

## **Buyer power and pass-through of large retailing groups in the Portuguese food sector**

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### **Abstract**

The fast development of large retailing groups has raised two major issues in the literature. First, it is usually claimed that these groups have, through the increasing concentration of their demand in the supplying market, benefited from a substantial rent shift from suppliers. A second issue is whether this rent shift passes-through to final consumers, thus increasing consumer welfare. The literature is rather inconclusive on these issues and mostly on the buyer power of large retailing groups and its impact on suppliers. This paper aims to fill in this gap by tackling buyer power and pass-through departing from the supply-side of the market. We do so on the basis of an instrumental variables panel-based econometric approach applied to purchases and sales data specific to large retailing groups, over 16 quarters from 2000 to 2003, and disaggregated at the brand, product, and supplier levels. Results reveal that purchasing pools and vertical agreements lower large retailing groups' acquisition prices and that these gains tend to pass-through to consumers. In parallel, additional findings suggest that these groups tend to increase their prices less than national trade.

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\* This paper is the main econometric contribution to the Project on the “Vertical relations between large retailing groups and their suppliers in the Portuguese food sector” put forward by Rosa Dias with whom I had the pleasure of collaborating until recently. Since then, I have an equal pleasure of developing this project in collaboration with Celeste Fonseca. I would mostly likely to thank Abel M. Mateus, Rosa Dias, Celeste Fonseca, Eugenio Miravete, Luís Cabral, and the internal seminar participants for helpful comments and suggestions. The usual disclaimer applies.

## 1. Introduction

After the implementation of the first hypermarket in Portugal by the Sonae's Continente group in 1985, more than 20 years after Carrefour built its first hypermarket in France, the activity of large retailing groups (LRGs) has shown a substantial growth in Portugal. This evolution can be mostly attributed to the high diversity these groups offer of services and goods at expected lower prices than national trade. Moreover, they have contributed to a progressive shift in consumers preferences to the goods they offer in their shelves. Parallel to this evolution and to meet local consumption needs, LRGs have further moved to opening smaller shops nearby traditional businesses in close competition with the latter.

Besides the possible negative effects this expansion has on traditional retailers, it is often argued that LRGs increase consumer welfare, through the higher product variety (and quality) sold at lower prices than traditional trade, but at the expense of rents they retrieve from suppliers. Yet, the literature is rather inconclusive on the economic impact LRGs have on consumers and, mostly, on suppliers, with most of the existing studies neglecting this latter side of the market. By considering the supply-side of the Portuguese food retailing sector, this paper aims to fill in this gap in the literature.

Though priors label LRGs as beneficial for consumers and prejudicial for suppliers, the complexity of these groups' structure and of the relations they have with suppliers raise the following doubts on such priors. First, although LRGs may have initially sell at low prices, once their market matures and the demand for their products grows, they may actually, in fact, exploit this increased market power to obtain price reductions from suppliers and to sell at prices which do not reflect these reductions. Insofar LRGs do not pass-through to final consumers the price reductions they obtain from suppliers, they do not, *ceteris paribus*, improve consumer welfare as much as they could given their buyer power.

Increasing LRGs' selling prices may, however, be consistent with increasing consumer and social welfare in case these groups contribute to a higher demand-price elasticity of final

consumers and bring efficiency gains to the market. Promotional campaigns and the high product diversity offered by LRGs may indeed increase consumer sensitivity to price changes. Besides, the sustained development of LRGs cannot be considered exogenous but, apart from generating its own demand, stems also from a fast growing demand for such services. This growing demand coupled with the competition among LRGs have triggered these groups to improve efficiency in the trade sector, both in the downstream side of the market, by increasing the diversity of the offer to final consumers, and upstream through vertical agreements and the pooling of purchases with other retailers and grocery chains.

Since these agreements contribute, *a priori*, to a higher concentration of demand in the supplying market, thus leaving fewer alternative customers to suppliers, it has been mostly for this reason that the growth of LRGs has been deemed, by many producer associations, to lead to the suppliers financial squeezing. Yet, a more concentrated demand in the supplying market is not necessarily harmful for suppliers. While vertical agreements may lower costs of both LRGs and suppliers, it is undoubtedly less costly for suppliers to sell to centralized buyers than to fragmented and sparsely located retailers. Moreover, despite their size, LRGs can hardly impose their buyer power on all suppliers. They tend, in particular, to lose bargaining power over large and concentrated suppliers of important consumer goods.

In particular, a recent contribution (Gohin and Guyomard, 2000) argues, on both theoretical and empirical grounds, that the suppliers / LRGs rent reallocation depends on the relative oligopolistic / oligopsony powers these players have in the supply-side of the market respectively, with both being conditioned by the demand-price inelasticity of the final good. This empirical analysis is, however, casuistic to a given product or bundle of homogeneous products, being thus poorly representative of the food retailing sector.

Most of the remaining literature focuses, instead, on the downstream side of the problem on the impact LRGs have on consumer welfare (*e.g.*, Barros, Brito and Lucena, 2006 in the Portuguese case; Flávian, Harberger and Polo, 2002 in the British and Spanish cases; and Asplund and Frieberg, 2002 in the case of Sweden). Among the few contributions tackling the

upstream relations between LRGs and suppliers, following a descriptive analysis of balance-sheet data, Bloom and Perry (2001) find, despite what is usually claimed, that Wal-Mart's increasing market power has risen the margins of its main suppliers.

In a more formal econometric approach, Barros *et al.* (2006) address buyer power and pass-through in the Portuguese food retailing sector. They find that while LRGs tend to benefit from lower acquisition prices, their growing downstream market concentration increases prices to final consumers. On these basis, they argue on a rent shift from suppliers to LRGs and on the absence of pass-through to final consumers. However, these findings on buyer power and pass-through depart from distinct samples: on a group of eleven producers on the analysis of buyer power and two consumption bundles on the analysis of pass-through. Whilst the small size of the sample on buyer power is likely to bias the empirical result, the mismatch between the samples on selling and purchasing prices creates a sample-bias distortion on the finding on pass-through.

Moreover, Barros *et al.* (2006) depart from the possibly biasing assumption that a higher downstream market concentration (of a local dimension) increases nation-wide buyer power. Actually, while retailers and grocery stores compete in the upstream supplying market, retailers operate in a different downstream market from grocery stores. From this distinction and the different geographic dimension between the two sides of the market, it follows that buyer power of LRGs is hardly comparable with these groups' concentration in the downstream side of the market.

In this paper, we tackle the same issue as Barros *et al.*, but solve for the latter caveats by considering harmonized selling and purchasing (price and quantity) data, specific to LRGs, observed over 16 quarters from 2000 to 2003, and disaggregated at the supplier, product, and brand levels. We tackle first, how vertical integration agreements and purchasing pools lower LRGs' acquisition prices, increasing thus their buyer power, and second, the way LRGs pass-through to final consumers these price reductions. We do so on the basis of the Arellano and Bond (1991) instrumental variables panel-based econometric approach, which controls for the

natural endogeneity between selling and purchasing data. Moreover, in addition to Barros *et al.* (2006), our results reveal further that LRGs have contributed to lower food prices, a finding which is consistent with the conventional wisdom that large retailers, apart from offering a higher diversity of products, sell at lower prices than traditional retailers.

The remaining of the paper is structured as follows. Section 2 below defines and describes the two-sided market of LRGs and highlights the tendency of this market to become, over the present decade, less concentrated over both its two sides. This section comments as well on the empirical difficulty of characterizing the LRGs' two-sided market and describes the data used in the econometric analysis of the main bulk of the paper. This latter consists in the econometric methodology and results on buyer power (section 3) and pass-through (section 4). Finally, additional data on panels of LRGs' selling prices, ranging annually over the period 1998-2005, suggest, on descriptive grounds, that these latter groups have contributed to lower the general food price level as opposed to the traditional trade. Section 6 concludes and draws some insights on competition policy considerations.

## 2. Two-sided market of LRGs

While buyer power is related to the shares LRGs have in the upstream supplying market, pass-through links this market with a downstream dimension as it measures the degree at which LRGs transmit to final consumers (*i.e.* to a downstream market) the gains they obtain from upstream suppliers. The uncovering of this two-sided market of LRGs is thus a prerequisite to the econometric evaluation of buyer power and pass-through.

After defining the two-sided market of LRGs (subsection 2.1), we describe its recent evolution, over the period 2002-2005, together with the evolution of the degree of concentration of LRGs over the two sides of the market (subsection 2.2).<sup>1</sup> The data we

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<sup>1</sup> Subsections 2.1 and 2.2 are based upon an internal document written with Ana Pinheiro.

consider in this market's description is, however, too aggregated and short over time for a reliable econometric measuring of buyer power and pass-through. For this reason, we use a larger sample of data, disaggregated at the product and brand levels (as described in subsection 2.3 below), for the econometric evaluation of these concepts.

## 2.1 Definition of the LRGs' two-sided market

As the activity of LRGs affect two levels of the market: the upstream where these groups act as customers to suppliers and the downstream where these groups sell (as retailers) to final consumers; the evaluation of the concepts of buyer power and pass-through requires the definition of a two-sided market. Analogously to any market, a two-sided market has, under a competition policy evaluation perspective, a double dimension: the material, or the relevant market of the product / service, and the geographic or the relevant geographic market. In the case of a two-sided market, the definition of the market dimensions differs, however, according to the side of the market that is considered.

In what concerns the **material dimension** of the LRGs' two-sided market, as referred by the European Commission (*vide* EC, 1997 and 2001), the relevant market is defined in terms of the substitutability concept. *In casu*,

- (i) In the **upstream** side of the market, since LRGs operate in the demand-side, substitutability is defined in terms of the supply-side *i.e.* in terms of the customers suppliers have in alternative to a LRG;
- (ii) In the **downstream** side of the market where LRGs act as service providers, substitutability is defined in terms of the products / services offered by retailers.

The material dimension of the upstream side of the market implies, in particular, that the relevant product (or service) market must be enlarged to the entire food sector.<sup>2</sup> Notwithstanding, as the supplying market structure and final consumers' preferences are likely to differ across products, the analysis of buyer power and pass-through disentangles between different product categories (see *v.g.* EC, 2000 and *infra*). Moreover, given the substitutability concept, buyer power and pass-through cannot, in general, be tackled at the level of a single product, but must be evaluated over a bundle of closely homogeneous or substitutable products (see *v.g.* Gohin and Guyomard, 2000). Food products are usually disentangled between the categories: “grocery”, “drinks”, “milk food”, “personal hygiene”, and “household cleaning”.<sup>3</sup>

Analogously to the product (or service) market, the **geographic market** is also two-sided.

In case of the upstream supplying market, since: (i) the product relevant market is defined as the entire food sector; (ii) all suppliers to this market and respective customers are implemented in the entire national territory, in spite of the regional location of their selling units; and (iii) large retailers and large grocery stores tend, in general, to centralize their purchases at the national territory level; the upstream purchasing market conditions of food products can be considered sufficiently homogeneous nation-wide for the relevant upstream geographic market to be defined as the national territory. This implies, in particular, that buyer power depends on the LRG's total purchases over the national territory, being thus invariant to the specific location of its selling units.<sup>4</sup> Moreover, though there are no economic or legal barriers for the importing of food products, since our study focus on the Portuguese food sector, we restrict attention to products which are bought and sold inland.

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<sup>2</sup> Though this study focuses on the food sector, LRGs operate, in general and in the Portuguese case, in a boarder market enlarged to the so called specialized retail (*v.g.* clothes and domestic electrical appliances).

<sup>3</sup> See *v.g.* the food product categories referred by the EC in its Carrefour – Promodés merger decision (EC, 2000) and by the Portuguese major brands' association (Centromarca, in <http://www.centromarca.pt>).

<sup>4</sup> It is worth noting that regional retailers, since they sell similar products to LRGs, they may as well buy from suppliers located outside their region, thus their buyer power is measurable in terms of their total purchases over the entire national territory, being thus of a nation-wide nature.

As for the downstream retailing activity, given transportation costs and the consumers' difficulty to move from a region to another, there are strong priors on the existence of several local downstream markets (v.g. EC, 2000 and Barros *et al.*, 2006). Yet, it is equally acceptable that LRGs' selling strategies (v.g. prices, advertising, and promotional campaigns) tend to have a nation-wide scope. Moreover, as referred by the EC (2000), competition among LRGs tend to have a regional or nation-wide scope broader than the local competition among specific selling units.<sup>5</sup> For this reason and for parsimonious motifs (see subsection 2.3 *infra*), we consider, in this paper; the geographic downstream market as the national territory. This carries through the implication that, analogously to buyer power, we tackle pass-through at the national level, though possibly differing across product categories (see also section 4 *infra*).

## 2.2 Evolution of the LRGs' two-sided market structure

To quantify the upstream and the downstream sides of the market, it is necessary to enumerate the major customers to suppliers together with their total purchases in this market and sales in the respective downstream markets.<sup>6</sup> We do so by considering the list of the major customers of the Portuguese major brands' association (Centromarca). This association classifies these customers into three major groups: (i) major LRGs, operating nation-wide; (ii) large grocery stores; and (iii) other channels, including the Hotels, Restaurants and Cafés (HORECA) channel and retailers of smaller dimension such as the traditional trade.

Among these customers, only the major LRGs and the large grocery stores provide us with reliable data on purchases and sales. The large number and strong heterogeneity of smaller firms belonging to the grocery channel together with the group "other channels" make it hard to obtain good quality data on this type of customers and thus on the overall market. The data

<sup>5</sup> In particular, in a recent merger decision, the Portuguese Competition Authority considered that the geographic analysis of the grocery market should be appreciated at the national level (see AdC, 2005).

