Competition between French grocery stores: Evidence from a price comparison website

Working paper

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Abstract:

The French grocery store chain Leclerc operates a price comparison website which allows to compare each of its stores with some local competitors, and performs chain comparisons at the national level. This papers uses price data collected from the comparison website to investigate static and dynamic price dispersion across French grocery stores. Although chains are found to largely determine store pricing policies, chain level comparisons are often of little informative value given heterogeneity observed at the store level. Furthermore, store comparison results tend to be sensitive to available product sets and vary significantly over time. Findings therefore suggest that static and dynamic price dispersion makes accurate price comparisons very costly for consumers.

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1 Introduction

Since the development of supermarket chains in France, several regulations have been implemented with a view to protect smaller retailers and producers from seemingly increasingly powerful large retail chains. The academic literature has yet shown large unexpected consequences of passed laws, and produced mixed evidence regarding the competitiveness of the market.

Bertrand and Kramarz (2002) analyse the impact of a restriction on large store openings introduced in 1974 to protect small retail stores. They find that a stronger deterrence of entry, decided by boards at the regional level, is associated with increased retailer concentration and weaker employment growth.

Biscourp et al. (2013) study the effects of a law passed in 1997 which modified existing below-cost pricing regulations with a view to protect small retailers and producers from larger retail chains. Existing regulation, dating back to 1963, had indeed proved to be inefficient given its loose definition of cost. The Loi Galland clarified the situation by defining the threshold as the invoice price, thus forbidding to take into account ex-post rebates into account. The paper documents a weakening of the relation between concentration and retail prices which is likely to reflect a reduction in intra-brand competition resulting from the Loi Galland. Indeed, the new regulation gives supplies of branded products the possibility to impose industry-wide price floors (minimum RPM), while negotiating the actual wholesale price with retailers through rebates. As expected, the measured effect is stronger for branded product than for store brand products, which are less likely to have been by the change in the regulation. Price dispersion is found to be reduced for branded products and the price gap between most expensive and less expensive stores is reduced. Price dispersion is yet observed to remain significant.

Since the seminal paper of Stigler (1961), a large literature has investigated the link between "consumer ignorance" and price dispersion i.e. the persistence over time of different prices for a homogeneous good in a given market. Following Varian (1980), a rich theoretical paradigm has emerged in which price dispersion results from price randomization by sellers in equilibrium. Empirical research, on the other hand, has long been hampered by a scarcity of relevant panel data.

Lach (2002) studies price dispersion with CPI data of four grocery store products sold in Israel over four years. Dynamic price dispersion is documented in the form of sellers frequently changing quartiles in the price distribution over months at the national level. Data are yet not rich enough to observe price dispersion within local markets.

Chandra and Tappata (2011), with retail gasoline price data, analyse price spreads of pairs of competitors based on the distance which separate them. They remark that the price ranking between two competitors tends to be noisier when distance increases, namely when consumer search costs are more likely to relax competition and therefore to create the tension between rent extraction and undercutting that leads to a mixed strategy equilibrium in Varian (1980).

Dubois and Perrone (2015) analyse price dispersion in the French supermarket industry with four product categories (beer, cola, coffe and whisky) with data spanning 1999-2001. They find that stores frequently change positions in the price ranking and estimate a structural model which accomodates sequential search, vertical product differentiation and heterogeneous consumer tastes. They find that search cost are high and that the majority of consumers is thus poorly informed about prices in equilibrium. Price elasticities differ significantly from the perfect information model.

Turolla (2016) estimate a structural model of demand and recover stores' price-cost margins. The paper finds that stores set prices according to the most competitive scenario, but that a significant portion of large grocery stores take advantage of insufficient competitive pressure to distort offer and increase margins.

Using rich price data collected from a comparison website, this paper documents static and dynamic price dispersion in the French supermarket industry. The first part of the paper provides a description of the data through a review of the methodology used by the website to compare prices.

2 Price comparison on quiestlemoinscher.com

As of 2015, the French retailing industry was dominated by six firms, which accounted for over 80% of total sales: Carrefour and Leclerc were the two largest with c. 20% market shares each, followed by Intermarche (14%), Casino (12%), Auchan (11%) and Systeme U (10%). An important distinction between firms lies in the ownership structures. While Carrefour, Casino and Auchan own most of the stores operated under their brands, Leclerc, Intermarche and Systeme U are essentially franchise networks.

