. Our specification addresses this concern in several ways. First, note that systematic (constant in time) differences in market power between markets are controlled for by the market fixed effects dummies. Second, we control, albeit imperfectly, for changes in market power overtime simply by including the shares of SCHIN in the regression. Note that this is market with one dominant firm, AMBEV, and one relevant fringe, SCHINCARIOL. Hence the larger the share of SCHIN, the more contested the market should be. On the other hand, it is well known that shares (or concentration) are not a sufficient statistic for market power. Our theory, and a straight market power story, would be indistinguishable only if three conditions are satisfied: 1) there are an uncontrolled for changes in market power; 3) market power increases in mature markets relative to immature ones; *and* 3) advertising softens competition in markets with more market power. Evidently, we cannot check the first condition (otherwise it would be controlled for). Neither can we (and it is outside the scope of this paper) address the third condition. We can, however, look at the evolution of prices in several markets to see if there is evidence that market power in increasing in mature markets relative to immature. Figures 11 and 12 show that prices in mature and immature markets move, in general, remarkably together, both for ANT and SCHIN. This indicates that, overtime, there is very little evidence that market power has changed differently between mature and immature markets.

5 CONCLUSION

Non-price advertising has, in the theory presented and in the empirical application, a distinctively different effect on prices according to product market maturity. Therefore, advertising can be a substitute, a complement, or even neutral to price competition.

From a consumer welfare perspective, the literature on advertising has concentrated on three issues: 1) the effects of price advertising; 2) the effect of advertising on market structure; and 3) on the informational content of advertising. In general, advertising is considered wasteful if its only effect is to change consumers' preferences (Dixit and Norman [1978]), also called “persuasive” advertising. Furthermore, advertising would be harmful to consumers if they induce a more concentrated market structure (Friedland [1977], Sutton [1974], Kaldor [1950-1951]), and Sutton [1990]). If, however, advertising conveys relevant information about the product, such as existence (Stigler[1961]) or quality (Milgrom and Roberts [1986]), it should be welfare increasing. The results presented here provide an additional, and indirect, welfare implication, through be effect of non-price advertising on the level of competitiveness in the market *for a certain level of market maturity.* In markets where potential growth is high (immature), advertising tends to be more pro-competitive than in low growth (mature) markets. Therefore, consumer welfare depends on advertising not only because of informational or market-structure reasons, but also because non-price advertising determines the level of competitiveness, *given a certain market structure.*

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FIGURE 1: Share and Price SCHIN, Nationwide