<sup>6</sup> As retailers and grocery stores compete as customers in the supplying market, there are, at least, two distinct downstream markets: retail and wholesale. Yet, since this study focus on LRGs, we restrict attention to a single downstream market, namely the (food) retail sector.

on these channels and on the overall market is thus extrapolated from the data on LRGs and large grocery stores in the way we describe in appendix 1.

## 2.2(a) Structure of the upstream side of the market

Table 1 below summarizes the results on the structure of the upstream side of the market, over the period 2002-2005.<sup>7</sup> The “JM pool” refer to the bargaining pool agreement between the Jerónimo Martins (JM) group and the bargaining central UNIARME, concluded in November 1998. This agreement implies, in particular, that the buyer power of each one of the JM’s firms (the grocery store Recheio and the retailers Pingo Doce, and Feira Nova) is measurable not in terms of their individual purchasing shares, but of the total UNIARME’s purchases.<sup>8</sup>

Results show, first, that LRGs tend to grow in this market overall and relatively to large grocery stores, with their purchases representing, in 2005, more than half of the total demand that is addressed to the food supplying market. Figure 1 *infra* depicts a similar picture across different product categories. Yet, though LRGs tend to increase relatively to other customers in the supplying market, there is also a tendency to a closing of the gap between the purchasing market shares of LRGs, with the shares of the two largest retailers (JM and Sonae’s Modelo-Continente, MC) showing a certain decline in favour of the remaining LRGs.

This closing of the gap between the LRGs’ purchasing shares contributes to a substantial decline in the value of the concentration index (HHI), computed in terms of the shares of all the LRGs with the JM’s being replaced by the JM pool’s. This index falls from a value higher than 1000 in 2002, the threshold value above which a market can be considered concentrated, to a value below 700 in 2005. Figure 2 *infra* depicts a similar tendency for the purchasing market becoming low concentrated across different food product categories.

<sup>7</sup> To shorten the presentation, we consider herein only the aggregated market results though the market analysis discriminated across product categories is available upon request.

<sup>8</sup> UNIARME is a bargaining central, constituted in 1986 by two major grocery stores (Manuel Nunes and Recheio) together with eleven other small to median sized wholesalers, with the intent of triggering the buyer power of its associates as a countervailing force to LRGs. It integrates, since November 1998, the group JM.

**Table 1**

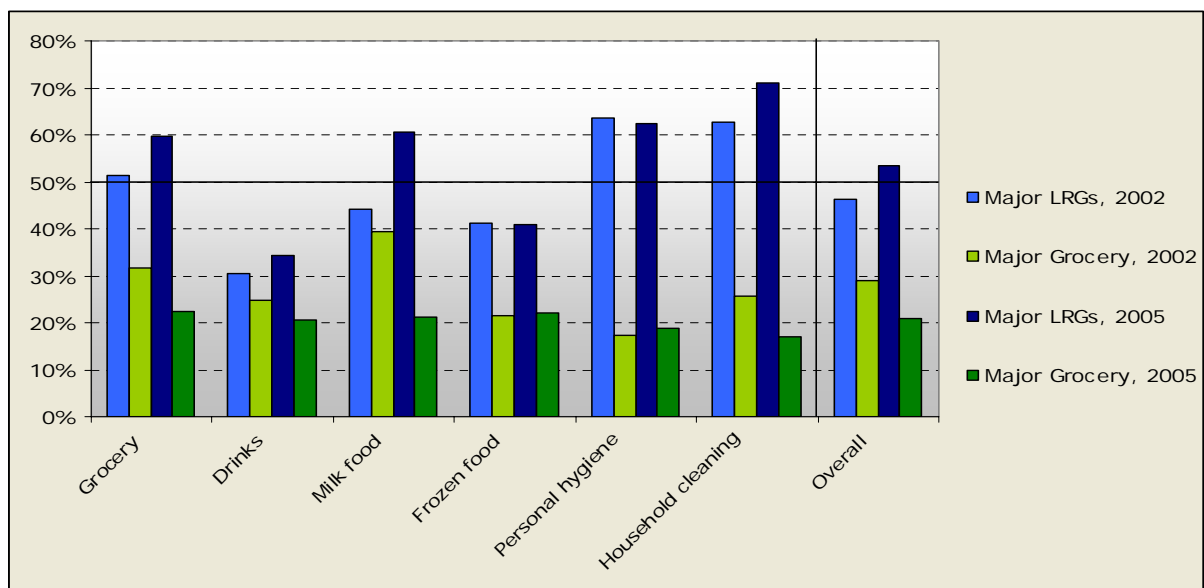
**Structure of purchases in the Portuguese food sector, over the period 2002-2005**

	2002	2003	2004	2005
Market value (Mio €)	7.827,6	7.702,9	7.499,1	7.518,9
<b>Major LRGs (%)</b>	<b>46,2</b>	<b>48,9</b>	<b>50,6</b>	<b>53,4</b>
Major 2 (%)	25,2	23,9	23,9	24,9
Major 5 (%)	42,2	43,3	44,5	46,2
Other (%)	4,0	5,6	6,1	7,2
<b>Major wholesalers (%)</b>	<b>29,1</b>	<b>25,8</b>	<b>23,9</b>	<b>20,8</b>
<b>Other channels (%)</b>	<b>24,8</b>	<b>25,3</b>	<b>25,5</b>	<b>25,8</b>
JM pool / leader	2,100	1,772	1,671	1,052
JM pool / LRGs	0,638	0,527	0,482	0,304
<b>HHI LRGs with JM pool</b>	<b>1168</b>	<b>1013</b>	<b>968</b>	<b>677</b>

*Note:* The Herfindahl-Hirschmann concentration index (HHI) is computed using all LRGs' shares in the purchasing market, kept confidential, with the JM's being replaced by the share of the "JM pool".

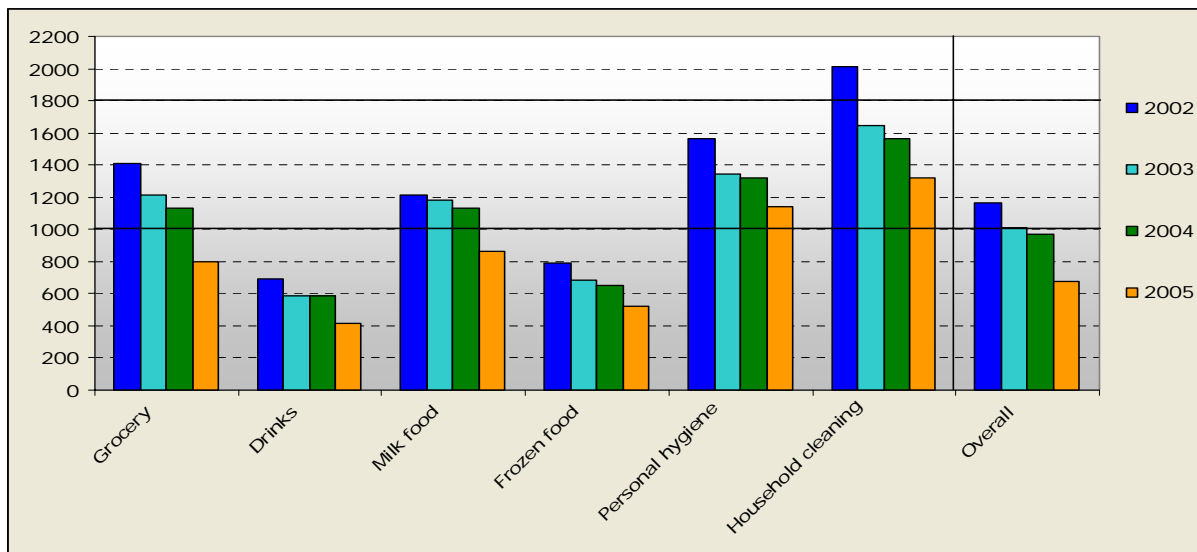
**Figure 1**

**Comparative evolution between 2002 and 2005 of the purchasing market shares of LRGs and large grocery stores across product categories**



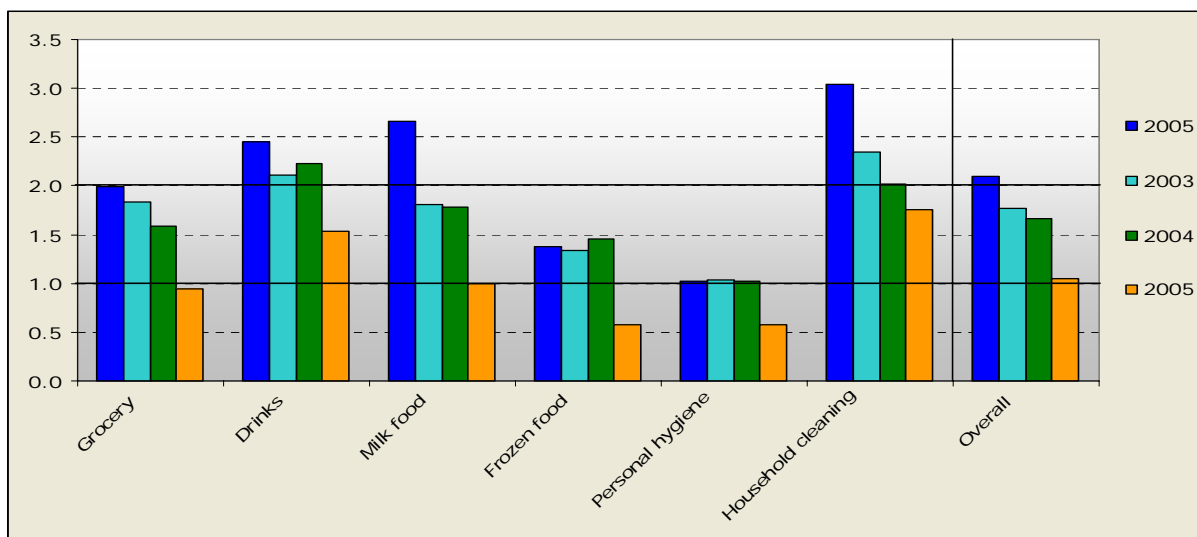
**Figure 2**

**Evolution of the HHI of the purchasing market shares of LRGs together with the JM pool, over the period 2002-2005 and across product categories**



**Figure 3**

**Evolution of the ratio of the purchasing market share between the JM pool and the market leader (MC), over the period 2002-2005 and across product categories**



Moreover, we observe further, in figure 3 above, that, although the JM pool regroups large retailers (the JM group) together with large grocery stores, its purchasing share shows a substantial decline, mostly when compared to the share of the market leader (MC), being nowadays comparable with the latter and even below it over the product categories “grocery”, “frozen food”, and “personal hygiene”.

## 2.2(b) Structure of the downstream retail market

Table 2 hereafter summarizes the structure of the downstream retail market and its recent evolution over the period 2002-2005.

**Table 2**  
**Structure of the downstream retail market over the period 2002-2005**

	2002	2003	2004	2005
Market value (Mio €)	10.482	10.716	10.632	11.304
<b>Major LRGs (%)</b>	<b>75,0</b>	<b>74,4</b>	<b>74,2</b>	<b>73,9</b>
Major 2 (%)	38,4	36,3	34,0	31,4
Major 5 (%)	67,5	66,6	65,7	62,3
Other (%)	7,5	7,8	8,5	11,6
<b>Other retailers (%)</b>	<b>25,0</b>	<b>25,6</b>	<b>25,8</b>	<b>26,1</b>
Major 2 / Next major 3	0,756	0,835	0,932	0,984
<b>HHI LRGs</b>	<b>1061</b>	<b>1005</b>	<b>980</b>	<b>956</b>

*Note:* The Herfindahl-Hirschmann concentration index (HHI) is computed using all the LRGs’ retail market shares, kept confidential.

Similarly with the results on the purchasing market, we observe a tendency to a closing of the gap between the major LRGs, with the cumulative of the third to the fifth largest retailer being catching up the cumulative of the major two and the remaining LRGs showing also a tendency to grow relatively to the largest two. Analogously, the HHI, computed in terms of the LRGs’ market shares, show also a declining tendency, though slighter than that observed over the purchasing market. Interestingly, retailers other than the nation-wide LRGs show also a slight

tendency to gain market share relatively to the latter, though the cumulative of their shares can be considered, given the shortness of our sample, rather stable over time.

Summing up, these findings reveal a substantial decline of the LRGs' concentration over the two sides of the market, specially as customers to suppliers in the upstream side. The next subsection describes the data which is used for the econometric evaluation of buyer power (section 3) and pass-through (section 4).

### **2.3 Data used in the econometric analysis of buyer power and pass-through**

Since buyer power (BP) and pass-through (PT) are likely to differ across bundles of closely homogeneous or substitutable products (see *v.g.* Gohin and Guyomard, 2000), the econometric (nation-wide) evaluation of these concepts, in sections 3 and 4 below respectively, must be based on a larger sample of data, disaggregated at the product and brand levels, than the one considered above. This larger sample of data is as follows.

As products are supplier- and brand-differentiated, a first requisite of the data is that it covers a sample of products, suppliers, and brands sufficiently large to represent the food retailing sector but not too large so as to allow a feasible and parsimonious econometric treatment. Second, since LRGs constitute the object of the study, the data must consist of purchases and sales specific to these groups. Finally, since PT relates the two sides of the market, the purchases and sales data samples must consider the same products, suppliers, and brands.