The creation of the comparison website quiestlemoinscher (thereafter "Qlmc") is part of a long term strategy of the group Leclerc to prove the competitiveness of its prices. Soon after the launch in May 2006, Carrefour filed a complaint about the lack of transparency and potential biases in comparisons. The website was forced to close by a court decision. An updated version of the website was released on November 2006 and has since then remained in operation. Legal proceedings nervetheless continued until the rejection by the court of cassation of Carrefour's claims in January 2010. A major merit of the legal action undertaken by Carrefour is its consequence for the transparency, namely the release of well identified store product price data. The following section provides an overview of the methodology of the comparison website, two crucial aspects of which are competitor and product choice. Data collected from the website are use to replicate its comparison results. The website was explored in March 2015, with a view to find the best way to extract price data. The only feasible solution appeared to successively crawl comparisons between Leclerc stores and each of their competitors. This implies that obtained data differ from the price database used by Qlmc to establish comparisons performed at the national level with competing supermarket chains.

2.1 Competitors

Until 2013, the website only offered comparisons between Leclerc and its competitors at the chain level. For each competing chain, prices were collected at a sample of store expected to be representative of the store network. Broad constraints were thus imposed on store location and size, while exact store choice was claimed to be random. From 2013 on, the development of the "drive" concept in France has allowed the comparison website to cover far more stores, and thus to start displaying store level comparisons. The concept of "drive" implies that consumers are offered the opportunity to shop online from a physical store (at the same prices) and collect their purchases whenever it suits them. The collection of prices can then be achieved efficiently on the internet, as opposed to costly physical store visits. As of March 2015, Qlmc claimed to cover 60% of the stores of the 10 supermarket chains compared (44% in August 2013).

Regarding store level comparisons, the website states that each Leclerc is compared with a selection of its most relevant competitors within 30 km, based on Leclerc managers' expertise. The website also indicates that stores whose surface is smaller than 1,000 m^2 are excluded, as well as stores belonging to chains which are deemed to be too differentiated (e.g. discounters). Finally, Leclerc stores are not included among potential competitors. A total number of 575 Leclerc stores were found to be listed on the website in March 2015. The comparison of each store with its respective selection of competitors yielded 2,390 pairs of stores, involving 1,815 unique Leclerc competitors (the number of pairs is larger since a store can be listed as a competitor of several Leclerc stores). Data were missing for 14 Leclerc stores and 51 Leclerc competitors. This implies that among competitors of the 561 Leclerc stores for which price data have been collected, 36 out of 1811 are missing ($\leq 2\%$).

Table 1: Representation of major national chains

	France	QLMC		Data	
	Nb stores	Nb stores	Coverage	Nb stores	Coverage
Auchan	142	125	88%	112	79%
Carrefour	222	188	85%	171	77%
Carrefour Market	925	421	46%	239	26%
Casino	392	151	39%	76	19%
Cora	58	58	100%	54	93%
Geant	108	108	100%	92	85%
Intermarche	1,770	1,022	58%	530	30%
Leclerc	579	579	100%	561	97%
Simply Market	305	50	16%	49	16%
Systeme U	1,030	632	61%	413	40%
Total	5,531	3,334	60%	2,297	42%

Data about store chains were provided by LSA, which is the source used by Qlmc.

Table 1 provides an overview of store coverage for the ten national chains compared on Qlmc in

March 2015. Coverage is high and rather close to coverage in the full Qlmc sample for chains which are characterized by large store surfaces: Auchan, Carrefour, Cora, Geant and Leclerc. This can be explained by the fact that Leclerc is present across all regions and operates rather large stores. Regarding chains with smaller store formats, coverage is lower both for Qlmc and in the data with respect to the website (e.g. 22% for Casino vs. 39% claimed by the website). Two natural explanations are the fact that stores from these chains are generally less likely to be considered relevant local competitors for Leclerc stores, and the slower development of "drive" within smaller stores (which make price collection less costly).