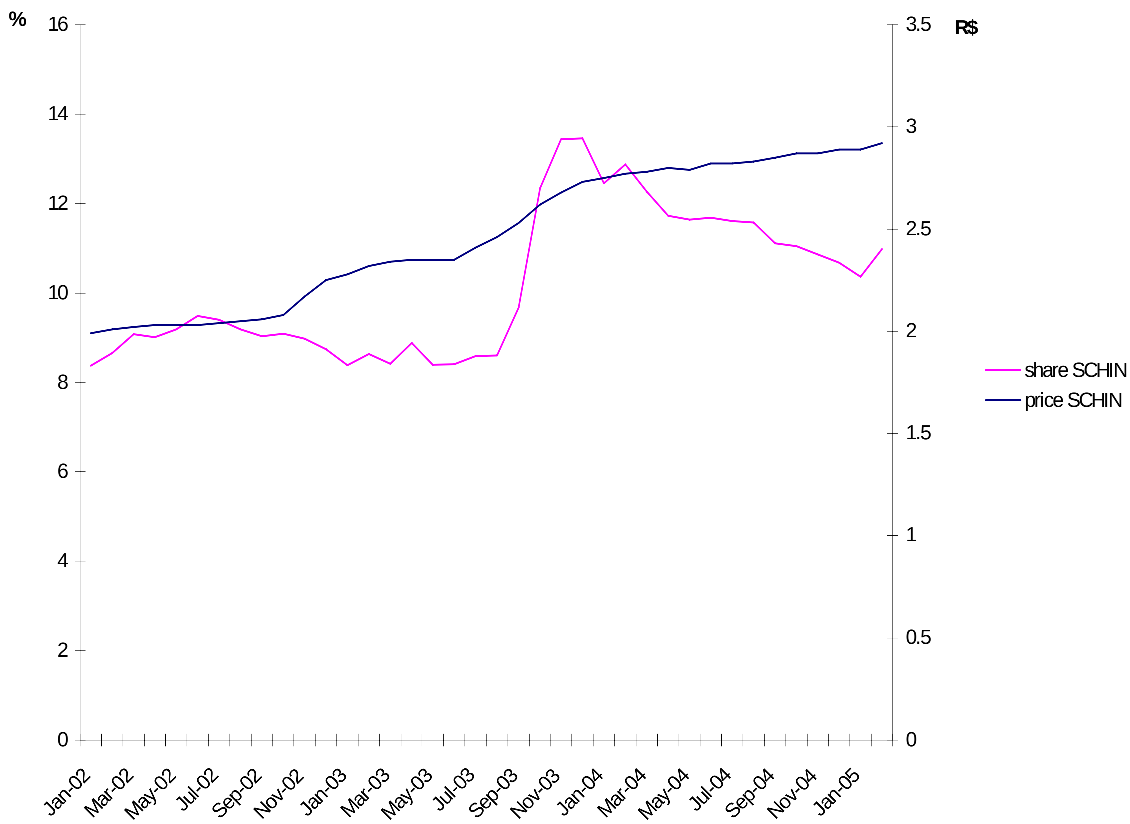

FIGURE 2: GRP SCHIN, Nationwide

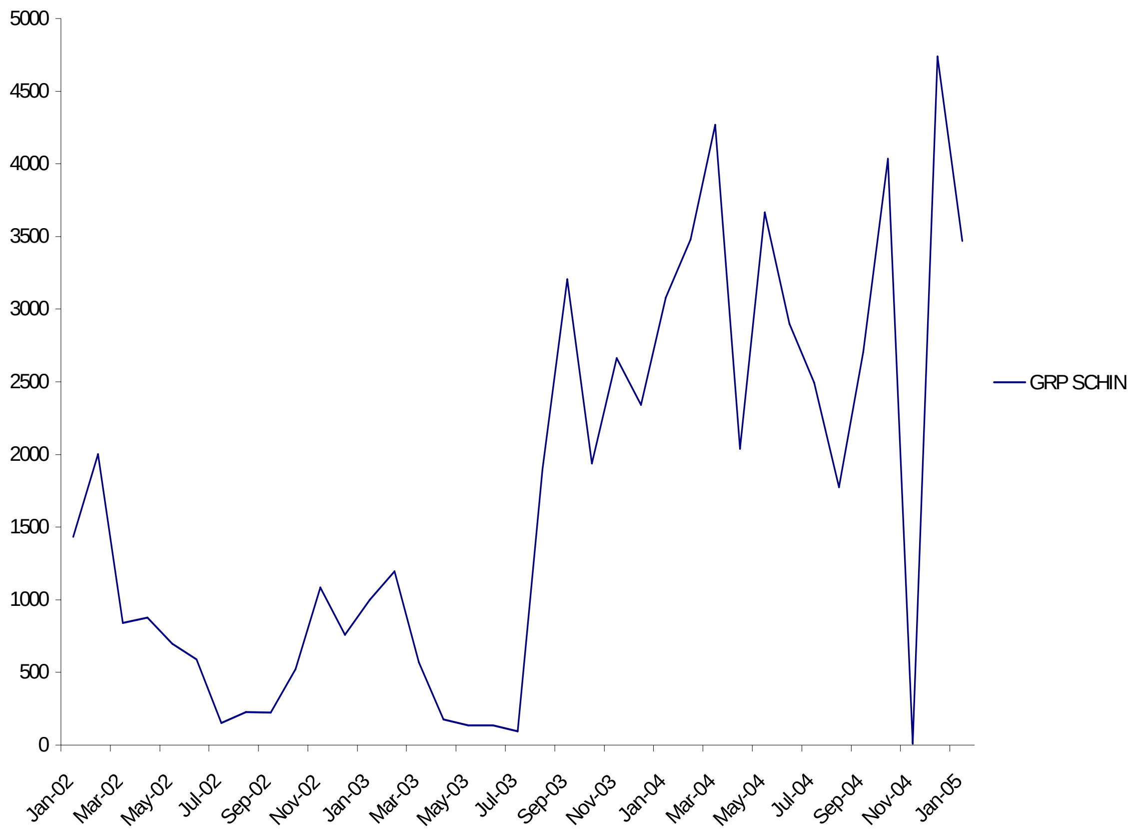

FIGURE 3: GRP ANT, Share SCHIN, Nationwide