Moreover, since the geographic relevant (two-sided) market is the national territory (see subsection 2.1 *supra*), purchases and sales must be centralized at the LRG level, *i.e.* they must be defined as totals over all of this group's selling units. This carries through a first limitation of the study, namely that of tackling PT at a nation-wide level whilst, as afore referred (in subsection 2.1 *supra*), though BP tends to have a nation-wide dimension, PT may differ across local markets of the LRGs' selling units. Tackling the regional dimension of PT would,

however, require regional data on sales which, given the dimension of our data (see *infra*), presents the *caveat* of implying the analysis of several large panels, one per region or local market, along with the difficulty of defining the relevant local markets to be considered. For this reason (see also subsection 2.1 *supra*), we tackle both BP and PT at the national level and leave local market considerations, notably on PT, for further research.<sup>9</sup>

Since purchases and sales data disaggregated at the product, supplier, and brand levels can be obtained only from the LRGs themselves,<sup>10</sup> we consider only the LRGs which dispose of this type of data. Hence, our sample is restricted to five LRGs which represent, in 2005, about 40% of total purchases to the food supplying market and around 54% of the Portuguese food retailing sector. Moreover, since products are brand differentiated, we only consider brands which are relatively common across all the LRGs. This implies the exclusion of white brand products which have not only shown, recently, a fast growing demand in Portugal, but may be an important source of BP as these products are direct competitors to the suppliers' own brands. We leave for further research the extension of our work to a broader sample of LRGs together with the consideration of white brand products.

The data, specific to each LRG, consists in the value of total purchases and total sales, in euros and quantity, disaggregated over 75 food products (from grocery, drinks, and milk food to household cleaning and personal hygiene), with a minimum of three major brands per product (harmonized across LRGs), and one single supplier for each brand-specific product, *i.e.* per combination product x brand, though a supplier may sell different brand-specific products. To simplify the presentation, we call each brand-specific product an *item*, indexed by *i*.<sup>11</sup> The data covers a total of 830 items, across all the LRGs considered, with purchases and sales observed over 16 quarters ranging from the first quarter of 2000 to the last quarter of 2003 (see appendix 2 for details).

<sup>9</sup> Barros *et al.* (2006) tackle pass-through at a local market level, but their analysis suffers, as afore referred, from a sample mismatch bias as it departs from distinct samples on purchases and sales data.

<sup>10</sup> Since the data is obtained directly from the LRGs, its sources are strictly confidential.

<sup>11</sup> This means that a product such as toothpaste may consist of different items, each one of them being specific to a given brand, *v.g.* Colgate, Pepsodent, *etc.*

Quantities are expressed in the same measurement units (package and weight) across sales, purchases, and LRGs. Since prices are not directly observed, they are computed by dividing the value of purchases and sales by the respective quantities. Hence, we consider average factious prices net of discounts and/or promotional components. These computed net-of-discount prices account, actually, better for BP and PT than tabulated prices. In particular, BP is mostly reflected by the discounts LRGs obtain from suppliers, with such discounts not affecting tabulated prices but lowering effective acquisition or net-of-discount prices.

The analysis of buyer power (section 3) and pass-through (section 4) is thus, and also because we do not dispose of data on suppliers, based on the degree of reduction in acquisition prices LRGs obtain in the supplying market and the way these gains are transmitted to final consumers as reductions on selling prices. Alternatively, we might measure these concepts in terms of the rents LRGs retrieve from suppliers. This alternative would, however, require specific data on suppliers to infer, in particular, their marginal costs.

### **3. Buyer power of LRGs**

This section describes the econometric modelling (subsection 3.1) and the empirical results (subsection 3.2) on buyer power.

#### **3.1 Econometric modelling of buyer power**

As afore referred, we tackle the issue on the rent shift from suppliers to LRGs through the impact buyer power (BP) has on lowering these groups' acquisition prices. Yet, BP is not directly observable but must be inferred from the data. Since among what is observable in the data, purchasing pooling and vertical agreements are likely to trigger BP (see subsection 2.2 above), we disentangle between the degree of BP among LRGs by isolating effects specific to these groups and vertical agreements, all measured relatively to purchasing pools, on net-of-

discount acquisition prices. The econometric modelling of BP departs thus from a dummy-based panel approach, with the major dummies being fixed effects to each LRG and specific to vertical agreements, isolated from different sources of observable heterogeneity in the data, as described hereafter.

Let here and henceforth a “dummy” be a 0-1 variable taking the value 1 over the panel entries to which the dummy refers and 0 otherwise. In particular, the dummy specific to LRG  $g$  (*i.e.*, this group’s fixed effect) takes the value 1 across all the items sold or purchased by this group, over all the quarters in the data, and 0 otherwise. We control for a single purchasing pool and for a single vertical agreement in the data, each defined by a dummy specific to the items which are purchased within these agreements. We disentangle then between the degree of BP across LRGs comparing the fixed effect and the vertical agreement coefficients all measured relatively to the purchasing pool dummy called the *pool*.<sup>12</sup> In particular, the pool contributes to the highest BP (*i.e.* to the lowest average net-of-discount acquisition prices) in case the latter fixed effect and vertical agreement coefficients are all positive.

We control for the possible non-linearity in the data by considering prices and quantities in logarithms (logs). Letting  $c_{it}$  and  $q_{it}$  be the logs of the purchasing prices and quantities for item  $i$  (over a total of 830 items) at quarter  $t$  respectively and  $p_{it}$  and  $s_{it}$  be the selling prices and quantities of the same item at the same quarter respectively, the proposed model for BP is,

$$c_{it} = \alpha + (\gamma_g + \gamma_{g|vert}) + \rho_n + \delta_j + \beta \hat{s}_{it} + \lambda_t + \xi_{it}, \quad (1)$$

with  $\hat{s}_{it}$  being instrumented as follows,

$$\hat{s}_{it} = \hat{\phi}_1 s_{it-1} + \hat{\phi}_2 s_{it-2} + \hat{\theta}_1 p_{it-1} + \hat{\theta}_2 p_{it-2} + \hat{\varphi}_1 c_{it-1} + \hat{\varphi}_2 c_{it-2}, \quad (2)$$

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<sup>12</sup> It is worth noting that whilst there is a single purchasing pool in our data, there may be vertical agreements other than the one we consider. The effect on BP of other possible vertical agreements is, however, implicitly controlled for by the LRGs’ fixed effect coefficients.

where  $\alpha$  is a constant term,  $\gamma_g$  is the fixed effect to LRG  $g$ ,  $\gamma_{g|vert}$  is the vertical agreement dummy,  $\xi_{it}$  is an error term which is assumed uncorrelated over time (quarters)  $t$  and items  $i$ ,  $\lambda_t$  is a time dummy capturing the time (trend and cycle) component common to purchasing prices, and the terms  $\rho_n$  and  $\delta_j$  are specific dummies to product  $n$  and supplier  $j$  respectively which capture the average (net-of-discount) purchasing price level specific to these categories.<sup>13</sup> Since all the dummies are expressed relatively to the pool, a negative (positive) ( $\gamma_g + \gamma_{g|vert}$ ) is, in particular, equivalent to saying that group  $g$  benefits (suffers) from lower (higher) acquisition prices than the pool.

The term  $\beta s_{it}$  controls, in turn, for the LRGs' size effect, with  $\beta$  being common across all items and LRGs and with the sold quantities  $s_{it}$  varying across items, LRGs, and time. Yet, since sales depends on the final prices LRG set to final consumers, which are, in turn, conditioned by these groups' acquisition prices, sales is indeed an endogenous regressor. Following Arellano and Bond (1991), we solve for this endogeneity problem by exploiting the panel structure of the data to instrument sales by its first two lags (quarters) along with the first two lags of purchasing and selling prices as in equation (2) *supra*.<sup>14</sup>

The *rationale* behind this approach is the following: the larger a LRG the more likely it is to obtain better conditions from suppliers; thus purchasing prices should be negatively affected by size. Therefore, the “size” of the group measured by its sales in the previous quarter is not strictly exogenous, but can be considered predetermined, being in this way a valid instrument in the regression (see Arellano and Bond, 1991).

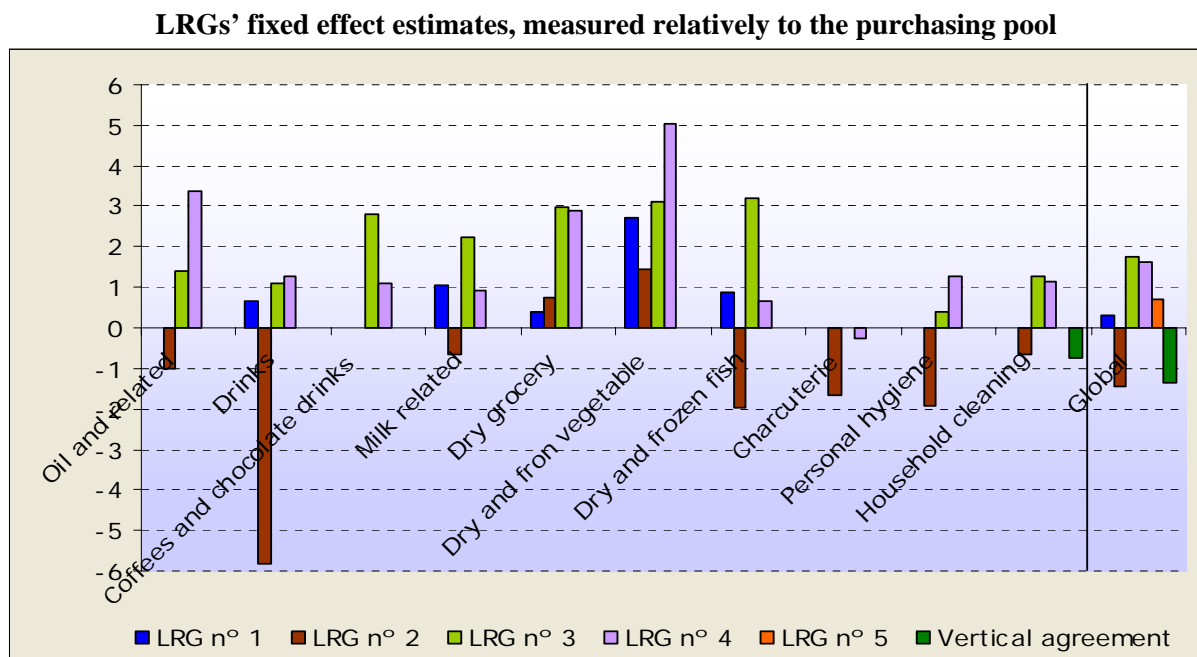
<sup>13</sup> For a parsimonious motif, rather than allowing further for brand-specific dummies, we control for the product-specific brand differentiation by the joint inclusion of product and supplier-specific dummies.

<sup>14</sup> The lagged purchasing prices are further expected to capture the residual serial correlation in the LHS variable that is left unexplained by the model. The inclusion of two lags only in the instruments is, in turn, justified by the short time length of the sample, restricted to 16 quarters.

### 3.2 Regression results

We disentangle between one regression over the entire panel and a regression over each one of the ten different product categories (listed in appendix 2). Figure 5 below displays the main regression results on the estimated  $\gamma$ , all relatively to the acquisition price level that is obtained by the pool set to the zero ordinate (see table A3 in appendix 3 for details). Values in the figure lying at the zero line mean that acquisition prices are statistically identical (at the 95% probability level) to those of the pool whilst negative (positive) values correspond to better (worse) acquisition price conditions than those obtained by the pool.<sup>15</sup>

Figure 5



Results reveal that the purchasing pool benefits, in general, from the best purchasing conditions (prices), with all the bars in the figure being positive except for LRG n° 2 and the

<sup>15</sup> A zero value may, nonetheless, also reflect categories with not enough observations for estimation to be carried through (see also table A3 in appendix 3).

vertical agreement. They reveal further that the LRGs which pool their purchases obtain lower acquisition prices inside the pool than for the items they buy separately outside the pool.

Results are not, however, necessarily in favour of the prior that groups having higher purchasing shares benefit, in general, from lower acquisition prices or that a high concentration of LRGs in the supplying market implies, necessarily, the lowering of acquisition prices (or a harmful effect on suppliers). As opposed, one of the largest retailer in Portugal (LRG n° 4) suffers, in most cases, from the highest acquisition prices whilst LRG n° 2 has a lower purchasing share in Portugal than LRG n° 4 but benefits from the best purchasing conditions in our sample. The justification for the findings on LRG n° 4 lies, however, possibly beyond the scope of this analysis and this for the twofold reason. First, it may stem from the poor reliability of this group's data which has been found to be affected by several missing and outlying values. Yet, such results may also be the by-product of this group buying mostly from specific suppliers, in vertical agreements, different from the ones we consider which are roughly common across all the LRGs.

Quite interestingly, our findings point out that the LRG benefiting from the lowest acquisition prices, namely LRG n° 2, had in 2003 a small share in the Portuguese market, but is, and was in that year, an important retailer abroad and has recovered ever since on its relative share over the largest retailers in Portugal. The international position of this group together with the fact of being an important seller of white brand products in Portugal are likely to induce strong pressures on internal suppliers triggering its BP in this market irrespectively of its internal market share. These two issues on the impact international positions and the selling of white brand products have on BP go, however, beyond the scope of the present paper and shall be left for further research.

## 4. Pass-through to final consumers

It is usually claimed that LRGs have contributed to improving consumer welfare through the reduction of selling prices they brought relatively to traditional retailers. Yet, though LRGs may have initially contributed to this effect, once their market matures and the demand for their products grows, they may actually, despite the price reductions they obtain from suppliers, through their BP, not transmit to final consumers all of these reductions at the cost of consumer welfare.<sup>16</sup> Insofar LRGs do not pass-through to final consumers the price reductions they obtain from suppliers, they contribute, *ceteris paribus*, to a lower consumer surplus than what their BP would permit and, thus, to a higher (social) deadweight loss. The aim of this section is to tackle this issue.