Table 2: Overview of competition around the 575 Leclerc stores in Qlmc

	Nb competitors	Distance (km) to closest	furthest	mean	median
Mean	5.0	2.4	15.9	8.8	8.5
Std	1.6	2.5	9.7	5.1	6.0
Min	1.0	0.1	0.9	0.8	0.5
Q10	3.0	0.7	4.6	3.0	2.5
Q25	4.0	1.1	8.4	4.8	3.7
Q50	5.0	1.8	15.3	7.8	6.5
Q75	6.0	2.7	21.5	12.3	12.5
Q90	7.0	4.7	26.3	15.7	18.0
Max	12.0	21.1	67.0	28.6	28.5

Table 2 provides an overview of competition according to qlmc comparisons (the website does not claim to be comprehensive). On average, a Leclerc store is compared with 5 competitors, and over 50% over Leclerc stores are compared with a store located within 2 km. The furthest competitor is generally within 30 km (15 km for almost half of them), except for 28 stores. For 14 Leclerc stores, the closest listed store if over 10 km away. No store meets these two criteria, hence it does not seem obvious that the lack or omission of nearby competitors led to include stores beyond reasonable distance. For instance, the Leclerc outlet which has the furthest competitor in the data (67 km) is listed with 7 competitors, of which 5 are located within 30 km.

2.2 Products and methodology

As of March 2015, only national brand products are covered by the website. Products are identified at the bar code level. There are seven food product categories: meat and fish, vegetables and fruits, bakery, fresh food, frozen food, savoury grocery, sweet grocery, baby food and drinks. Non food products are split in four categories: health and beauty, household, pets and home and textile. Products are further classified within product families. Regarding chain comparisons, the number of products covered within each family is determined by the volume of national hypermarket and supermarket sales, with a global objective of 3,000 products. Within each family, products

are chosen based on the national hypermarket and supermarket detention rate. Products whose detention rate is below 30% (i.e. products referenced by less than 30% of the stores) are dropped. This led to a total of 2,461 national brand product references covered for March 2015 (2,510 in August 2013). As regards store level comparisons, all products found at both stores are used in comparisons.

Price records obtained from the website include all products used in each store level comparison. As a consequence, there are 12,318 unique products in the data as of March 2015. Table 3 provides an overview of the relative weights of each section in terms of product number and value. The five largest sections, regardless of the criterion, are Fresh products, Health and Beauty, Savoury Grocery, Sweet Grocery and Drinks. Families within each sections are detailed in table 10. Drinks and Health and Beauty products tend to have larger values than products from other categories, so that they account for a significantly higher share in terms of value than product count.

Table 3: Overview of product section weights

	All products		$\geq$ 500 obs		$\geq$ 700 obs	
	Nb %	Value %	Nb %	Value %	Nb %	Value %
Baby and dietetic food	4.7	4.3	3.9	3.0	3.3	2.4
Drinks	10.0	15.3	10.9	20.4	11.1	21.9
Fresh products	21.1	15.5	19.8	16.7	18.4	15.2
Frozen food	3.0	3.1	3.0	3.9	2.4	3.1
Health and beauty	17.3	26.9	11.5	12.8	12.4	13.4
Home and textile	2.5	3.4	0.5	0.7	0.3	0.4
Household	5.5	6.8	5.5	6.8	5.8	7.2
Pets	1.9	2.8	3.0	4.4	3.0	4.5
Savoury grocery	16.5	9.4	19.6	12.5	20.4	12.6
Sweet grocery	17.0	12.3	22.1	18.8	22.8	19.2
Vegetables and fruits	0.5	0.4	0.2	0.2	0.2	0.2
Total	100.0	100.0	100.0	100.0	100.0	100.0
Total Nb or Value (euros)	12,318	43,883	3,467	9,138	2,578	6,682

The comparison of Leclerc with its competitors follows two simple steps. First, the average price of each product is computed for each chain, provided the product is observed within enough stores of the chain. Leclerc is then successively compared to each of its competitors based on all products for which a chain price was computed. The result displayed on the website is the percentage difference between the price of the basket for the competing chain and for Leclerc:

$$\frac{\sum_i P_{iC} - \sum_i P_{iL}}{\sum_i P_{iL}}$$

where i refers to all products in the baskets, P_{iC} and P_{iL} respectively stand for the average price of product i for the competing chain (C) and for Leclerc (L). The comparison between two stores

is very similar except that it uses store prices instead of average chain prices.

2.3 Price comparison results

Results for chain level comparisons performed according to the website methodology are reported in table 4. Despite the fact that data collected differ from these used by Qlmc, results are very similar, and are found to be relatively robust to variations in included products. Geant Casino is the second cheapest chain as of March 2015, only 1.5% more expensive than Leclerc (1.8% according to Qlmc). Dropping the 20% products which weigh in most favorably for Leclerc reduces the comparison result to 0.4%.