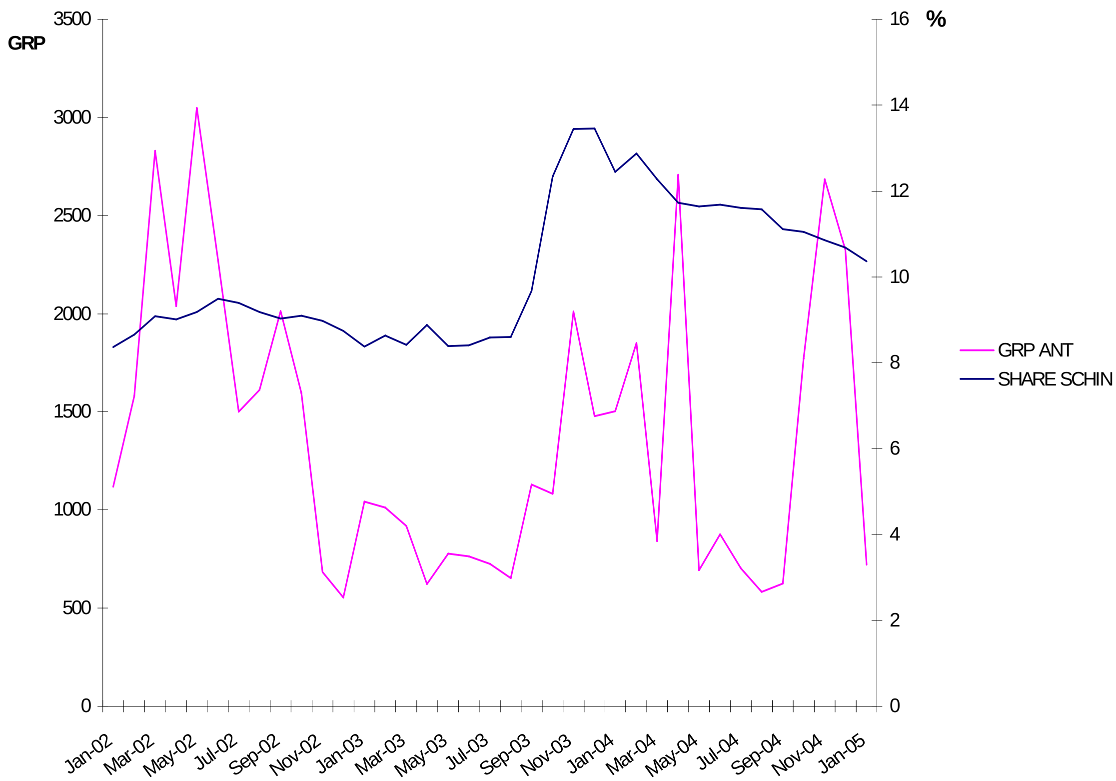

FIGURE 4: Price ANT, Share SCHIN, Nationwide

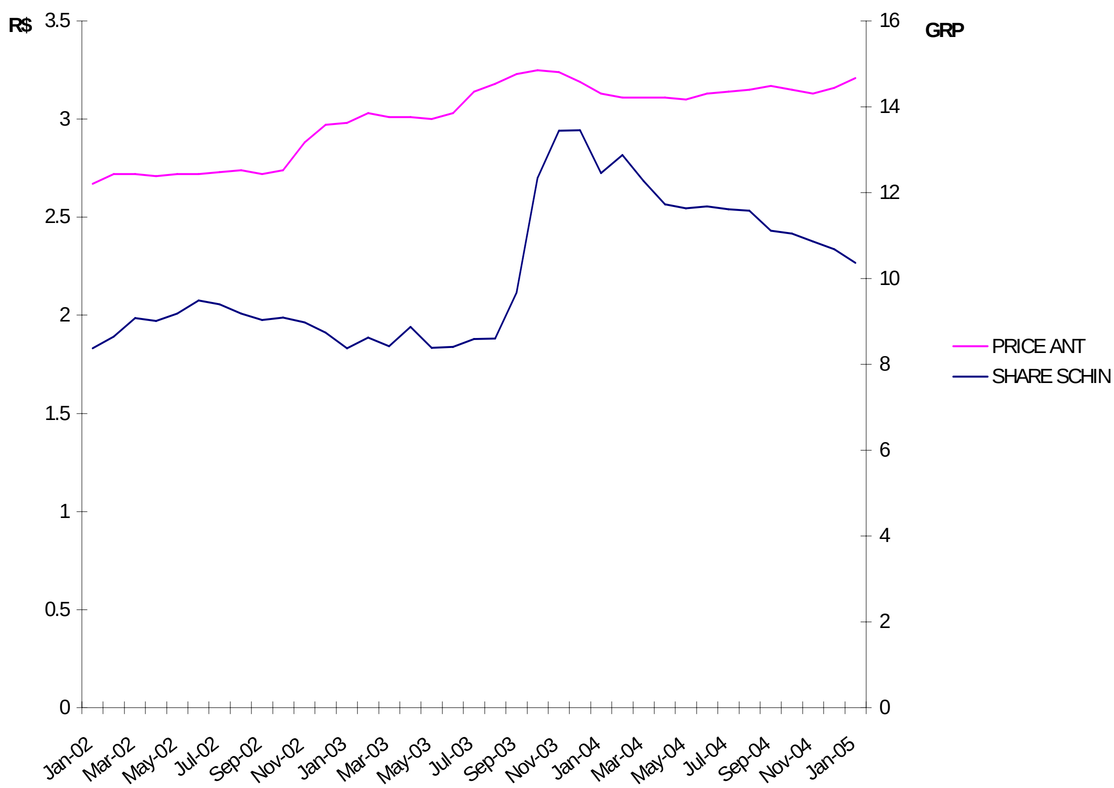

Figure 5: Price BRAHMA, share SCHIN, Nationwide