### 4.1 Econometric modelling of pass-through

Pass-through (PT) is thus herein perceived as a mechanism through which LRGs transmit to final consumers at least as much of the price reductions they obtain from suppliers. If instead suppliers increase their prices, there is PT if LRGs change their selling prices (to final consumers) at most as much as the rise in their acquisition prices.

Letting the big caps  $P$  and  $C$  denote, in analogy with the notations in section 3 *supra*, the levels of the LRGs' selling and acquisition prices respectively, there is PT if in case  $C$  rises (falls),  $P$  increases at most (decreases at least) as much as  $C$ . In other words, there is PT in case the ratio  $P/C$  does not increase following from a (positive or negative) change in  $C$ .<sup>17</sup>

Formally, letting

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<sup>16</sup> It is worth noting that, in this paper, we view consumer welfare only in terms of price changes free from considerations on v.g. the services, product diversity and quality LRGs offer to consumers.

<sup>17</sup> PT is thus equivalent to saying that the LRGs' gross selling margin, namely  $(P - C)/P = 1 - C/P$ , does not increase after a rise or a fall in  $C$ .

$$\pi_{it} = p_{it} - c_{it}, \quad (2)$$

be the log of the ratio  $P/C$ , for item  $i$ , quarter  $t$ , and a given LRG, testing for PT is thus equivalent to testing for the non-positivity of the following quantity:

$$\psi = \frac{\partial \pi}{\partial c} I(\Delta c > 0) - \frac{\partial \pi}{\partial c} I(\Delta c < 0), \quad (3)$$

where  $I(\cdot)$  is a dummy variable taking the value 1 if the inner expression is true and 0 otherwise, with  $\psi$  representing the elasticity of the ratio  $P/C$  to changes in  $C$ . PT is the higher the more  $\psi$  is negative and is inconsistent with cases in which  $\psi > 0$ .

To illustrate the testing of PT through the sign of  $\psi$ , consider the following example:

**Example 4.1:** Consider an initial state with  $P_0 = C_0 = 100$  (thus  $\pi_0 = 0$ ) and a 10 units change in  $C$ . Following from the discrete time approximation of  $\psi$ , it is straightforward to show that the new  $P/C$  ratio satisfies:

$$P_1 = C_1(1 + \psi/10),$$

and the new unitary margin  $\Pi_1 \cong \psi/10$ . In case there is PT with v.g.  $\psi = -1/10$ , if  $C$  falls to  $C_1 = 90$ ,  $P_1 = 0,99 \times 90 = 89,1$  with  $\Delta P = -10,9 < \Delta C = -10$ ; if, instead,  $C$  rises to  $C_1 = 110$ ,  $P_1 = 0,99 \times 110 = 108,9$  with  $\Delta P = 8,9 < \Delta C = 10$ . If, in contrast,  $\psi > 0$ , there is no PT since  $P$  rises (falls) proportionally more (less) than  $C$  respectively.

Though  $\psi$ , in expression (4) above, aggregates positive and negative changes in  $C$ , the usual economic inertia of final product prices to fall suggests that PT may, actually, be much more likely to occur when acquisition prices rise than when they fall. Whilst when  $C$  rises LRGs tend not to increase their margins in order to keep customers, when  $C$  falls LRGs are tempted not to change their selling prices at the cost of final consumers. Results in section 5 below suggest, however, that our empirical findings on PT do not depend on whether  $C$  rises or falls.

It is worth noting that since PT is related to the way LRGs change their selling prices after a change on the prices they obtain in the supplying market, departing from distinct samples on purchasing and selling price data may lead to misleading results on PT. This is why the Barros *et al.* (2006) finding on no PT is likely to be biased as they argue that LRGs, following from an increasing downstream (local) market concentration, tend to sell at higher prices despite the fact that, through their BP, they tend to benefit from lower acquisition prices.

#### 4.2 Empirical results on pass-through

There is a major hint on the testing for the non-positivity of  $\psi$ , in expression (4) above, namely the natural endogeneity between  $\pi$  and  $c$ . Since  $c$  clears the supplying market, it depends on the relative bargaining power between this market players, LRGs and suppliers, and thus on  $\pi$ . In particular, LRGs are likely to exert a downward pressure over  $c$  for the products where they obtain smaller  $\pi$ . We control for this endogeneity by instrumenting the endogeneous variables in the model using a similar approach to the one in section 3 *supra*.

We proxy the relative bargaining power between LRGs and suppliers by the share these players have over each one of the 10 product categories in the data. Let  $\tau_{jt}^g$  be the share LRG  $g$  has over the sales of all LRGs in product category  $j$  and  $\tau_{jt}^s$  be the share supplier  $s$  has over the sales of all suppliers in product category  $j$ .<sup>18</sup>

The estimated model for  $\pi$  is

$$\pi_{it} = \alpha + \gamma_g + \psi_g (\hat{c}_{it} I(\Delta c_{it} \geq 0) - \hat{c}_{it} I(\Delta c_{it} < 0)) + \beta_g \hat{\tau}_{it}^g + \beta_s \hat{\tau}_{it}^s + \rho_n + \delta_s + \lambda_t + \zeta_{it}, \quad (6)$$

<sup>18</sup> Formally,  $\tau_{jt}^g$  corresponds to the ratio of total sales in category  $j$  of LRG  $g$  over all LRGs whilst  $\tau_{jt}^s$  is the ratio of total purchases in category  $j$  from all LRGs to supplier  $s$  over the cumulated purchases from all LRGs to all suppliers in this category. It is straightforward to show that these shares are, by construction, invariant across all the items in the same product category.

where,  $\alpha$  is the intercept and  $\rho_n$ ,  $\delta_s$ , and  $\lambda_t$  are dummy-variables specific to product  $n$ , supplier  $s$ , and quarter  $t$  respectively, and  $\gamma_g$  is the LRG  $g$  fixed effect, with all these effects being measured relatively to the pool (see section 3 above). The  $\beta_g$  and  $\beta_s$  account, in turn, for the effects a 1% increase in the shares of LRG  $g$  and supplier  $s$  have on the ratio  $P/C$  respectively and  $\psi_g$  measures the PT effect specific to LRG  $g$ .

We solve for the possible endogeneity bias induced by the RHS variables  $c$ ,  $\hat{\tau}^g$ , and  $\hat{\tau}^s$  by instrumenting these variables, marked with an “hat” in expression (6) above, with the first two lags (quarters) of all of them and of the LHS variable (see also section 3 above). The use of the lagged LHS variable as instrument is, as in the previous section, further expected to capture the serial correlation in  $\pi$  left unexplained by the remaining variables in the model.

Regressions are, as in section 3 *supra*, performed over the entire panel and over each one of the 10 product categories. Table 3 below presents the main regression results on the estimated  $\psi_g$ , the  $\beta_g$  and  $\beta_s$  coefficients, and the intercept, all followed by the corresponding t-statistics between parenthesis, the number of observations (nob), the  $R^2$  and the p-value of the regression together with the Wald test, statistic and corresponding p-value, on the equality between the  $\psi_g$  of the LRGs which pool their purchases. Values in bold highlight the coefficients which are significantly different from zero at the 90% probability level.<sup>19</sup>

Results provide evidence of PT, with about 78% of the cases being consistent with selling prices responding proportionally to changes in acquisition prices, *i.e.* with the corresponding estimated  $\psi$  being statistically null at probability levels higher than 95%. In 18% of the cases, as well as over the entire panel, there is stronger evidence of PT, with LRGs decreasing their selling margins, in favour of final consumers, after a change in acquisition prices. This stronger evidence of PT is compelling, over the entire panel, with LRGs n° 1 and 2, where a 1% change in  $C$  results in 0,04 and 0,022% decrease in the ratio  $P/C$  respectively.

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<sup>19</sup> The critical values of the t-statistics are, in absolute terms, 1.65 and 1.96 at the 90 and the 95% probability levels respectively. These regression results are detailed in Table A4 in appendix 4.

**Table 3**  
**Regression results on the existence of pass-through across LRGs**  
**Panel A: Results over the entire panel and the first 5 product categories**

	Entire panel	Oil & related	Drinks	Coffees ...	Milk food	Dry grocery
$\psi$ LRG 1	<b>-0.040</b> (-2.39)	<b>-0.116</b> (-2.63)	0.010 (0.12)	0.033 (1.09)	-0.040 (-1.01)	<b>-0.051</b> (-1.80)
$\psi$ LRG 2	<b>-0.022</b> (-2.05)	<b>-0.058</b> (-1.96)	-0.023 (-1.22)	0.040 (1.17)	<b>-0.067</b> (-1.80)	<b>-0.072</b> (-2.41)
$\psi$ LRG 3	0.005 (0.13)	<b>-0.150</b> (-3.07)	-0.005 (-0.18)	0.032 (0.47)	0.062 (0.79)	<b>-0.064</b> (-1.69)
$\psi$ LRG 4	<b>0.028</b> (1.96)	0.030 (0.32)	0.085 (0.83)	-0.002 (-0.06)	0.041 (0.97)	-0.021 (-0.46)
$\psi$ LRG 5	0.079 (1.47)	0.139 (1.19)	0.103 (1.34)	-0.021 (-0.17)	<b>-0.115</b> (-1.97)	<b>0.097</b> (1.70)
$\beta_g$	0.019 (0.15)	-0.287 (-0.81)	0.094 (0.26)	-0.431 (-0.80)	0.090 (0.30)	-0.420 (-1.44)
$\beta_s$	<b>-0.342</b> (-4.65)	-0.392 (-1.60)	0.331 (1.37)	0.082 (0.26)	<b>-1.073</b> (-6.64)	0.216 (1.12)
Intercept	<b>2.130</b> (14.34)	<b>2.535</b> (6.90)	<b>1.349</b> (4.30)	<b>4.429</b> (6.31)	<b>4.889</b> (10.60)	<b>1.272</b> (5.26)
NOB	10423	780	1078	702	1144	1571
R2	.237	.388	.333	.437	.372	.348
p-value	.0000	.0000	.0000	.0000	.0000	.0000
Wald	1.32	<b>5.07</b>	1.72	0.15	<b>2.82</b>	<b>5.58</b>
p-value	.2513	.0246	.1905	.7035	.0933	.0183

The products categories with a stronger PT effect, where the estimated  $\psi$  are the more statistically negative, are: “oil and related” with estimated  $\psi$  coefficients of -0.116 and -0.15 for LRGs n° 1 and 3 respectively; “milk food” with estimated  $\psi$  coefficients of -0.115 for LRG n° 5; and “dry and frozen fish” for LRG n° 3 with a 1% change in acquisition prices representing a 0.111% fall in its selling margin. In contrast, most of the findings on LRG n° 4 go against PT: over the entire panel as well as over the categories “dry and frozen fish” and “personal hygiene”, with a 1% change in  $C$  implying, in the first case, a 0.028% increase in

this group's selling margin. The estimated  $\psi$  coefficients of this group in the remaining product categories are all statistically null at standard probability levels.

**Table 3, Panel B: Results over the 6<sup>th</sup> to the 10<sup>th</sup> product categories**

	Dry & frozen vegetables	Dry & frozen fish	Charcuterie	Personal hygiene	Household cleaning
$\psi$ LRG 1	-0.082 (-1.51)	-0.064 (-1.58)	-0.071 (-0.99)	-0.033 (-0.50)	0.017 (0.38)
$\psi$ LRG 2	-0.007 (-0.20)	0.007 (0.28)	-0.071 (-0.71)	-0.041 (-1.38)	0.026 (0.86)
$\psi$ LRG 3	0.011 (0.07)	<b>-0.111</b> (-2.63)	-0.046 (-0.62)	0.028 (1.25)	0.014 (0.68)
$\psi$ LRG 4	-0.210 (-0.93)	<b>0.111</b> (1.67)	0.068 (1.22)	<b>0.057</b> (2.73)	0.015 (0.73)
$\psi$ LRG 5	0.050 (0.67)	0.044 (0.89)	-0.015 (-0.24)	0.014 (0.25)	0.200 (1.32)
$\beta_g$	0.238 (0.43)	0.352 (0.85)	-0.054 (-0.12)	0.263 (0.98)	0.060 (0.26)
$\beta_s$	<b>-1.701</b> (-5.23)	0.102 (0.47)	-0.176 (-0.89)	0.123 (0.71)	0.039 (0.19)
Intercept	-0.284 (-0.53)	<b>1.283</b> (2.16)	<b>3.036</b> (6.60)	<b>1.972</b> (8.36)	<b>1.048</b> (3.66)
NOB	858	477	516	1362	1935
R2	.416	.495	.310	.325	.242
p-value	.0000	.0000	.0000	.0000	.0000
Wald	0.06	<b>5.15</b>	0.26	0.06	1.50
p-value	.8073	.0238	.6122	.8029	.2213

Moreover, we find further similar PT effects among the LRGs which pool their purchases, with the  $\psi$  coefficients being statistically identical at standard probability levels. The finding of negative fixed effects, with all these effects being measured relatively to the purchasing pool, suggest further that this pool is likely to benefit, together with LRG n° 2, from the

highest selling margins (see also table A4 in appendix 4). Quite interestingly, as commented in section 3 *supra*, this pool and LRG n° 2 are also those benefiting from the highest BP.

