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Is price dispersion a concern for French consumers?

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Deviations from 'optimal prices' may imply that monetary policy is not efficiently transmitted to inflation, hindering central banks' objective of price stability. But is price dispersion also a concern for consumers? This Rue de la Banque *describes price dispersion across stores in France and then focuses on the perspective of consumers. Indeed, price deviations from 'normal' prices are persistent over time in France and expensive and cheap stores tend to be consistently so across the products they sell. Luckily for French consumers, assessing the relative expensiveness of stores appears rather easy.*

A striking fact known to every single person living in a market economy is that the same product is sold at different prices (that is, the so-called 'law of one price' is false). Any attempt to understand how prices are set is doomed to fail if it does not account for the fact that even for homogeneous goods prices differ across sellers at any given time.[1] The violation of the law of one price is a potential concern not only for economists and central banks, but also for all consumers.

The trouble is that, although we all have casual evidence of stores selling the same product at different prices, assessing price distributions at the economy-wide level requires a huge amount of information. The need to gather and treat 'big data' is why we used to know very little about such a familiar phenomenon. This *Rue de la Banque* is based on the first analysis of the shape and structure of price dispersion in the French retail sector (Berardi et al., 2017), exploiting information on almost 40 million prices across 1,500 stores in France.

The main message is that, while deviations from optimal prices are a concern for central banks, they are less so for consumers as they are in a relatively easy position to decide where to shop. Indeed, because price dispersion does not change a lot over time, and expensive and cheap stores tend to be consistently so across the product range that they sell, it is relatively easy for French consumers to decide where to shop.

Is price dispersion an issue for central banks?

Shedding light on firms' pricing decisions is key to better understanding the impact of monetary policies. Deviations from optimal prices (i.e. the prices that setters 'should' choose) imply that the transmission of monetary policy is hindered by market structure rigidities.

It is possible to break down price setters' decisions into two dimensions. The first one, already widely explored in the last decade,[2] is how often and by how much prices are adjusted, i.e. price dynamics. If prices adjust less quickly than they should, we say that they are rigid. The second dimension, currently bursting forth with a number of recent research frontier papers exploiting big data,[3]

1 *See for instance Stigler (1961).*
2 *See Berardi et al. (2015) for the most recent analysis of price dynamics in France and Dhyne et al. (2006) for a comparison of price rigidity across Eurosystem countries.*
3 *See for instance Kaplan and Menzio (2015) and Gorodnichenko and Talavera (2017).*

is whether the same product is set at different price levels across sellers, i.e. price dispersion across stores. If price levels are different across stores, then we say that they are dispersed.

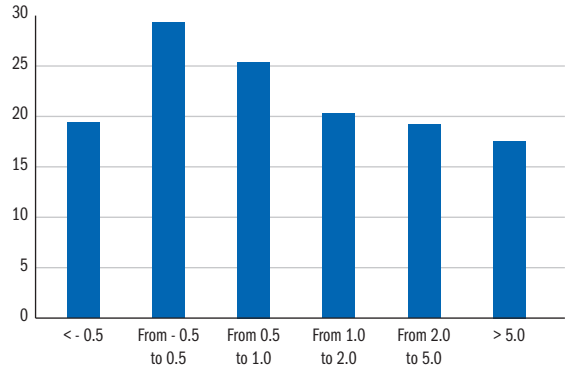
Both price rigidity and price dispersion are a concern for central banks whose primary objective is price stability. Indeed, both signal deviations from optimal price levels that hinder the transmission of monetary policy to inflation.

From a theoretical point of view, many popular macroeconomic models predict a close link between price dispersion and the degree of price rigidity. In time-dependent Calvo-style models of price stickiness, as well as in economic state-dependent models and using reasonable calibrations,[4] flexible prices (typically characterised by a high frequency of price adjustment) are little dispersed.

Consistently, from an empirical point of view, Chart 1 shows that the cases where prices for a given product are close to the 'normal' price of that item (i.e. close to 0 price dispersion on the x-axis) are also the ones exhibiting a higher frequency of price changes (y-axis).[5] In other words, some posted prices are unlikely to closely track optimal prices, both because they are rarely adjusted and because they largely deviate from their 'normal' level.[6]

C1 Correlation between price rigidity and dispersion

(x-axis: mean deviation from the modal price of a product in %; y-axis: mean monthly frequency of price changes)



Source: authors' calculations using 45 million grocery store prices in medium and large-sized supermarkets in 2011-12.
Notes: The chart shows, at the product and store level, the positive relation between the degree of price rigidity (measured on the y-axis by the lower frequency of price changes) and the degree of price dispersion (measured on the x-axis by a larger deviation from product modal prices at a given point in time). The mean monthly frequency of price changes measures price flexibility. The mean deviation from the modal price at a given point in time (x-axis) measures price dispersion (0 means that the price perfectly coincides with the 'normal' price for a product).

Is price dispersion an issue for consumers?