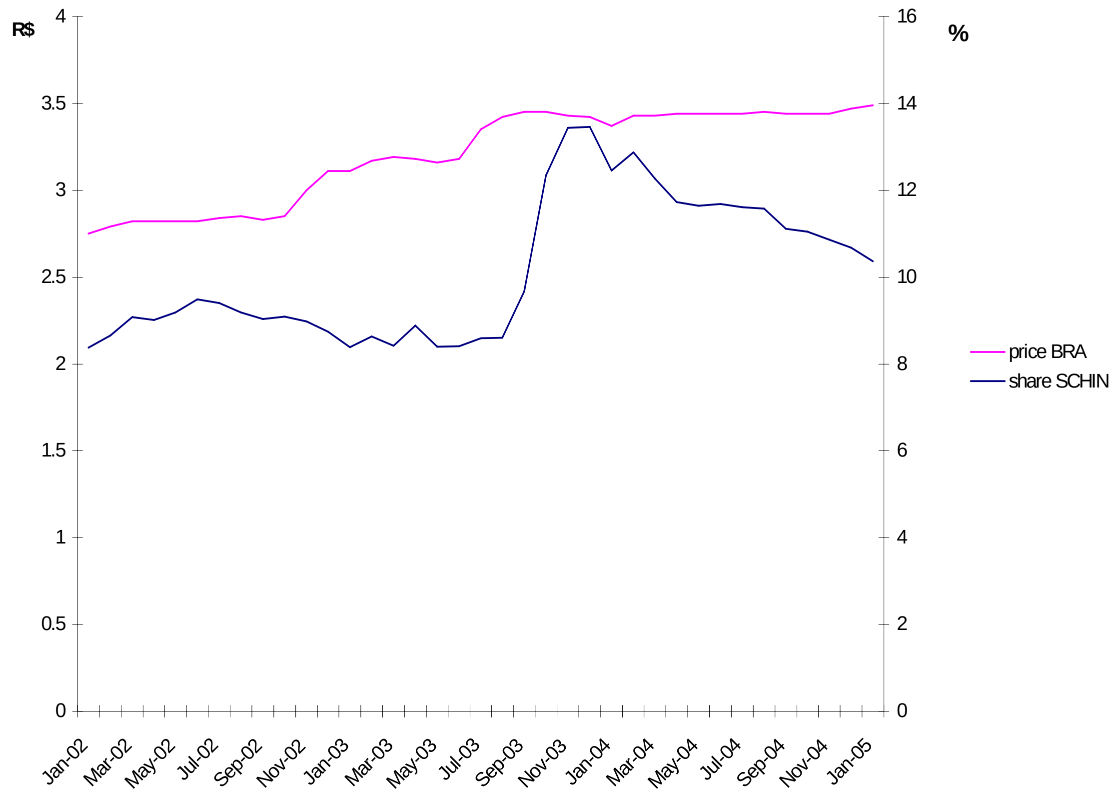

Figure 6: GRP BRAHMA, share SCHIN, Nationwide

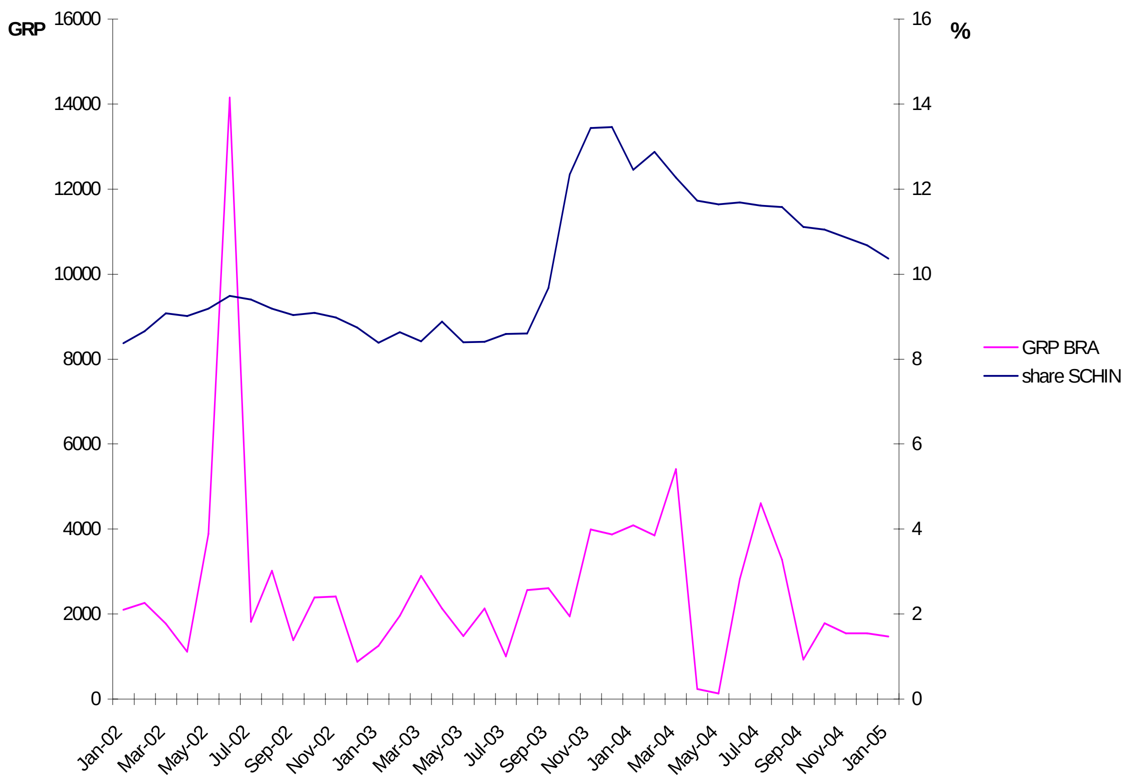

Figure 7: , Price SKOL, Share SCHIN