Concerning the  $\beta$  coefficients, findings suggest that only the suppliers' shares, not the LRGs', have an impact on the LRGs selling margins. Results over the entire panel point out that a 10% increase in suppliers shares leads to a 3,4% fall on LRGs' selling margins whilst in some categories (v.g. "milk food") this fall goes beyond 10%. This finding may stem from the relative stability of the LRGs' shares observed over the considered time period, sustained, in part, by the existence, at that time, of legal barriers on the constitution of large hypermarkets.

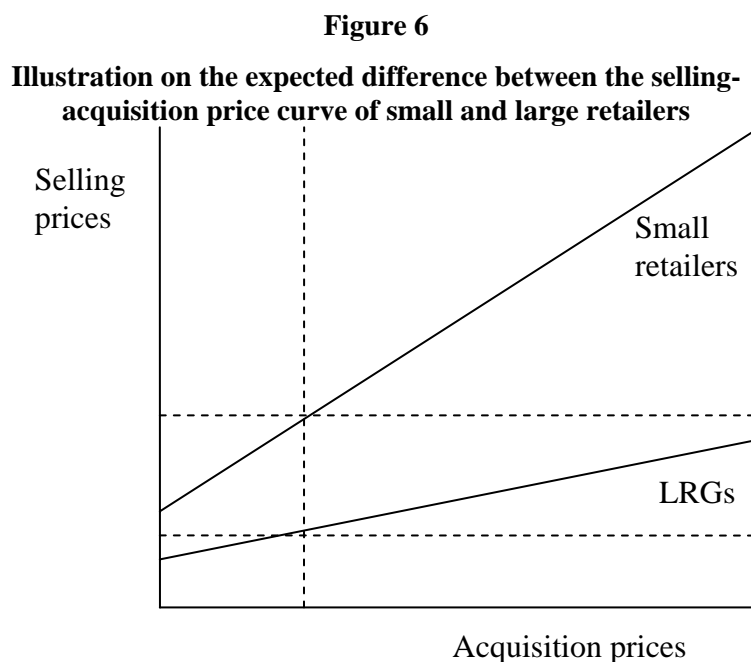
Summing up, results show evidence of PT and moderated evidence that, over some product categories, a change in acquisition prices leads LRGs to decrease their selling margins in favour of final consumers. PT tends further to be lower, and even absent, for the groups having the highest BP, reflected by their purchasing market shares or participation in the pool. Results in section 5 hereafter reinforce our empirical findings on BP and PT by highlighting that, during the recent period 1998-2005, LRGs tend to increase their selling prices (to final consumers) at a lower rate than national trade including traditional retailers.

## 5. Selling prices of LRGs

The analysis of the market structure in section 2 *supra* reinforces our empirical findings on buyer power (section 3) and pass-through (section 4). *De facto*, it highlighted a decreasing degree of concentration, over the period 2000-2005, of LRGs over the two sides of the market: both upstream as customers to the supply-side and downstream on the retail sales to final consumers. Whilst this falling degree of concentration, reinforced, in particular, by the removal, in March 2004, of the legal barriers to the entry in the market, should trigger the competition among LRGs, this latter should imply smoother relations between these groups and suppliers as well as a higher degree of pass-through from LRGs to final consumers.

The descriptive results in this section show, in parallel, that, over the period 1998-2005, LRGs tend to pass-through to final consumers the price reductions they obtain from suppliers as they tend to increase their prices less than the respective consumer price index (CPI). Moreover, results reveal in addition a downward trend in the LRGs' prices of the major food products, namely those of grocery, drinks, and milk food, from 2002 onwards whereas the respective CPI shows a sustained upward trend during the same period.

These findings suggest that since LRGs dispose of BP, they tend, when compared with traditional trade, to: (i) sell at lower prices than traditional trade and (ii) adjust less their selling prices to a change on purchasing prices; contributing thus to a stronger PT effect (i.e. a lower  $\psi$ ), as illustrated in figure 6 hereafter.<sup>20</sup>



The data considered in this section consists in the final gross-of-taxes selling prices to final consumers, adjusted to eventual promotional campaigns and specific to a given day in July

<sup>20</sup> Results in this section suggest a widen of the gap, over time, between the selling prices of traditional retailers and LRGs. We do not, however, dispose of reliable data on the acquisition prices of the traditional trade to empirically evaluate the illustration of figure 6 above.

over the eight years period 1998-2005, over a range of 205 food items covering the categories “general grocery” (*i.e.* grocery, drinks, and milk food products, for a total of 108 items), “household cleaning” (55 items), and “personal hygiene” (42 items). These panels (eight years per 205 food items) are discriminated across a total of 37 selling units over the six major LRGs operating in Portugal. These LRGs account, in 2005, for about 55% of total purchases in the supplying market and a cumulated share of about 2/3 of the downstream retail market. The selling units, namely 16 supermarkets and 21 hypermarkets, are further disentangled by three geographic areas: the two major cities, Lisbon and Porto, and the aggregate of eight other large cities (see appendix 5 for details).

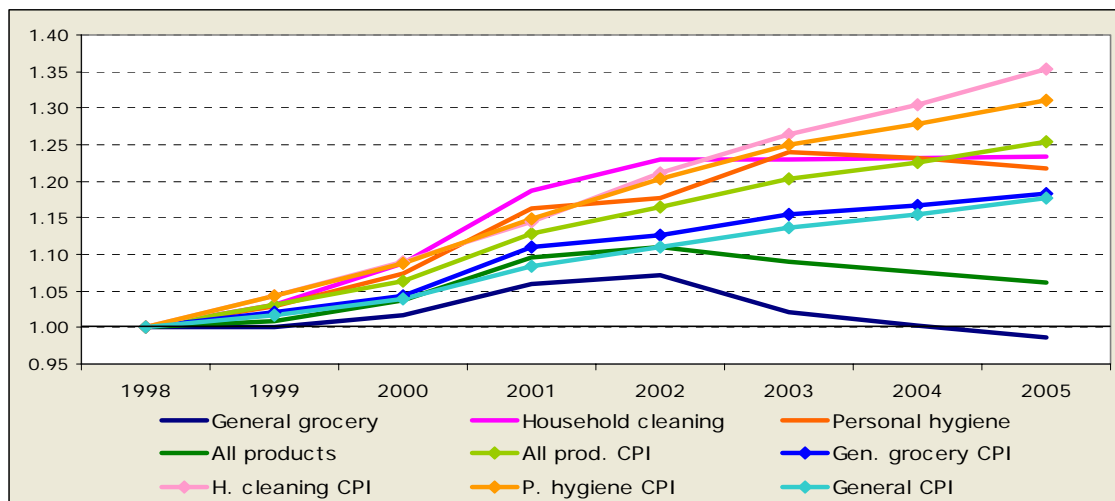
Together with this data, we consider the CPI specific to each one of the three afore referred product categories along with the general CPI, based upon which inflation is measured. Finally, we compute LRGs’ selling price indexes, specific to each product category and overall, by averaging prices according to the CPI weights.

Figure 7 below depicts the evolution of the nation-wide LRGs’ selling price indexes in comparison with the respective CPIs (the basis being 1998 = 1), across the three product categories. It shows, first, that LRGs tend to increase their selling prices at a lower rate than national trade including traditional small businesses. Moreover, results reveal in addition that from 2002 onwards LRGs tend to decrease their prices of the major food products, namely those of “general grocery” (grocery, drinks, and milk food), which account for more than 90% of the food CPI.<sup>21</sup> The average price of this category attains, even, in 2005 a level below the one in 1998. This result coupled with the strong importance of this category in the food sector induce a downward trend on the overall LRGs’ food price index from 2002 onwards together with a strong widen of the gap between this index and the respective CPI, from around 5% in 2002 to around 20% in 2005 (see green line in figure 7 below).

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<sup>21</sup> The general CPI weights are 20,9% to the “general grocery” overall category, exceeding by large the 1,2% and 1,7% attributed to “household cleaning” and “personal hygiene” respectively.

**Figure 7**  
**Comparison between LRGs' selling price indexes and the corresponding CPIs**  
**in the Portuguese inland (Basis: 1998 = 1)**



*Legend:* “General grocery” regroups the food products of the categories grocery, drinks, and milk food. The “general CPI” stands for the overall macroeconomic CPI, based upon which inflation is measured.

The same picture characterizes the evolution across regions, though to a lower extent in Porto (see figures A5.1, A5.2, and A5.3 as well as table A5.1 in appendix 5). Whilst the evolution in Lisbon clearly highlight these results, the “household cleaning” LRGs’ prices in Porto show a lower increase rate than the respective CPI only from 2003 onwards, a period which coincides with the removal of the legal barriers to the growth of LRGs. The removal of these barriers, in March 2004, seem, in turn, to have, mostly, contributed to a relative stability of the “household cleaning” and “personal hygiene” LRGs’ prices, with a further possible effect on the sustained decline of the general grocery prices.

Summing up, as these findings may be the by-product of the LRGs’ buyer power, *i.e.* of these groups benefiting from better acquisition price conditions than other retailers, they suggest as well that LRGs pass-through to final consumers the acquisition price reductions they obtain from suppliers. In other words, these results do not infrim the empirical findings on buyer power (section 3) and pass-through (section 4).

## 6. Concluding comments

During the last two decades, LRGs have become strongly dominant in the Portuguese food retailing sector. This development raises two major issues: first, whether it has led to a rent shift from suppliers to LRGs and second, whether there has been pass-through to final consumers with LRGs contributing to improve consumer welfare.

The existing literature is rather inconclusive on these issues and, notably, on the impact buyer power has on suppliers, with most of the studies focusing on the downstream side of the problem. Two major exceptions to this literature are Gohin and Guyomard (2000) and Barros *et al.* (2006). Though priors tend to label LRGs as beneficial for consumers and prejudicial for suppliers, Gohin and Guyomard argue, mostly on theoretical grounds, that buyer power depends on the balance between the oligopsony and the oligopolistic powers of LRGs and suppliers respectively. In particular, buyer power tends to be small in strongly concentrated supplying markets despite the dimension of LRGs.

Barros *et al.* (2006) propose a more general econometric analysis of buyer power and pass-through in the Portuguese food retailing sector. They find that LRGs use their buyer power to lower acquisition prices though, in opposition with pass-through, their selling prices tend to increase. Their analysis departs, however, from distinct samples on selling and purchasing prices, with the latter being confined to 11 suppliers only and from the possibly biasing assumption that the downstream market concentration of LRGs increase their nation-wide buyer power. Whilst the small sample on purchasing prices is likely to bias the findings on buyer power, the mismatch between the selling and the purchasing price samples raises doubt on their conclusions on pass-through.

In this paper, we tackle the same issues as Barros *et al.*, but solve for the latter caveats by considering a very large panel of harmonized data on purchases and sales specific to LRGs and disaggregated at the product, brand, and supplier levels. The data consists in quantities and prices, with the latter being net of taxes and of all discounts LRGs / consumers obtain

from suppliers / LRGs respectively. We tackle the twofold issue. First, the way the LRGs' buyer power, triggered by purchasing pooling and vertical integrations agreements, contributes to lowering acquisition prices and second, whether these price reductions are passed-through to final consumers. Estimation is performed on the basis of the Arellano and Bond (1991) instrumental variables panel-based econometric approach.

Our findings suggest that lower purchasing prices are not necessarily associated with higher purchasing shares, but tend mostly to benefit vertically integrated retailers and groups with a large international position. Results provide further evidence on pass-through as LRGs tend to change their selling prices proportionally to the changes they obtain in acquisition prices. In parallel, a descriptive analysis of selling price data on LRGs, relative to the larger time period 1998-2005, suggests further that LRGs tend to increase their selling prices at a lower rate than national trade including other retailers such as traditional small businesses. Whilst this finding may be the by-product of buyer power, *i.e.* of the fact that LRGs benefit from better acquisition price conditions than other retailers, they reinforce as well the empirical result that LRGs pass-through to consumers the acquisition price reductions they obtain from suppliers.

Moreover, a descriptive analysis of the market structure, over the period 2002-2005, corroborates the tendency for the empirical finding on a unit pass-through effect. *De facto*, this analysis reveals a decreasing concentration of LRGs over the two market sides: both upstream as customers to suppliers and downstream as retail sellers to final consumers. Whilst this decreasing degree of concentration should trigger the competition among LRGs, this latter should promote smoother relations between these groups and their suppliers (or reduce the buyer power of LRGs) and sustain the degree of pass-through from LRGs to final consumers.

This paper's findings on pass-through and a decreasing degree of market concentration may suggest no need for intervention of the Portuguese Competition Authority (PCA) in this sector. Notwithstanding, this paper draws a general picture of the overall food sector rather than focusing on specific food product markets which may deserve attention from a regulatory perspective. In particular, the PCA can intervene to prevent purchasing pooling and/or vertical

integration agreements put forward by LRGs, together with other retailers or grocery stores, which may imply a too strong concentration in specific product markets. Moreover, in addition to the EC Competition Law, the Portuguese competition legislation prohibits situations of “abuse of the state of economic dependency” (see article N° 7 of the national competition law) which are well framed within the vertical relations between large buyers, such as LRGs, and suppliers. Yet, such product specific cases can only be disentangled through a casuistic analysis to the supplier and product levels, more refined than the one performed in this paper and closer to the Gohin and Guyomard (2000) contribution.