Price dispersion is not only a concern for central banks, but also for consumers. Indeed, it is a key statistic entering welfare calculations.[7] Consumers may pay lower or higher prices for the exact same product depending on where they buy it. From a theoretical perspective, the same product can be sold at different prices for two reasons. The first one is that consumers may not know which store sells a product at the lowest price, because, to find out, they would need to visit several stores and this would cost them time and energy. The second reason is that the same product may be perceived as not exactly identical when bought in different stores. For instance, a consumer may prefer to buy a bottle of milk at a corner store in his posh neighbourhood even if he knows that the same bottle is less expensive at a less fancy and more remote superstore.

These two cases have different empirical implications, so that the analysis of price dispersion enables us to understand what is actually going on. Indeed, in the second case, different sellers would be able to set prices for the same product that differ in a persistent way. However, in the first case, if price dispersion for a homogeneous product is to persist over time, sellers must be able to increase and decrease their prices relative to other stores over time, so that consumers cannot easily find out which store is selling at the lowest prices. Otherwise, if consumers manage over time to identify stores that are always selling at low prices, then they will eventually shop there and price dispersion will tend to disappear. Therefore, in the first case the ranking of stores within the cross-sectional price distribution should randomly change over time.

4 *See Sheremirov (2015).*
5 *The same holds true as far as the size of the price change is concerned. From a theoretical point of view, models with sticky prices predict a negative relationship between the frequency of price changes and their size, so that the latter may be interpreted as an alternative measure of price stickiness. Consistently, larger price changes are also empirically associated with a larger cross-sectional price dispersion.*
6 *A further concern for central banks is that, with price rigidity, high inflation mechanically results in price dispersion. Indeed, even assuming an initial situation in which all prices are at their optimal level, inflation implies that prices need to be adjusted over time. In the presence of heterogeneous price rigidity (which has been widely documented), updates are not swift and synchronical, mechanically generating price dispersion. Since the resulting magnification of price distortion is a subject of concern especially in countries hit by high inflation (see for instance Alvarez et al., 2013 about the case of Argentina), we do not investigate the relation between inflation and price dispersion in the case of France.*
7 *See Woodford (2003).*

In order to discriminate between different sources of price dispersion with very different implications for consumers, we then need to analyse prices over time and empirically establish whether price dispersion is mainly temporal (a store's price moves up and down in the price distribution over time) or spatial (some stores consistently charge more or less than others for the same good). This is a crucial question that our analysis answers.[8]

Data source and assessment of price dispersion in France

We exploit an original dataset containing almost 40 million weekly price records from geolocalised medium and large-sized supermarkets in France. They are gathered from more than 1,500 stores and concern the thousand most widely sold products (identified at the barcode level) over the period October 2011 to September 2012.[9]

We define price dispersion as price differences for exactly the same product (i.e. barcode) sold in different stores over a given week. In order to measure price dispersion, we first compute a 'normal' price for each product at a given point in time. This 'normal' price represents a reference, which can be defined as the average (or alternatively the modal) price of a product across stores in a week. Then, we define relative prices as the percentage deviations from each product's 'normal' price. If, for example, a relative price is negative, it means that a price observation recorded in a particular store is lower than the 'normal' price for that product that week. Computing the absolute deviation enables us to assess the overall extent of price dispersion. In France, prices in the retail sector are on average 5.4% away from their 'normal' price.

It is rather easy for consumers to find out which stores are cheap or expensive overall

However, assessing the overall extent of price dispersion does not tell us much about how consumers may deal with it. In particular, are shoppers in a position to easily avoid relatively high price levels through their choice of shopping destination?

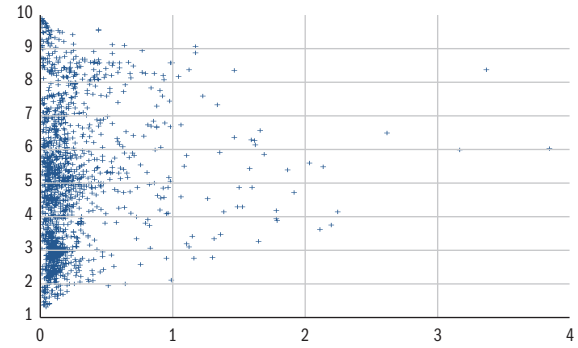
To answer this question we weekly rank stores according to the average decile to which the relative prices of their products belong. A store belonging to the first decile in a given week, for instance, is a store in which, on average, products are sold below their 'normal' national price, i.e. a relatively cheap store.

A crucial finding is that that the store ranking of overall expensiveness varies little over time (see Chart 2a).