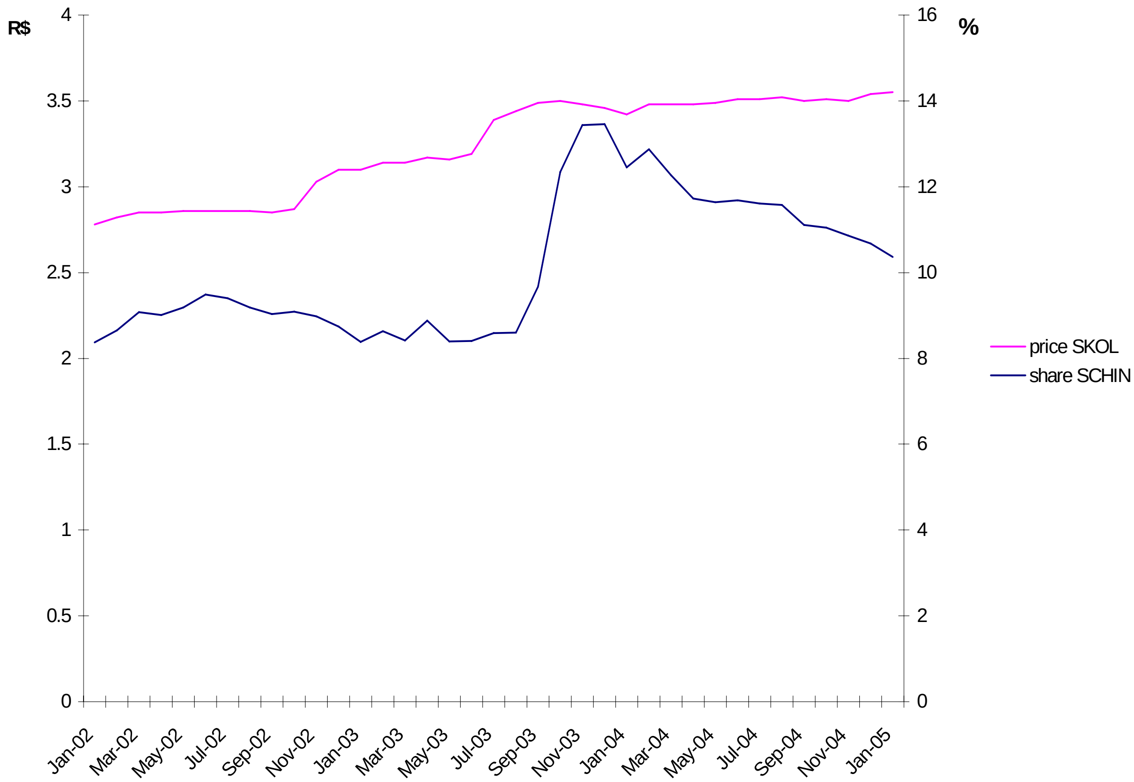

Figure 8: GRP SKOL, share SCHIN, Nationwide

Figure 9: GRP ANT, All Regions

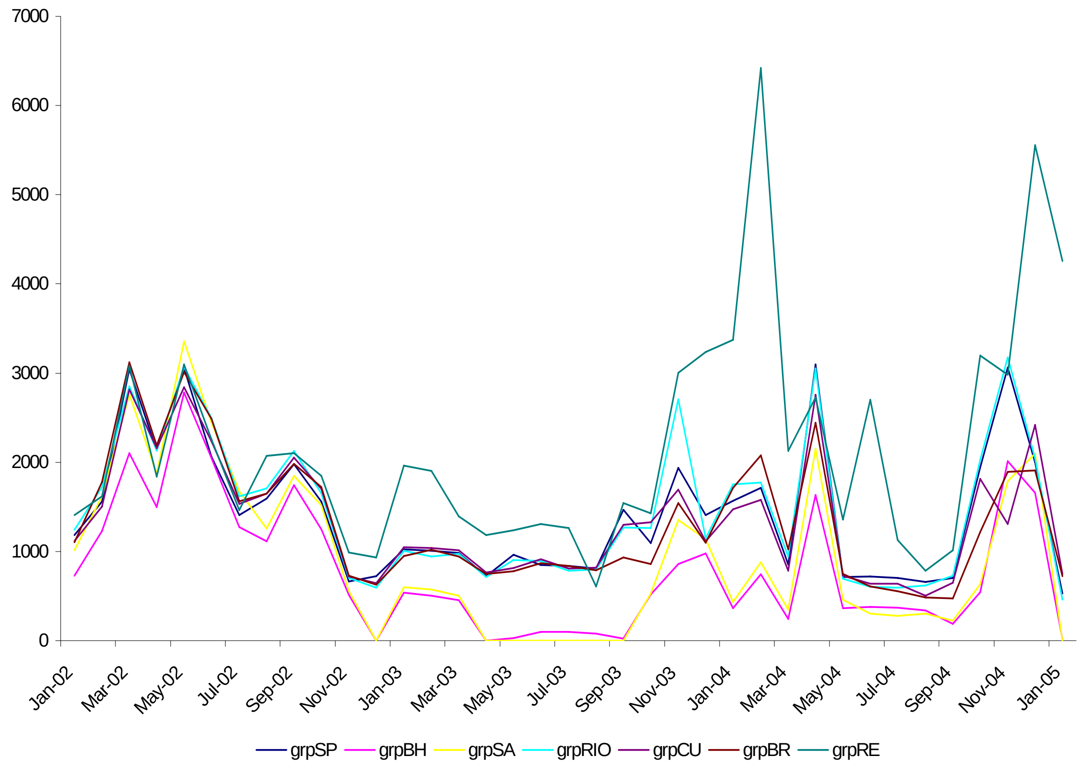

Figure 10: GRP SCHIN, All Regions