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## Appendix

### Appendix 1: Structure of the supplying market

The major customers of the supplying market referred by Centromarca (see subsection 2.2 in the text) are the following:

- (i) Nation-wide (major) LRGs: Jerónimo Martins (with the retailers Pingo Doce and Feira Nova), Sonae's Modelo-Continente, Les Mosquetaires or ITMI (Intermarché and Ecomarché), Auchan (Pão de Açúcar and Jumbo), Carrefour (including its discount-type network Dia%/Minipreço), Leclerc, Lidl, Tengelmann, and El Corte Inglés;
- (ii) Large grocery stores, including the networks Recheio (group JM), GCT, and Makro together with cooperatives of SME
- (iii) Other channels which conglomerate channels other than retailers and grocery stores, such as the Hotels, Restaurants, and Cafés' (HORECA), and smaller dimension customers, such as the traditional trade and regional retailers (v.g. the shop networks Alisuper in Algarve and A. C. Santos in the district of Lisbon)

Given the data availability problems on the quantification of the LRGs' two-sided market (see subsection 2.2 in the text), the estimation of the upstream and the downstream sides of the market is done as described hereafter.

#### A1.1 Estimating the upstream side of the market

To evaluate this market we consider the following data:

- (i) The year 2002 shares of all the Centromarca's major customers in the total purchases to this universe, as referred by this association, overall and discriminated across product categories; and
- (ii) The total purchases of all the major LRGs *supra* together with the grocery stores Recheio, GCT, and Makro, overall and discriminated across product categories, over the period 2002-2005.

Given this data, we extrapolate the remaining of the market, namely the total purchases of “large grocery cooperatives” and “other channels”, over the period 2002-2005 in the following way. Considering a given year and a given product category, the total purchases of these two groups of customers are extrapolated from the total purchases of what we call a “reference group of customers” weighted by the ratio of purchasing shares, what we refer to as “basis shares”, between the unobserved group of customers and the cumulative purchasing share of the reference group. In other words, extrapolation consists of the following:

- (i) Considering a given product category and, first, the Centromarca’s 2002 purchasing shares, disaggregated at the product category and customer levels, as the “basis shares”, the 2002 purchases of the “large grocery cooperatives”, over that product category, is extrapolated from the cumulative total purchases of the major grocery stores (Recheio, Makro, and GCT) over that category weighted by the ratio of “basis shares” over the same category between the cumulative of the “large grocery cooperatives” and the cumulative of the three major grocery stores (Recheio, Makro, and GCT). Purchasing data for this channel and for the remaining years, 2003, 2004, and 2005, is extrapolated in the same way, but considering as “basis shares” the shares which have been estimated for the previous year.
- (ii) The total purchases of “other channels” over each product category is estimated in the same manner, but considering as the “reference group” the cumulative of all the major LRGs together with all the major wholesalers (*i.e.* the cumulative of the large grocery stores and the large grocery cooperatives)

## A1.2 Estimating the downstream retail market

The estimation of this market’s value is built from recent publications with data on the sales of the afore referred major LRGs available up to 2004, but excluding the groups Tengelmann and El Corte Inglés.<sup>22</sup> Whilst the total sales of these latter two groups are inferred from those

<sup>22</sup> Vide Activity Report of APED, 2004, available at <http://www.aped.pt/>, the publication *Distribuição Hoje*, 2005, and Fonseca (2005), with all these publications being available in the Portuguese language only.

of Lidl by keeping the same differential between them as for purchases, the data on all LRGs for the year 2005 is inferred from that of 2004 by keeping the same growth rate, between 2004 and 2005, as the data on purchases. Analogously, we infer the total sales of the channel “other retailers” by setting their share to the purchasing market share of “other channels” (see table 1 in the text) weighted by what the major LRGs’ purchases represent on the overall purchases of these groups together with the major grocery stores.

## Appendix 2: Description of the data used in the econometric analysis

Following from recent consumer surveys, including the one of the Portuguese Directorate-General of Enterprises, we consider 75 food products divided according to 10 product categories as listed in table A2 below.

**Table A2**  
**List of products considered in the econometric analysis**

<p><b>C1. Oil and related</b></p> <p>1. Azeite 0,7 graus</p> <p>2. Azeite 1,5 graus</p> <p>3. Margarina de mesa</p> <p>4. Margarina vegetal</p> <p>5. Óleo alimentar</p> <p>6. Vinagre vinho branco</p>	<p><b>C5. Dry grocery</b></p> <p>25. Açúcar branco</p> <p>26. Arroz longo Agulha</p> <p>27. Arroz longo Carolino</p> <p>28. Bolacha Maria</p> <p>29. Cereais Corn Flakes</p> <p>30. Esparguete</p> <p>31. Farinha trigo 55</p> <p>32. Farinha láctea</p> <p>33. Flocos cereais c/mel</p> <p>34. Sal cozinha grosso</p> <p>35. Sal mesa fino</p>	<p><b>C8. Charcuterie</b></p> <p>49. Chouriço de carne</p> <p>50. Chouriço de carne extra</p> <p>51. Fiambre da perna</p> <p>52. Mortadela, embalagem</p> <p>53. Salsichas Frankfurt</p>
<p><b>C2. Drinks</b></p> <p>7. Água s/gás nascente</p> <p>8. Água s/gás mineral</p> <p>9. Cerveja branca nacional</p> <p>10. Refriger. laranja c/gás</p> <p>11. Refriger. laranja s/gás</p> <p>12. Vinho tinto 2-3 euros</p> <p>13. Vinho tinto 4-5 euros</p>	<p><b>C6. Dry vegetables</b></p> <p>36. Ervilha cozida enlatada</p> <p>37. Ervilha ultracongelada</p> <p>38. Feijão branco cozido</p> <p>39. Feijão branco seco</p> <p>40. Feijão catarino seco</p>	<p><b>C9. Personal hygiene</b></p> <p>54. Amaciador cabelo</p> <p>55. Champô cabelo normal</p> <p>56. Creme barbear</p> <p>57. Dentifricio flúor</p> <p>58. Espuma barbear</p> <p>59. Pensos higiénicos</p> <p>60. Sabonete</p>
<p><b>C3. Coffees &amp; chocolates</b></p> <p>14. Café solúvel cafeína</p> <p>15. Café torrado moído</p>		<p><b>C10. Household cleaning</b></p> <p>61. Abrilhantador loiça</p> <p>62. Amaciador roupa</p> <p>63. Detergente lavagem manual roupa</p>

16. Chocolate solúvel	41. Grão bico cozido	64. Detergente concentrado
17. Mistura solúvel c/café	42. Grão bico seco	Lavagem manual loiça
<b>C4. Milk food</b>	43. Jardineira ultracongel.	65. Deter. pó lavagem Loiça
18. Iogurte morango	<b>C7. Dry and frozen fish</b>	66. Deter. pó máquina loiça
19. Iogurte natural	44. Bacalhau corrente	67. Deter. pó máquina roupa
20. Leite UHT meio gordo	45. Bacalhau crescido	68. Gel sanitário
21. Manteiga c/sal	46. Conserva atum	69. Guardanapos papel folha dupla
22. Queijo curado prato	47. Pescada cong. Tipo 3	70. Guardanapos papel f. simples
23. Queijo flamengo bola	48. Pescada cong. Tipo 5	71. Lenços papel bolso
24. Queijo regional saloio		72. Lixívia tradicional
		73. Papel higiénico branco fl. Dupla
		74. Papel higiénico branco super
		75. Sabão roupa em barra

The data collected from the 5 LRGs, used in the econometric analysis (see sections 3 and 4 in the text) consists, in turn, in the following information:<sup>23</sup>

- (i) The 3 brands of each product, apart from one we specify, the most sold by the group or, in case the product has no brand, the 3 major suppliers of the product;
- (ii) The package / weight of each referred item (product x brand);
- (iii) The list of the main suppliers of each one of the referred items;
- (iv) Total purchases, in units and euros, of each item together with the total purchases, in euros, to each one of the referred suppliers;
- (v) Total sales, in units and euros, of each item referred by the group;
- (vi) Annual frequency of purchases to each supplier;

The original data, in monthly frequency, ranged from January 2000 to December 2003. Yet, the presence of missing and outlying values in the original series forced the following data preliminary treatment: first, we exclude, from the original data, series observed over less than two years and solve for missing observations in the remaining data by cumulating

<sup>23</sup> The original data includes 16 fresh products in addition to the 75 listed above. The analysis of this data is, however, postponed for further research given its poor reliability due to the presence of too many missing values.

observations in a quarterly frequency. Remaining missing and outlying values in the quarterly data are adjusted through simple interpolation between the two nearest adjacent observations.

Though, as suggested by Luís Cabral, we might consider an approach allowing for monthly observations with missing values, this alternative presents the twofold *caveat* of being likely to bring additional noise and spurious volatility to estimates as, in particular, purchases have, in general, a lower frequency than the monthly. Moreover, though simple interpolation is likely to induce spurious endogeneity in the data, this effect is not expected to be high as a small number of observations was subjected to such a treatment.

### **Appendix 3: Regression results on buyer power**

Table A3 below reports the detailed regression results on buyer power (see subsection 3.2 in the text). Values marked in bold are statistically equal to zero at the 95% probability level. Entries marked with a '--' indicate the categories for which there was not enough data for estimation. Finally, 'nob' refers to the total number of observations per regression, 'p-value' is the probability value of the regression and "R<sup>2</sup>" refers to its adjusted R<sup>2</sup>-statistic.

**Table A3**  
**Regression results on buyer power**  
**Tables A3, Panel A: Regression results over the entire panel and the first 2 categories**

		Total		C1. Oil and related		C2. Drinks	
		Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
RHS	s	-0,969	-43,91	-1,812	-21,98	-0,722	-7,42
LRGs	LRG 1	0,324	3,95	<b>-0,161</b>	<b>-0,52</b>	0,658	3,33
	LRG 2	-1,457	-12,73	-1,015	-2,73	-5,804	-14,40
	LRG 3	1,748	23,77	1,414	5,21	1,076	6,05
	LRG 4	1,613	23,15	3,362	11,06	1,271	6,65
	LRG 5	0,698	3,84	--	--	--	--
Vertical agreement		-1,367	-9,16	--	--	--	--
Intercept		5,822	8,75	11,844	12,13	7,221	5,43
N.º obs.		10439		780		1079	
p-value		0,000		0,000		0,000	
R2		0,508		0,738		0,774	
Categories	1. Óleos e margarinas	1,054	6,28				
	2. Bebidas	<b>0,015</b>	<b>0,02</b>				
	3. Cafés e chocolates	<b>-0,114</b>	<b>-0,24</b>				
	4. Lactínios	1,985	4,25				
	5. Mercearia seca	<b>0,327</b>	<b>0,86</b>				
	6. Legumes secos e congelados	-3,437	-6,78				
	7. Peixe seco e congelado	<b>-0,476</b>	<b>-0,83</b>				
	8. Charcutaria	<b>0,785</b>	<b>1,13</b>				
	9. Higiene pessoal	-0,237	-2,10				
Cat. 1	1. Azeite 0,7 graus						
	2. Azeite 1,5 graus			-0,959	-2,46		
	3. Margarina mesa			-0,802	-3,70		
	4. Margarina vegetal			-1,337	-5,24		
	5. Óleo alimentar			3,565	11,08		
	6. Vinagre vinho branco			-1,595	-3,05		
Cat. 2	1. Água s/gás nascente						
	2. Água s/gás mineral					0,965	4,39
	3. Cerveja branca nacional					1,375	6,15
	4. Refrigerante laranja c/gás					1,030	4,58
	5. Refrigerante laranja s/gás					<b>-0,253</b>	<b>-0,81</b>
	6. Vinho tinto 2-3 euros					-2,263	-3,32
	7. Vinho tinto 4-5 euros					-1,955	-2,99

**Table A3, Panel B: Regression results over categories 3 to 5**

		C3. Coffee & chocolate drinks		C4. Milk food		C5. Dry grocery	
		Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
RHS	s	-1,193	-16,58	-0,783	-8,19	-1,817	-18,54
LRGs	LRG 1	<b>-0,688</b>	<b>-1,90</b>	1,064	10,29	<b>0,374</b>	<b>1,62</b>
	LRG 2	<b>0,188</b>	<b>0,51</b>	-0,656	-3,16	0,734	2,79
	LRG 3	2,805	10,94	2,214	11,41	2,997	15,59
	LRG 4	1,108	5,12	0,934	7,90	2,896	12,48
	LRG 5	--	--	--	--	--	--
Vertical agreement		--	--	--	--	--	--
Intercept		11,779	10,27	2,232	1,82	18,338	15,59
N.º obs.		702		1144		1573	
p-value		0,000		0,000		0,000	
R2		0,654		0,588		0,581	
Cat. 3	1. Café solúvel cafeína						
	2. Café torrado moído	-2,991	-7,54				
	3. Chocolate solúvel	<b>0,049</b>	<b>0,13</b>				
	4. Mistura solúvel c/café	0,797	3,44				
Cat. 4	1. Iogurte morango						
	2. Iogurte natural			-0,966	-5,16		
	3. Leite UHT meio gordo			2,578	5,71		
	4. Manteiga pasteurizada c/sal			2,330	9,64		
	5. Queijo curado prato			6,424	12,46		
	6. Queijo flamengo bola			1,726	5,85		
	7. Queijo regional saloio			4,936	8,70		
Cat. 5	1. Açúcar branco granulado						
	2. Arroz agulha					-2,683	-2,73
	3. Arroz carolino					-3,629	-3,89
	4. Bolachas Maria					-5,174	-3,35
	5. Cereais Corn Flakes					-7,788	-6,12
	6. Esparguete					-4,378	-3,98
	7. Farinha trigo 55					-6,908	-5,48
	8. Farinha láctea					<b>0,472</b>	<b>1,37</b>
	9. Flocos cereais c/mel					--	--
	10. Sal cozinha grosso					4,295	9,05
	11. Sal mesa fino					--	--