Table 4: Comparisons at the chain level

	Nb stores		Nb products		Comparison vs. Leclerc			
	Qlmc	Data	Qlmc	Data	Qlmc	Data	Bias 10%	Bias 20%
Auchan	125	112	1,976	2,382	+7.6%	+6.5%	+5.5%	+5.0%
Carrefour	188	171	1,294	1,284	+7.8%	+8.2%	+7.0%	+6.0%
Carrefour market	421	239	2,032	3,401	+13.5%	+12.4%	+11.6%	+10.2%
Casino	151	76	na	1,650	+16.7%	+16.8%	+15.8%	+15.4%
Cora	58	54	1,326	2,994	+10.2%	+9.4%	+8.3%	+7.3%
Geant Casino	108	92	1,582	1,582	+1.8%	+1.5%	+0.7%	+0.4%
Intermarche	1,022	530	1,971	6,287	+7.0%	+7.1%	+5.8%	+5.0%
Simply market	50	49	na	1,070	+12.9%	+13.4%	+11.6%	+11.2%
Systeme U	632	413	2,386	4,565	+6.7%	+5.8%	+4.8%	+4.7%

Comparisons are based on 561 Leclerc stores (vs. 581 in Qlmc). In the column "Bias 10%", the 10% products which compare most favorably for Leclerc in terms of percent price difference are dropped.

Results for store level comparisons performed according to the website metholodgy are reported in table 5. The website lists 99 comparisons between a Leclerc and a Geant Casino. On average, the Geant Casino is found to be 1.8% more expensive than its Leclerc competitor. In some cases, Geant Casino is cheaper than Leclerc. A Geant Casino is indeed found to be 0.6% less expensive than its Leclerc competitor. In general, national level comparisons appear to be relatively meaningful considering the distributions of store level comparisons.

Table 5: Comparisons between Leclerc stores and their competitors by chain

	Nb pairs	Comparison of Leclerc stores vs. competitors by chain Mean	Std	Min	Q25	Q50	Q75	Max
Auchan	118	+6.5%	3.3%	+1.6%	+4.1%	+5.7%	+8.3%	+19.5%
Carrefour	175	+8.2%	5.2%	-3.5%	+5.8%	+8.1%	+9.4%	+36.2%
Carrefour market	235	+13.8%	3.3%	+1.3%	+11.7%	+13.5%	+15.8%	+24.5%
Casino	57	+17.9%	4.8%	+0.5%	+16.8%	+18.7%	+21.0%	+27.5%
Cora	57	+8.6%	2.4%	+3.6%	+6.7%	+8.4%	+10.3%	+15.6%
Geant Casino	99	+1.8%	1.5%	-0.6%	+0.7%	+1.3%	+2.3%	+5.3%
Intermarche	525	+7.1%	2.8%	+2.0%	+5.4%	+6.6%	+8.2%	+28.4%
Simply market	49	+13.4%	6.2%	+6.5%	+9.8%	+10.6%	+15.4%	+31.8%
Systeme U	355	+6.7%	4.0%	+1.1%	+3.8%	+5.8%	+8.7%	+26.0%

Pairs are required to include 400 products or more. There are 118 comparisons between a Leclerc store and an Auchan store. On average, an Auchan store is 6.5% more expensive than its Leclerc competitor.

2.4 Comparison history

Collected data can be used to compare prices across periods and therefore to explain part of the changes recorded in successive chain price comparisons displayed by the website. Inflation between two successive periods is computed by comparing the sum of average prices of all products available over the two periods. Variations can then multiplied to obtain statistics over longer periods.

Leclerc prices between May 2007 and May 2012 have increased by 1.13% (average annual increase of 0.25%). Until May 2011, other chain display similarly low variations. This translates in a relative status quo in chain comparison results. Geant Casino is then the most expensive chain (+6% to +10%vs. Leclerc), followed by Cora and Carrefour Market (+5%). Auchan, Carrefour, Geant Casino, Intermarche and Systeme U display rather similar price levels (+3-4%). After May 2011, most chains display a progressive loss in competitivess as compared to Leclerc. A remarkable exception is Geant Casino which, after a peak at +13.8% vs. Leclerc in September 2012, becomes increasingly price competitive from May 2013 on. Carrefour appears to be willing to match this progression in 2014, and then to give up in 2015. As a consequence, while Geant Casino was the most expensive chain at the beginning of the period studied, it is the closest competitor of Leclerc in terms of price level as of March 2015 (+1.3% vs. Leclerc, to be compared with +12.2% in March 2013). Intra-chains comparisons between May 2014 and March 2015 suggest that the relative loss in price competitiveness of Carrefour actually results from a mild change in prices by Carrefour (-1.4%) constrasting with significant cuts implemented by other chains (e.g. -4.3% for Auchan, -5.1% for Leclerc, -5.2% for Intermarche). Geant Casino achieves its unprecedented level of price competitiveness through an 8.5% decrease.