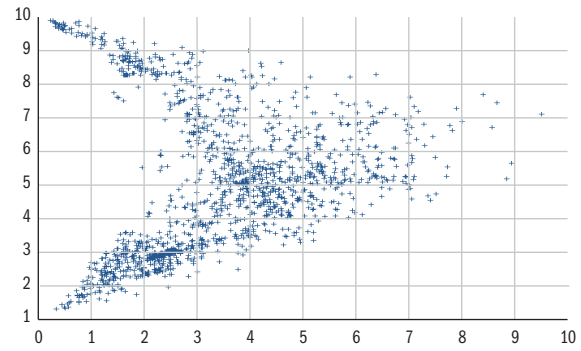
C2 Ranking of stores according to their overall expensiveness

(x-axis: variance; y-axis: decile)

a) Over time



b) Along the distribution of barcodes



Source: authors' calculations.
Notes: In Chart 2a, the overall expensiveness of a store is computed as the average decile of a store's relative prices across barcodes. The variance represents the variability of a store's overall expensiveness over several weeks. In Chart 2b, the overall expensiveness of a store is computed as the average decile of a store's relative prices over several weeks. The variance represents the variability of a store's overall expensiveness along the distribution of barcodes.
Stores characterised by an average low decile (i.e. overall cheap stores), as well as those characterised by an average high decile (i.e. overall expensive stores), are consistently so over time.

In other words, overall expensive and cheap stores (which correspond to the highest and the lowest deciles respectively) tend to be consistently so over time. Consumers are therefore in a favourable position to assess by experience whether a store is generally expensive or cheap, as this characteristic tends to be persistent over time.

8 For a more technical and in-depth study of price dispersion in the French retail sector see Berardi et al. (2017).
9 These data were collected and made available to us by Prixing, a start-up company providing consumers with a free mobile price comparator (see http://www.prixing.fr).

Another important finding is that expensive stores tend to exhibit high price levels consistently across the product range that they sell (Chart 2b). It is then plausible that these stores are characterised by certain features that justify their price levels in the eyes of consumers (for instance, they could be more spacious, less crowded, etc.). Similarly, cheap stores tend to sell most products at low prices.

In conclusion, price dispersion in France appears to be mainly spatial: some stores charge more or less than others for the same products in a persistent way.

Notice, however, that assessing the expensiveness of stores is a more complicated task for consumers in the case of middle ranked stores. Indeed, those are characterized by a much larger variance of price dispersion both over time (Chart 2a) and across products (Chart 2b). In other words, in middle-ranked stores (i.e. those in intermediate deciles): (i) a product may be relatively expensive one week and cheap the following week and (ii) some products may be relatively expensive and others cheap. These characteristics of stores that are neither very expensive nor very cheap considerably complicate the task of consumers who would like to choose where to shop for their favourite basket of products based on price levels.

Knowing the reputation of the retail chain to which a store belongs is a good approximation

One may argue that assessing whether a store is cheap or expensive overall takes some amount of effort. Indeed, it requires, even if only once, paying attention to each price and having an idea of the corresponding 'normal' price.

However, we find that the retail chain to which a store belongs is a good indicator of its level of overall expensiveness. To reach this conclusion, we compute the average decile of each retail chain based on the decile of relative expensiveness of the products that it sells. Berardi et al. (2017) show that this overall ranking of retail chains is rather stable over time. A store that is expensive at the beginning of the period remains expensive throughout the period. Furthermore, the ranking of retail chains based on their relative expensiveness is also stable over the two-year price-observation period. Consequently, consumers can base their shopping destination choices on a relatively simple assessment of a retail chain's reputation.

The calculation of the overall expensiveness of a store also reveals an easy rule of thumb for consumers. In general medium-sized supermarkets tend to be more expensive than large supermarkets. Moreover, this is always true within the same group.

However, within each retail chain, some products may be sold at a relatively expensive price while others are cheap. In order to show the variability of this price dispersion, it is essential to ascertain to what extent the prices of various products in a given supermarket chain differ from both the average of prices in the same supermarket, as well as from prices in other supermarkets. A small price variance indicates that the large majority of products are sold at quite low prices relative to other stores that sell the same products.

In this respect, we demonstrate that in the retail chains where the average price is higher compared to other chains, the majority of that chain's prices are expensive but are also tightly grouped around the average. Furthermore, in the cheapest retail chains, prices tend to be cheap and tightly grouped around the average. Two conclusions can be drawn: first, it is easy for consumers to know what to expect with regard to the relative expensiveness of these supermarket chains; and second, these retail chains have a similar price fixing policy across a wide range of products.

However, middle-ranked retail chains that are generally neither expensive nor cheap tend instead to sell different products at different relative price levels. It is therefore more difficult for consumers to assess the level of expensiveness of their consumption in middle-ranked retail chains, as it depends on their consumption basket.

In fine, *French consumers can assess a store's relative price levels rather easily*

French consumers are not heavily affected by price dispersion, as in many cases they are able to assess the relative expensiveness of stores rather easily. Indeed, price deviations from barcode 'normal' prices are persistent over time in France. Moreover, not only do relatively expensive and cheap stores remain so, but they also tend to have similar relative prices across the product range that they sell. Finally, the retail chain to which a store belongs is a good indicator of its level of overall expensiveness.

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