**Table A3, Panel C: Regression results over categories 6 to 8**

		C6. Dry & frozen vegetables		C7. Dry & frozen fish		C8. Charcuterie	
		Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
RHS	s	-1,570	-18,13	-0,801	-14,40	<b>0,047</b>	<b>1,06</b>
LRGs	LRG 1	2,719	8,34	0,888	3,58	<b>0,089</b>	<b>0,52</b>
	LRG 2	1,425	3,14	-1,986	-2,71	-1,653	-6,31
	LRG 3	3,092	9,73	3,196	5,34	--	--
	LRG 4	5,017	16,20	0,674	2,86	-0,282	-2,48
	LRG 5	--	--	--	--	--	--
Vertical agreement		--	--	--	--	--	--
Intercept		15,453	11,24	0,123	0,12	-1,199	-2,13
N.º obs.		858		481		520	
p-value		0,000		0,000		0,000	
R2		0,564		0,805		0,691	
Cat. 6	1. Ervilha cozida enlatada						
	2. Ervilha ultracongelada	<b>-1,321</b>	<b>-1,45</b>				
	3. Feijão branco cozido enlatado	3,060	7,18				
	4. Feijão branco seco	3,409	5,32				
	5. Feijão catarino seco	3,889	5,18				
	6. Grão bico cozido enlatado	2,977	6,58				
	7. Grão bico seco	5,992	9,62				
	8. Jardineira ultracongelada	<b>-1,567</b>	<b>-1,67</b>				
Cat. 7	1. Bacalhau corrente						
	2. Bacalhau crescido			<b>0,286</b>	<b>1,03</b>		
	3. Conserva atum			6,729	8,02		
	4. Pescada congelada tipo 3			--	--		
	5. Pescada congelada tipo 5			-0,530	-1,99		
Cat. 8	1. Chouriço carne					-2,154	-7,66
	2. Chouriço carne extra					<b>-0,175</b>	<b>-0,79</b>
	3. Fiambre da perna					-0,850	-4,13
	4. Mortadela, embalagem					-4,101	-12,98
	5. Salsichas Frankfurt						

**Table A3, Panel D: Regression results over the last two categories**

		C9. Personal hygiene		C10. Household cleaning	
		Coef.	t-stat	Coef.	t-stat
RHS	s	-1,123	-8,83	-1,116	-21,16
LRGs	LRG 1	<b>0,148</b>	<b>0,97</b>	<b>0,133</b>	<b>0,84</b>
	LRG 2	-1,930	-6,44	-0,649	-2,88
	LRG 3	0,386	2,17	1,279	7,24
	LRG 4	1,274	6,53	1,148	6,68
	LRG 5	--	--	<b>-0,277</b>	<b>-1,36</b>
Vertical agreement		<b>-0,400</b>	<b>-1,35</b>	-0,742	-3,43
Intercept		9,040	6,79	7,643	15,06
N.º obs.		1365		1937	
p-value		0,000		0,000	
R2		0,577		0,534	
Cat. 9	1. Amaciador Cabelo normal				
	2. Champô cabelo normal	0,484	2,90		
	3. Creme barbear	-0,940	-3,87		
	4. Dentrífico flúor	1,681	5,05		
	5. Espuma barbear	<b>-0,399</b>	<b>-1,26</b>		
	6. Pensos higiénicos	--	--		
	7. Sabonete	0,901	4,69		
Cat. 10	1. Abrilhantador loiça				
	2. Amaciador roupa			1,186	5,57
	3. Detergente lavagem manual loiça			1,876	6,50
	4. Detergente concentrado lavagem manual loiça			1,083	4,31
	5. Detergente pó lavagem manual roupa			<b>-0,445</b>	<b>-1,54</b>
	6. Detergente pó máquina loiça			-0,426	-2,83
	7. Detergente pó máquina roupa			2,941	8,31
	8. Gel sanitário			-1,581	-3,85
	9. Guardanapos papel folha dupla			3,939	6,08
	10. Guardanapos papel folha simples			4,907	9,72
	11. Lenços papel bolso brancos			4,729	7,25
	12. Lixívia tradicional			1,339	5,23
	13. Papel higiénico branco folha dupla			6,554	10,05
	14. Papel higiénico branco super			4,560	6,64
	15. Sabão roupa em barra			2,373	6,60

## Appendix 4: Regression results on pass-through

Table A4 hereafter reports the regression results on pass-through (see subsection 4.2 in the text). The legend is similar to that of table A3 in appendix 3 above.

Tables A4, Panel A: Regression results over the entire panel and the first 2 categories

		Total		C1. Oil and related		C2. Drinks	
		Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Elasticities <i>psi-coeff.</i>	LRG 1	<b>-0,040</b>	<b>-2,39</b>	<b>-0,116</b>	<b>-2,63</b>	0,010	0,12
	LRG 2	<b>-0,022</b>	<b>-2,05</b>	<b>-0,058</b>	<b>-1,96</b>	-0,023	-1,22
	LRG 3	0,005	0,13	<b>-0,150</b>	<b>-3,07</b>	-0,005	-0,18
	LRG 4	0,028	1,96	0,030	0,32	0,085	0,83
	LRG 5	0,079	1,47	0,139	1,190	0,103	1,340
Shares	LRGs	0,019	0,15	-0,287	-0,810	0,094	0,260
	Suppliers	<b>-0,342</b>	<b>-4,65</b>	-0,392	-1,600	0,331	1,370
Fixed effects	LRG 1	-1,195	-19,60	-0,751	-2,84	-1,008	-6,14
	LRG 2	-0,279	-3,75	0,111	0,39	<b>1,085</b>	<b>4,40</b>
	LRG 3	-1,601	-28,64	-1,922	-9,13	-1,288	-8,20
	LRG 4	-1,370	-24,31	-1,995	-9,43	-0,795	-4,82
	LRG 5	-1,425	-11,87	--	--	--	--
Constante		2,130	14,34	2,535	6,90	1,349	4,30
nob		10423		780		1078	
p-value		0,000		0,000		0,000	
R2		0,237		0,388		0,330	
Wald test	Stat	1,32		5,07		1,72	
	p-value	0,2513		0,0246		0,1905	
Categories	1. Óleos e margarinas	0,278	2,83				
	2. Bebidas	-1,446	-8,21				
	3. Cafés e chocolates	<b>0,595</b>	<b>1,49</b>				
	4. Lacticínios	<b>-0,017</b>	<b>-0,04</b>				
	5. Mercearia seca	<b>0,560</b>	<b>1,57</b>				
	6. Legumes secos e congelados	1,079	2,75				
	7. Peixe seco e congelado	-1,012	-2,16				
	8. Charcutaria	-0,859	-5,09				
	9. Higiene pessoal	<b>-0,027</b>	<b>-0,38</b>				
Cat. 1	1. Azeite 0,7 graus						
	2. Azeite 1,5 graus			0,594	2,47		
	3. Margarina mesa			0,369	2,43		
	4. Margarina vegetal			<b>-0,010</b>	<b>-0,05</b>		
	5. Óleo alimentar			<b>0,020</b>	<b>0,11</b>		
	6. Vinagre vinho branco			<b>0,086</b>	<b>0,32</b>		
Cat. 2	1. Água s/gás nascente						
	2. Água s/gás mineral					<b>-0,202</b>	<b>-1,07</b>
	3. Cerveja branca nacional					0,376	2,19
	4. Refrigerante laranja c/gás					<b>0,193</b>	<b>1,10</b>
	5. Refrigerante laranja s/gás					<b>-0,003</b>	<b>-0,01</b>
	6. Vinho tinto 2-3 euros					<b>0,274</b>	<b>0,82</b>
	7. Vinho tinto 4-5 euros					<b>0,230</b>	<b>0,93</b>

**Tables A4, Panel B: Regression results over categories 3 to 5**

		C3. Coffee & chocolate drinks		C4. Milk food		C5. Dry grocery	
		Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Elasticities	LRG 1	0,033	1,09	-0,040	-1,01	-0,051	-1,80
<i>psi-coeff.</i>	LRG 2	0,040	1,17	-0,067	-1,80	<b>-0,072</b>	<b>-2,41</b>
	LRG 3	0,032	0,47	0,062	0,79	-0,064	-1,69
	LRG 4	-0,002	-0,06	0,041	0,97	-0,021	-0,46
	LRG 5	-0,021	-0,170	<b>-0,115</b>	<b>-1,97</b>	0,097	1,70
Shares	LRGs	-0,431	-0,800	0,090	0,30	-0,420	-1,44
	Suppliers	0,082	0,260	-1,073	-6,64	0,216	1,12
Fixed effects	LRG 1	-0,479	-1,76	-1,067	-10,89	-1,046	-6,84
	LRG 2	<b>-1,224</b>	<b>-4,27</b>	-0,626	-4,69	<b>-0,763</b>	<b>-4,54</b>
	LRG 3	-2,243	-9,54	-1,880	-6,63	-1,922	-17,20
	LRG 4	-1,531	-8,31	-0,661	-5,72	-1,839	-16,42
	LRG 5	--	--	--	--	--	--
Constante		4,429	6,31	4,889	10,60	1,272	5,26
nob			702		1144		1571
p-value			0,000		0,000		0,000
R2			0,437		0,372		0,348
Wald test	Stat		0,15		2,82		5,58
	p-value		0,7035		0,0933		0,0183
Cat. 3	1. Café solúvel cafeína						
	2. Café torrado moído	1,729	5,10				
	3. Chocolate solúvel	-0,408	-2,06				
	4. Mistura solúvel c/café	<b>-0,233</b>	<b>-1,43</b>				
Cat. 4	1. Iogurte morango						
	2. Iogurte natural			<b>0,262</b>	<b>1,51</b>		
	3. Leite UHT meio gordo			-1,487	-5,80		
	4. Manteiga pasteurizada c/sal			-0,849	-3,42		
	5. Queijo curado prato			-3,026	-8,46		
	6. Queijo flamengo bola			-0,844	-2,91		
	7. Queijo regional saloio			-3,455	-8,76		
Cat. 5	1. Açúcar branco granulado					<b>-1,095</b>	<b>-1,48</b>
	2. Arroz agulha					<b>-0,762</b>	<b>-1,01</b>
	3. Arroz carolino					<b>0,026</b>	<b>0,12</b>
	4. Bolachas Maria					<b>-0,097</b>	<b>-0,13</b>
	5. Cereais Corn Flakes					-1,699	-2,41
	6. Esparguete					<b>-0,679</b>	<b>-0,89</b>
	7. Farinha trigo 55					0,885	4,50
	8. Farinha láctea					--	--
	9. Flocos cereais c/mel					1,074	4,98
	10. Sal cozinha grosso					1,054	5,14
	11. Sal mesa fino						

**Tables A4, Panel C: Regression results over categories 6 to 8**

		C6. Dry & frozen vegetables		C7. Dry & frozen fish		C8. Charcuterie	
		Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Elasticities	LRG 1	-0,082	-1,51	-0,064	-1,58	-0,071	-0,99
<i>psi-coeff.</i>	LRG 2	-0,007	-0,20	0,007	0,28	-0,071	-0,71
	LRG 3	0,011	0,07	<b>-0,111</b>	<b>-2,63</b>	-0,046	-0,62
	LRG 4	-0,210	-0,93	0,111	1,67	0,068	1,22
	LRG 5	0,050	0,67	0,044	0,89	-0,015	-0,24
Shares	LRGs	0,238	0,43	0,352	0,85	-0,054	-0,12
	Suppliers	-1,701	-5,23	0,102	0,47	-0,176	-0,89
Fixed effects	LRG 1	-3,130	-13,11	-1,001	-5,94	-0,659	-3,63
	LRG 2	-1,450	-5,13	<b>0,938</b>	<b>3,03</b>	0,686	2,99
	LRG 3	-3,101	-15,72	-0,898	-3,42	--	--
	LRG 4	-3,339	-15,00	-0,503	-2,78	-0,071	-0,59
	LRG 5	--	--	--	--	--	--
Constante		-0,284	-0,53	1,283	2,16	3,036	6,60
nob		858		477		516	
p-value		0,000		0,000		0,000	
R2		0,416		0,495		0,310	
Wald test	Stat	0,06		5,15		0,26	
	p-value	0,8073		0,0238		0,6122	
Cat. 6	1. Ervilha cozida enlatada						
	2. Ervilha ultracongelada	1,093	2,43				
	3. Feijão branco cozido enlatado	<b>0,407</b>	<b>1,73</b>				
	4. Feijão branco seco	-0,878	-2,77				
	5. Feijão catarino seco	<b>-0,453</b>	<b>-1,27</b>				
	6. Grão bico cozido enlatado	1,183	3,67				
	7. Grão bico seco	-1,511	-4,85				
	8. Jardineira ultracongelada	<b>-0,245</b>	<b>-0,53</b>				
Cat. 7	1. Bacalhau corrente						
	2. Bacalhau crescido			<b>0,086</b>	<b>0,71</b>		
	3. Conserva atum			-1,307	-2,47		
	4. Pescada congelada tipo 3			--	--		
	5. Pescada congelada tipo 5			<b>0,281</b>	<b>1,43</b>		
Cat. 8	1. Chouriço carne						
	2. Chouriço carne extra					0,894	3,10
	3. Fiambre da perna					-0,405	-1,90
	4. Mortadela, embalagem					-0,962	-4,29
	5. Salsichas Frankfurt					-1,229	-5,26