3 Price dispersion

Since its creation in 2007, Qlmc prominently displays aggregate comparisons with its major national competitors. On the one hand, such information may be considered relevant by consumers willing to adopt a rule of thumb which weighs the cost/time of transportation with prices and products expected to be offered in a store of a given chain. On the other hand, without being deceptive per se, such comparisons could simply reflect differences in store characteristics such as location, size, market competitiveness etc. In order to address this issue, this section first investigates price dispersion within chains, and then discusses the possibility to account for prices through observed store and market characteristics.

3.1 Chain level pricing policies

French supermarket chains are known not to generally follow uniform national pricing policies. Empirical investigations however reveal various degrees of uniformity at the chain level. Table 6 reports the frequency of the mode (most common price) of each product at the chain level. Geant Casino stands out in terms of product price homogeneity. On average, a product is sold at the very same price in 89% of the chain stores. This implies that a random basket of goods has a relatively high probability to have the very same price in two Geant Casino stores, even if both are located far apart from each each other. The closest followers are Systeme U and Leclerc, for which the mode accounts for 39% and 38% of price observations on average.

Table 6: Distribution of the frequency of the mode (most common price) per product

	Nb	Mean	Std	Min	Q25	Q50	Q75	Max
Auchan	416	19	11	5	12	16	22	63
Carrefour	319	29	17	7	17	23	36	87
Carrefour Market	777	33	19	11	20	26	42	100
Geant Casino	417	89	10	45	83	91	97	100
Casino	157	37	15	6	29	33	44	86
Cora	364	20	11	6	14	17	23	90
Intermarche	1,326	25	19	5	13	18	29	97
Leclerc	1,788	38	23	3	14	38	59	95
Super U	1,077	39	12	9	32	37	44	91

On average, 38% of all Leclerc stores set the very same price for a given product.

Price uniformity is also investigated from a store prospect. Table 7 accounts for the percentage of products carried by each store the price of which is found to be equal to the mode of the observed chain prices. The average Geant Casino store appears to follow a standard chain price for approximately 80% of its products. The median is 94% while is the min is 6% hence it appears that a limiter number of stores depart significantly from standard prices while price uniformity is

the rule for the bulk of the store chains. Leclerc also exhibits a relatively strong concentration at the store level.

Table 7: Distribution of the frequencies of "standard" prices per store

	Nb	Mean	Std	Min	Q25	Q50	Q75	Max
Auchan	107	14	7	2	9	13	18	37
Carrefour	146	28	15	0	19	28	36	67
Carrefour Market	223	32	16	0	19	32	45	60
Geant Casino	91	81	23	6	71	94	96	98
Casino	74	16	11	2	7	13	27	49
Cora	54	13	8	1	6	14	18	29
Intermarche	513	24	11	0	15	24	32	50
Leclerc	552	44	18	4	31	47	58	80
Super U	409	35	37	0	6	11	83	98

On average, the prices of 44% of the products carried by a Leclerc store are equal to the most common prices observed at Leclerc stores.

3.2 Store price levels and dispersion

In order to study the relation between price level, price dispersion, and market characteristics, we need to build measures of store price levels and store price dispersion. This is achieved by running the following regression:

$$\log P_{ij} = \text{Product}_i + \text{Store}_j + \epsilon_{ij}$$

where Product_i is a product effect and Store_j is a store effect. The coefficient Product_i associated with a dummy variable equal to 1 for products carried by store i provides information regarding the price level of store i compared to a reference store. The residual variation ϵ_{ij} can be interpreted as the percentage deviation of a store product price from its expected geometric mean. The average of the residuals is approximately null for each product and each store. Price dispersion is approximated at the store level by computing the standard deviation of the residuals. As a robustness check, the regression is also run successively for each supermarket chain so that the estimates of product fixed effects are chain specific. This specification is supported by table 6 and table 7 as they reveal significant degrees of price homogeneity within chains. These can be seen to be relatively consistent with price dispersion measured through the standard deviation of price residuals.