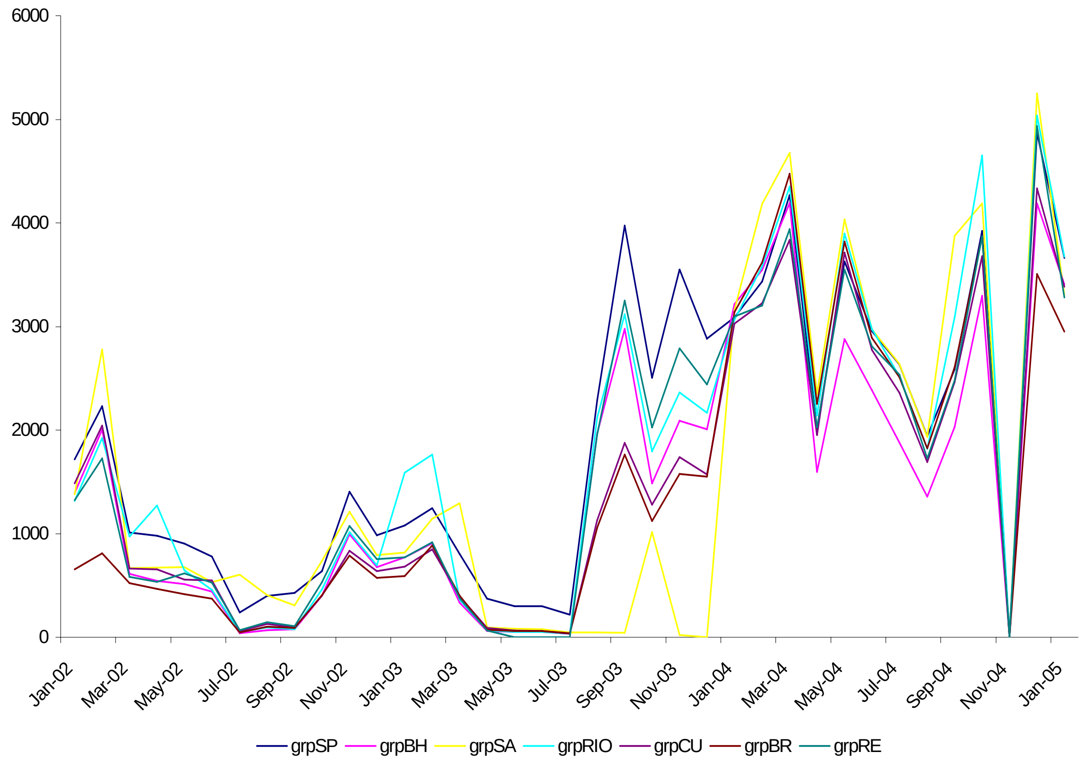

Figure 11: Prices ANT, Mature and Immature Markets

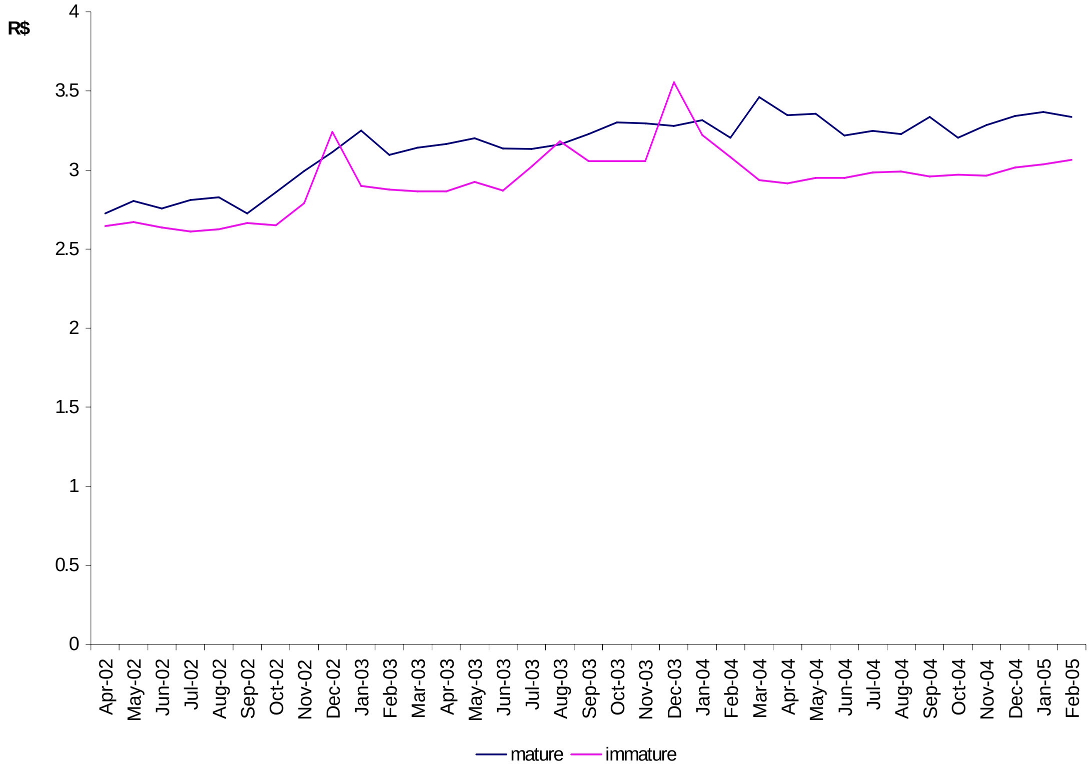