**Tables A4, Panel D: Regression results over the last two categories**

		C9. Personal hygiene		C10. Household cleaning	
		Coef.	t-stat	Coef.	t-stat
Elasticities <i>psi-coeff.</i>	LRG 1	-0,033	-0,50	0,017	0,38
	LRG 2	-0,041	-1,38	0,026	0,86
	LRG 3	0,028	1,25	0,014	0,68
	LRG 4	0,057	2,73	0,015	0,73
	LRG 5	0,014	0,25	0,200	1,32
Shares	LRGs	0,263	0,98	0,060	0,26
	Suppliers	0,123	0,71	0,039	0,19
Fixed effects	LRG 1	-0,788	-6,29	-1,205	-8,20
	LRG 2	<b>0,437</b>	<b>2,39</b>	-0,653	-3,67
	LRG 3	-0,854	-8,70	-1,225	-8,04
	LRG 4	-1,150	-10,24	-1,348	-8,26
	LRG 5	--	--	<b>-1,419</b>	<b>-8,98</b>
Constante		1,972	8,36	1,048	3,66
nob		1362		1935	
p-value		0,000		0,000	
R2		0,325		0,242	
Wald test	Stat	0,06		1,50	
	p-value	0,8029		0,2213	
Cat. 9	1. Amaciador Cabelo normal				
	2. Champô cabelo normal	-0,416	-3,81		
	3. Creme barbear	0,415	2,62		
	4. Dentrífico flúor	-0,595	-4,47		
	5. Espuma barbear	<b>-0,213</b>	<b>-1,15</b>		
	6. Pensos higiénicos	<b>-0,147</b>	<b>-0,87</b>		
	7. Sabonete	-0,381	-3,54		
Cat. 10	1. Abrilhantador loiça				
	2. Amaciador roupa			0,349	3,22
	3. Detergente lavagem manual loiça			<b>-0,123</b>	<b>-0,72</b>
	4. Detergente concentrado lavagem manual loiça			<b>-0,155</b>	<b>-0,93</b>
	5. Detergente pó lavagem manual roupa			1,598	6,68
	6. Detergente pó máquina loiça			0,444	3,63
	7. Detergente pó máquina roupa			<b>0,059</b>	<b>0,31</b>
	8. Gel sanitário			0,756	3,33
	9. Guardanapos papel folha dupla			<b>-0,412</b>	<b>-1,21</b>
	10. Guardanapos papel folha simples			0,441	1,83
	11. Lenços papel bolso brancos			<b>-0,055</b>	<b>-0,16</b>
	12. Lixívia tradicional			<b>-0,040</b>	<b>-0,24</b>
	13. Papel higiénico branco folha dupla			<b>-0,106</b>	<b>-0,32</b>
	14. Papel higiénico branco super			<b>0,043</b>	<b>0,11</b>
	15. Sabão roupa em barra			0,794	3,38

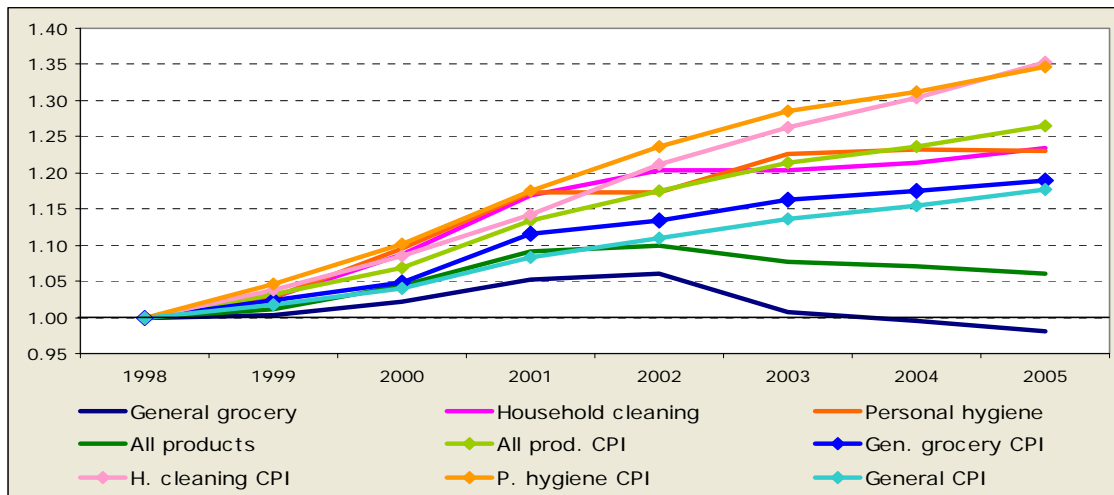
## Appendix 5

The data on the selling prices of LRGs (see section 5 in the text), consists of the following:

- (i) For each product and a given selling unit (super and hypermarkets), the gross-of-taxes selling price to final consumers, observed at a given day of July over the eight years of the period 1998-2005;
- (ii) A total of 205 food items, identified by brand and package, covering the three food categories of “general grocery” (which regroups the grocery, drinks, and milk food products, for a total of 108 items), the “household cleaning” (55 items), and the “personal hygiene” (42 items).
- (iii) The data covers six LRGs, which account for about 55% of the total purchases to the supplying market and for about 66% of the total sales in the downstream retailing activity, and a total of 37 selling units over these six LRGs, discriminated according to their dimension, 16 supermarkets and 21 hypermarkets, and their location in three areas: the two major cities, Lisbon and Porto, and the aggregate of eight other large cities (Braga, Viseu, Aveiro, Coimbra, Leiria, Setúbal, Évora, and Faro).
- (iv) The regional weights to the nation-wide price index are computed on the basis of the 2002 resident population in each one of these districts, for a total of 2,136,013 in Lisbon, 1,781,836 in Porto, and 4,198,097 in the aggregate of the remaining districts.

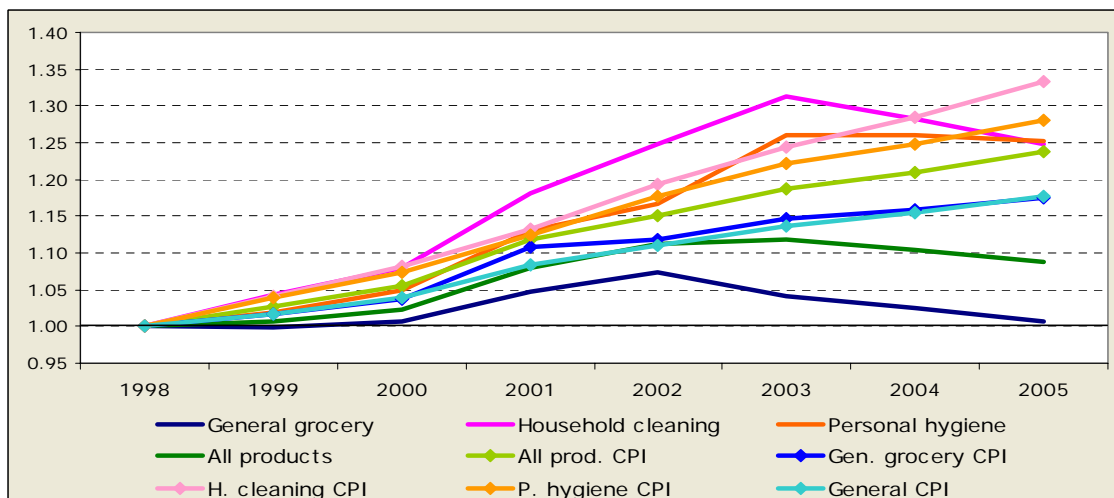
In addition to the nation-wide results in the text (see section 5 and figure 7), figures A5.1, A5.2, and A5.3 below compare the LRGs’ selling price indexes with the corresponding CPIs, across the different product categories, in the districts of Lisbon (figure A5.1), Porto (figure A5.2), and in the aggregate of the remaining eight districts (figure A5.3). They highlight the consistency of the regional results with the nation-wide, with the major exception of the “household cleaning” LRGs’ prices in Porto which show a tendency to grow below the respective CPI only from 2003 onwards, with such a timing coinciding with the removal of the legal barriers to the LRGs’ growth, approved in March 2004 (see section 5).

**Figure A5.1**  
**Comparison between LRGs' selling price indexes and the corresponding CPIs**  
**in the district of Lisbon (Basis: 1998 = 1)**

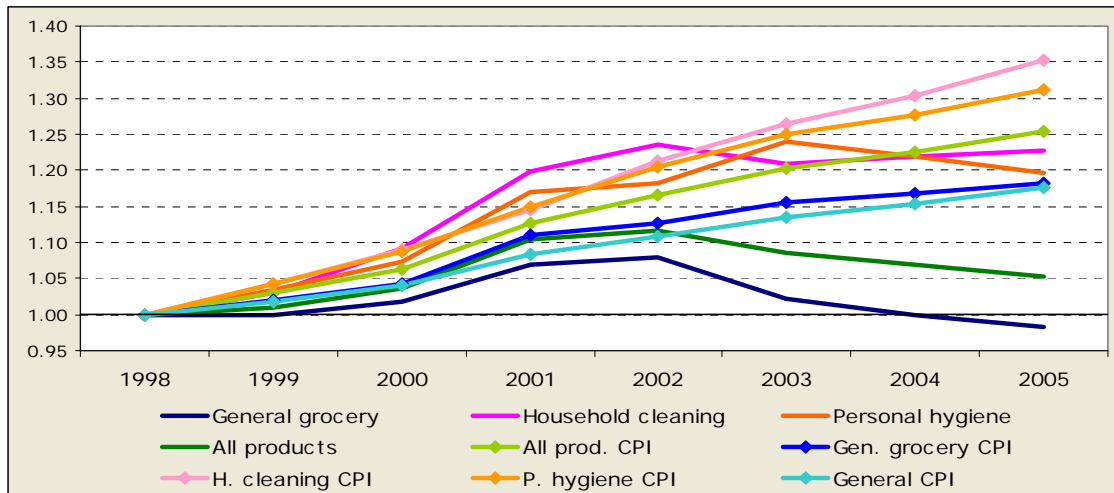


*Legend:* “General grocery” regroups the food products of the categories grocery, drinks, and milk food. The “general CPI” stands for the overall macroeconomic CPI, based upon which inflation is measured.

**Figure A5.2**  
**Comparison between LRGs' selling price indexes and the corresponding CPIs**  
**in the district of Porto (Basis: 1998 = 1)**



**Figure A5.3**  
**Comparison between LRGs' selling price indexes and the corresponding CPIs**  
**in the remaining regions (Basis: 1998 = 1)**



The results from these figures (see also section 5 and figure 7 in the text) are summarized in table 4 below. This table compares, across regions and product categories, the average and the cumulative changes in the LRGs' selling prices with the respective CPIs over the period 1999-2005. It reveals, first, that, over all regions and product categories, LRGs change their prices at a lower rate than the respective CPIs, both on average over the period 1999-2005 and when compared the 2005 price level with the 1998's. In particular, the nation-wide and overall LRGs' food prices show an average 0,9% increase during the period 1999-2005 as opposed to the 3,3% increase of the respective food CPI and the 2,6% average inflation rate (*i.e.* the average increase of the general CPI).

**Table 4**

**Comparative average and cumulative changes (in %) between the LRGs' selling prices and the corresponding CPIs, across product categories and over the period 1999-2005**

		LRGs' selling prices		Respective CPIs		Differential between LRGs' prices and CPIs	
		Average 1999-2005	Cumulative 1998-2005	Average 1999-2005	Cumulative 1998-2005	Average 1999-2005	Cumulative 1998-2005
<b>Lisbon</b>	Grocery, drinks, and milk food	-0.3	-2.0	2.5	19.0	-2.8	-21.0
	Household cleaning	3.1	23.4	4.4	35.3	-1.3	-11.8
	Personal hygiene	<b>3.1</b>	23.1	<b>4.4</b>	34.7	<b>-1.3</b>	<b>-11.6</b>
	<b>Overall</b>	<b>0.9</b>	<b>6.1</b>	<b>3.4</b>	<b>26.4</b>	<b>-2.5</b>	<b>-20.3</b>
<b>Porto</b>	Grocery, drinks, and milk food	0.1	0.7	2.3	17.4	-2.2	-16.8
	Household cleaning	3.3	24.9	4.2	33.2	-0.9	-8.4
	Personal hygiene	<b>3.3</b>	25.3	<b>3.6</b>	28.1	<b>-0.3</b>	<b>-2.8</b>
	<b>Overall</b>	<b>1.2</b>	<b>8.7</b>	<b>3.1</b>	<b>23.7</b>	<b>-1.9</b>	<b>-15.1</b>
<b>Regions</b>	Grocery, drinks, and milk food	-0.2	-1.7	2.4	18.3	-2.6	-19.9
	Household cleaning	3.0	22.7	4.4	35.4	-1.4	-12.7
	Personal hygiene	<b>2.7</b>	19.7	<b>3.9</b>	31.1	<b>-1.3</b>	<b>-11.3</b>
	<b>Overall</b>	<b>0.8</b>	<b>5.3</b>	<b>3.3</b>	<b>25.4</b>	<b>-2.5</b>	<b>-20.0</b>
<b>National</b>	Grocery, drinks, and milk food	-0.2	-1.3	2.4	18.3	-2.6	-19.6
	Household cleaning	3.1	23.3	4.4	35.4	-1.3	-12.0
	Personal hygiene	<b>2.9</b>	21.8	<b>3.9</b>	31.1	<b>-1.0</b>	<b>-9.3</b>
	<b>Overall</b>	<b>0.9</b>	<b>6.2</b>	<b>3.3</b>	<b>25.4</b>	<b>-2.4</b>	<b>-19.1</b>
<b>General inflation</b>				<b>2.6</b>	<b>13.6</b>		