Local market characteristics are found to account for a minor share of the variance in store indexes. In particular, Leclerc does not appear to be significantly less price competitive relative to competitors once one tries to capture the competitiveness of the local market, the size and revenue of the population and the surface of the store. The affiliation of a store appears to be a strong determinant of its overall price level, which is consistent with the relative strong intra-chain price

concentration previously obtained and other studies on retail chain prices. **?** and Chamayou (2016) observe similar results with gas station prices respectively in the US and in France (even though gas station chains do not follow uniform pricing policies).

ADD REGRESSION RESULTS

Price dispersion measured at the store level is found to be strongly correlated with the store price level.

3.3 Pair price dispersion

Price dispersion is investigated at the pair level, based on the idea introduced in Chandra and Tappata (2011) that distance between sellers can be used as a proxy for consumer information. Pairs of competitors which are separated by a very low distance can indeed be expected to compete fiercely, so that they constitute a population in which the "law of one price" is the most likely to hold. On the other hand, a larger distance is likely to be tantamount to poorer consumer information, namely a competition setting which could be described by a model of search. A common feature of such models is the absence of pure strategy equilibria. In the single product case, mixed strategy equilibria have traditionally been given a dynamic interpretation, corresponding to the changes in ranks that can be observed among sellers over time. In the multi-product case, ADD REF have shown that sellers can randomize on each product (either in a way that simply replicates the single product case, or in a way that involves a correlation between a seller's prices).

Of all comparisons between chains exhibiting similar price levels, the Leclerc vs. Geant Casino comparison is the most stable across stores, and within stores across products. Table 8 shows that among 215 pairs, Geant Casino is +1.4% more expensive on average, and Leclerc is less expensive in 85.1% of the pairs.

Table 8: Static store level comparisons (15 km - 100 obs min)

Chain A	Chain B	Nb pairs	B vs A avg comparison	Pairs won by A (%)	Share of products (avg %) A wins	B wins	Draw	Reversed
Leclerc	Geant Casino	215	+1.4%	85.1	61.8	22.4	15.8	20.4
Leclerc	Carrefour	555	+9.1%	98.4	78.5	15.1	6.4	14.7
Geant Casino	Carrefour	89	+7.6%	98.9	70.8	25.1	4.1	25.1
Carrefour	Auchan	191	-0.3%	51.8	46.3	44.3	9.4	28.9
Carrefour	Intermarche	365	-1.0%	38.6	45.8	51.2	3.0	34.0
Carrefour	Systeme U	196	+2.6%	60.7	57.1	38.8	4.1	27.3
Auchan	Intermarche	212	+0.8%	61.8	54.0	43.0	3.0	32.9
Auchan	Systeme U	145	+3.1%	66.2	60.5	35.2	4.3	27.0
Intermarche	Systeme U	490	+1.0%	51.2	51.5	41.3	7.3	25.3

Among 215 pairs of Leclerc and Geant Casino competitors, Geant Casino is +1.4% more expensive on average, and Leclerc is less expensive in 85.1% of the pairs. On average, a Leclerc sells 61.8% of products strictly cheaper than its Geant Casino competitor. Regardless of whether Leclerc or Geant Casino wins the overall comparison, on average, the loser i.e. most expensive store is strictly cheaper on 20.4% of products.

Descriptives statics of dynamic price dispersion are reported in Table 9. Among 114 store comparisons involving a Leclerc and a Geant Casino, 4.4% are won by a different store in the two periods. On average, 21.2% of products taken into account in the comparison changed order between the two periods i.e were strictly cheaper at Leclerc in first period and became strictly cheaper at Geant Casino in second period or the reverse.

Table 9: Dynamic store level comparisons (15 km - 100 obs min)

Chain A	Chain B	Nb pairs	Dynamic "Rank reversals" Pairs (%)	Products (%)
Leclerc	Geant Casino	114	4.4	21.2
Leclerc	Carrefour	152	5.9	24.6
Geant Casino	Carrefour	46	71.7	42.5
Carrefour	Auchan	49	42.9	38.0
Carrefour	Intermarche	119	53.8	38.6
Carrefour	Systeme U	102	48.0	37.2
Auchan	Intermarche	86	22.1	32.4
Auchan	Systeme U	101	34.7	29.9
Intermarche	Systeme U	322	32.8	30.5

Among 114 store comparisons involving a Leclerc and a Geant Casino, 4.4% are won by a different store in the two periods (draws can be neglected as they virtually never happen). On average, 21.2% of products taken into account in the comparison changed order between the two periods i.e were strictly cheaper at Leclerc in first period and became strictly cheaper at Geant Casino in second period or the reverse.