Figura 12: Prices SCHIN, Mature and Immature

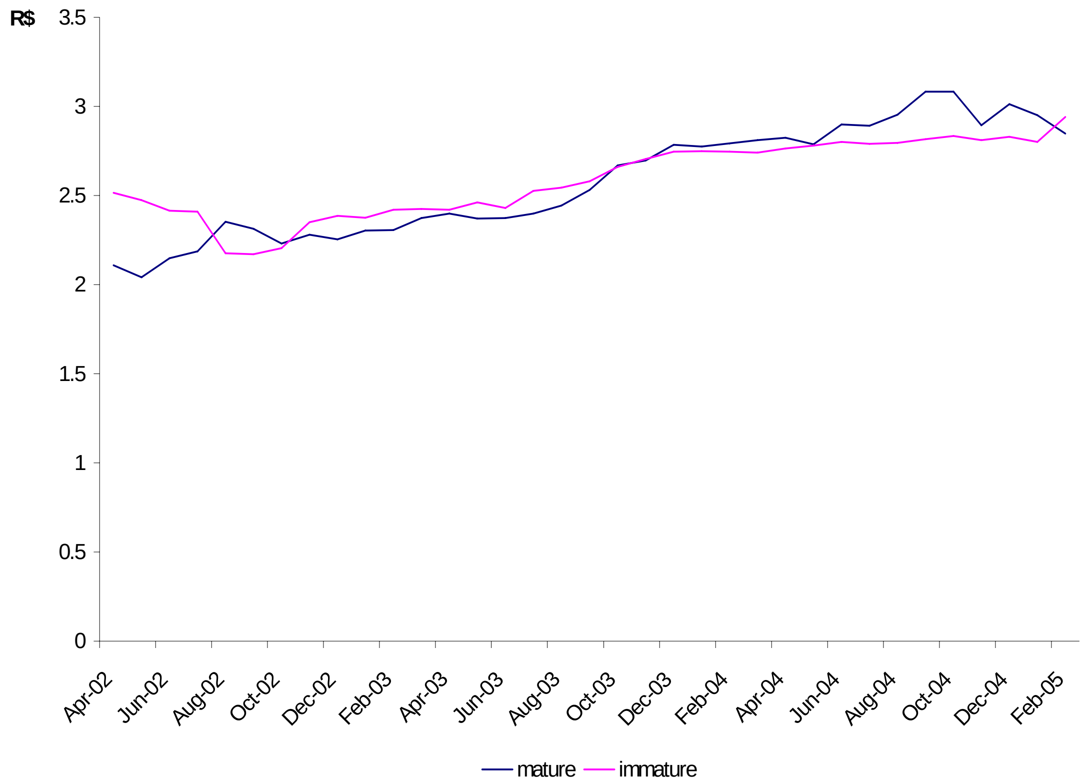

TABLE 1: Income per capita (2002) and Distribution of Income (2001) between the 40% poorer and 1% richer