ADD REGRESSION RESULTS

ADD COMMENTS

3.4 Market price dispersion

While in the single product case, the main source of complexity attached to measuring market dispersion is the definition of markets, the presence of several products, in particular when their number is large as is the case with supermarkets, raises another major methodological issue. Absent quantity data, product choice is bound to be largely data dependent, and thus exposes results to various biases. Also, differentiation cannot be ignored by focusing on non differentiated pairs such as with competitor pair analysis, hence results are necessarily sensitive to potential misspecifications and must therefore be interpreted with great care.

The first approach followed in the paper consists in adopting markets as defined by the price comparison website. They are consequently all centered around one Leclerc store, and contain not other Leclerc store. Robustness checks are run to evaluate the impact of two potential issues: the absence of some supermarkets in the price data, and the presence of overlapping markets whenever two Leclerc are too close to each other. The first issue is addressed by narrowing the analysis to markets where virtually all active supermarkets are observed, and the second by considering that two Leclerc can be active in the same market, and alternatively by dropping overlapping markets. The second approach simply consists in considering radiuses around Leclerc stores as is standard in the literature. This typically excludes some competitors listed by Qlmc (and may include others?).

All products for which prices are available at 2/3 or more of observed supermarkets are taken into account in the analysis. Markets for which less than 100 products satisfy this criterion are dropped. Measures of price dispersion are computed both with raw prices and price residuals. Figures obtained with raw prices are likely to overestimate consumer search related price dispersion since price comparison results suggest that persistent price differences (across products and time) are non negligible. The method used to compute price residuals implies that the expected value of a large enough basket should be similar for each store in the market. As a consequence, price dispersion can be evaluated either by considering the distribution of all price residuals, or by studying separately each product distributions (which can then be aggregated to obtain a measure of price dispersion at the market level).

We investigate how market price dispersion varies with the number of sellers or the intensity of competition captured by HHI. We also investigate the link between market price dispersion and an index of market prices. The market index is built by considering how expensive each store operating in a given market is in comparison to all stores affiliated to the same chain. Alternatively, store surfaces are taken into account to weight prices indexes in the computation.

ADD DESCRIPTIVE STATISTICS

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A Additional descriptive statistics

Table 10: Overview of product families within sections

Section	Families
Baby and dietetic food (573)	Baby food (418); Dietetic products (155)
Drinks (1,233)	Beer and Spirits (443); Fizzy drinks and Cola (244); Water (176); Juices and Smoothies (110); Squash and Cordial (101); Wine, Champagne and Cider (159)
Fresh products (2,595)	Butter and Cream (199); Meat (490); Cheese (491); Milk and eggs (150); Fish (98); Delicatessen (660); Yoghurts and Chilled Desserts (507)
Frozen food (368)	Ice cream and Frozen yoghurt (101); Frozen vegetables and fries (91); Frozen pizzas, pies and ready meals (128); Frozen Meat and Fish (48)
Health and Beauty (2,127)	Kitchen Roll and Tissues (86); Oral care (169); Feminine care and Baby changing (138); Drugstore (97); Haircare (558); Face and body skincare (951); Men toiletries (128)
Home and textile (308)	DIY and Car (9); Kitchen and dining room (50); Home Office (171); Batteries, lightbulbs and plugs (54)
Household (679)	Air fresheners and insect killers (118); Laundry (124); Cloths, Gloves and Scourers (45); Cleaning (225); Dishwashing (64); Specialist laundry and Washing machine cleaner (103)
Pets (239)	Cat and dog food (233); Litter (6)
Savoury grocery (2,032)	Snacks (214); Condiments and Spices (609); Canned goods (406); Pre-cooked dishes (205); Pasta, Rice and Flour (328); Soups (270)
Sweet grocery (2,099)	Biscuits (294); Coffee and Tea (368); Chocolates ans sweets (450); Desserts, Sugar and Sweeteners (318); Breakfast (453); Cakes (215)
Vegetables and fruits (65)	Fruits (65)