Metropolitan Area	Income Per Capita#	40% poorer (A)#*	10% richer (B)#*	B/A
Recife	7,822	491 468	122 911	19.25
Salvador	4,309	503 620	125 927	21.12
Belo Horizonte	8,093	741 888	185 528	15.28
Rio de Janeiro	10,537	1 700 823	425 295	15.17
São Paulo	13,139	2 970 266	742 720	14.96
Curitiba	8,408	489 912	122 497	14.80
Brasília	16,361	350 827	87 732	19.90

Source: Pesquisa nacional por amostra de domicílios 2001: microdados. Rio de Janeiro: IBGE, 2002. 1 CD-ROM.

In 2002 reais

*Active population: age >= 10 years with income

TABLE 2: OLS Results
Dependent Variable:Log(price)

	(1)	(2)
Mature	-0.921	-0.244
	(8.7%)	(8.0%)
LogADV	-0.005	-0.006
	(32.0%)	(40%)
LogADVxMature	**0.011**	**0.0355**
	(6.0%)	**(5.7%)**
Lprice1	0.375	0.3176
	(0.0%)	(0.0%)
Lprice2	0.139	0.1516
	(2.5%)	(2.6%)
Share1	-0.004	0.0074
	(6.6%)	(4.2%)
Share2	0.004	0.0074
	(4.4%)	(2.4%)
Share3	-0.002	-0.001
	(32.5%)	(50%)
ShareComp	-0.003	-0.002
	(3.0%)	(33.8%)
LPriceComp	-0.323	-0.415
	(0.0%)	(0.0%)
Observations	440	316
Rsquared	90%	89%

Robust Standard Errors, *p*-values in parehtheses. (1): All Regions, (2) Except Recife and Belo Horizonte. Firm, product and time dummies included. Share and price of competitor are reported as the sum of four coefficients, current and three lags. L stands for Log.

TABLE 3: GMM Arellano-Bond Instruments
Dependent Variable: 1st Difference of PRICE

	(1)	(2)
DMature	- -	- -
DADV	-1.29e-6 (19.9%)	-3.15e-6 (1.0%)
DADVxMature	**2.40e-5** **(4.1%)**	**4.60e-5** **(0.2%)**
Dprice1	0.323 (0.0%)	0.280 (0.0%)
Dprice2	0.125 (0.0%)	0.136 (0.0%)
DShare1	-0.011 (5.9%)	-0.016 (0.8%)
DShare2	0.013 (0.2%)	0.021 (0.2%)
DShare3	0.000 (98.3%)	0.000 (88.8%)
DShareComp	-0.011 (2.1%)	-0.001 (16.2%)
DLPriceComp	-0.311 (0.0%)	-0.366 (0.0%)
Observations	440	316
Test null: 0 2nd order autocorrelation	*p*- value = 80.9%	*p*- value = 90.0%

Robust Standard Errors, *p*- values in parehtheses. All variables in 1st difference. Instruments are the third and fourth (third, fourth) of the dependent variable. (1): All Regions, (2) Except Recife and Belo Horizonte. Firm, product and time dummies included. Share and price of competitor are reported as the sum of four coefficients, current and three

TABLE 4: GLS estimates
Dependent Variable: Log(PRICE)

	(1)	(2)
Mature	-0.002	-0.089
	(95.7%)	(23.3%)
LADV	-0.005	-0.005
	(13.4%)	(16.9%)
LADVxMature	**0.010**	**0.023**
	(5.1%)	**(1.7%)**
Lprice1	0.419	0.358
	(0.0%)	(0.0%)
Lprice2	0.08	0.115
	(5.7%)	(4.5%)
Share1	-0.003	0.004
	(0.5%)	(0.1%)
Share2	0.004	0.0074
	(0.0%)	(0.0%)
Share3	-0.002	-0.001
	(1.4%)	(28.8%)
ShareComp	-0.002	-0.001
	(0.1%)	(24.7%)
LPriceComp	-0.345	-0.441
	(0.0%)	(0.0%)
Observations	440	316
Test null: 0 2nd order autocorrelation	90%	89%

Robust Standard Errors, *p*-values in parehtheses. GLS: each regions is allowed a different standard deviation, and different AR(1) coefficient. (1): All Regions, (2) Except Recife and Belo Horizonte. Firm, product and time dummies included. Share and price of competitor are reported as the sum of four coefficients, current and three lags. L stands for Log.

Departamento de Economia PUC-Rio
Pontifícia Universidade Católica do Rio de Janeiro
Rua Marques de Sâo Vicente 225 - Rio de Janeiro 22453-900, RJ
Tel.(21) 35271078 Fax (21) 35271084
www.econ.puc-rio.br
flavia@econ.puc-rio.br