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Local Market Structure and Consumer Prices: Evidence from a Retail Merger *

Dennis Rickert† Jan Philip Schain‡ Joel Stiebale‡

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Abstract

This paper analyzes the effects of a merger between a German supermarket chain and a soft discounter on consumer prices. We exploit geographic variation in prices within retail chains and brands and use a difference-in-differences estimator to compare regional markets with a change in market structure to a control group in unaffected markets. Our results indicate that both insiders and outsiders raised average prices after the merger, particularly in regions with high expected change in retail concentration. In contrast, we estimate price declines in regions that did not experience a rise in concentration but were potentially affected by cost savings within the merged entity. We also provide evidence that remedies imposed by competition authorities were not sufficient to offset anti-competitive effects.

JEL codes: *D22, L11, L81, L66, K21*
Keywords: *Mergers and Acquisitions, Ex-post Merger Evaluation, Retail Markets, Retail Prices, Competition.*

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1 Introduction

There has been a substantial rise in industry concentration and market power in most sectors in the US and Europe over recent decades (e.g., Autor et al., 2017; De Loecker and Eeckhout, 2017). This development is at least partly a result of merger and acquisition (M&A) activity which has gained importance in recent years with a combined worldwide deal value that exceeded $4 trillion for the first time in 2015.[1] Retail industries have been particularly affected by this development. For instance, the four largest firms within US retailing sectors have increased the average share of sales by more than 15 percentage points within 20 years (Autor et al., 2017). In Germany, France, and the UK, the combined market share of the five biggest retailers exceeds 70% (Inderst, 2013), whereas in northern Europe the three largest retailers hold combined market shares of around 90% (Allain et al., 2017). Since retail purchases constitute a high share of consumption expenditures, increasing retail concentration is a central topic both in economic policy and within public debates.[2] In this paper, we analyze the effects of changes in local market structure—induced by a merger between two German retail chains—on consumer prices.

Economic theory yields contrary predictions regarding the impact of M&As. On the one hand, mergers might allow firms to reduce competition in downstream markets and increase prices at the expense of consumers (von Ungern-Sternberg, 1996; Dobson and Waterson, 1997). On the other hand, a merger can lead to efficiency gains which benefit consumers in the form of lower prices or new and improved products (Williamson, 1968). The net effects are particularly difficult to predict in the presence of buyer power in vertical relations which play an important role for retail markets. Specifically, merging firms might benefit from lower wholesale prices due to enhanced bargaining power vis-à-vis their suppliers (e.g., Galbraith, 1954; Chipty and Snyder, 1999) or size-related discounts (e.g., Katz, 1987; Scheffman and Spiller, 1992). Whether consumers benefit from efficiency gains or the enhanced buyer power of merging firms, however, depends on suppliers' bargaining position relative to other retailers (Inderst and Valletti, 2011) as well as the characteristics of market structure and demand which determine the pass-through of cost savings (Bulow and Pfleiderer, 1983; Weyl and Fabinger, 2013; Gaudin, 2016).

Due to mixed theoretical predictions, and the difficulty of matching observed price patterns with counterfactual merger simulations, researchers have recently argued that more evidence from ex-post merger analysis is clearly needed (e.g., Angrist and Pischke, 2010).[3] Subsequently, a grow-

[1] See, for instance, `http://www.wsj.com/articles/2015-becomes-the-biggest-m-a-year-ever-1449187101`, accessed November 2, 2017. See Grullon et al. (2017) for a recent study that relates variation in concentration levels across industries and time to M&As.

[2] See, for instance, `https://www.economist.com/news/finance-and-economics/21727893-digital-age-protecting-customers-interests-harder-ever-market`, accessed November 2, 2017.

[3] While there is a prominent and controversial debate about the usefulness of structural models versus quasi-

ing empirical literature has estimated the effects of M&As on prices and other outcomes and has produced mixed results. For instance, Hosken et al. (forthcoming) analyze 14 retail mergers and conclude that prices were raised after some mergers while they decreased or remained unchanged in other cases. Allain et al. (2017) report a significant price increase after a merger among French retailers, while Argentesi et al. (2016) find adjustments in the product portfolio after a merger in the Dutch retail market but no significant price changes within products.[4] The ambiguity of theoretical and empirical results is also reflected in the heterogeneity of national competition authorities' decisions on mergers. For instance, both the European Commission and the Federal Trade Commission approved almost 90% of all proposed retail mergers without constraints (Allain et al., 2017). In contrast, based on concerns about consumer surplus and producer profits, Germany's federal cartel office (Bundeskartellamt) either denied or imposed strict remedies on all mergers that were recently proposed.[5]

The aim of this paper is to investigate the price effects of a merger between two German retail companies, where a large supermarket chain acquired a soft discounter. This merger was challenged by competition authorities but was eventually cleared, subject to remedies, at the end of 2008.[6] Following the previous literature on ex-post merger evaluations, we start by estimating the average causal effect of the merger on consumer prices. We develop a unique identification strategy to disentangle price growth due to increasing market concentration from price declines that stem from cost savings. Furthermore, we contribute to the literature by analyzing heterogeneous effects which can potentially explain the inconclusiveness of previous empirical studies. In particular, we investigate differences in price responses between discounters and supermarkets, between private label products and national brands, and how these responses vary with predicted changes in regional retail market concentration. By relating the direction of price effects to local market conditions, our study provides a potential explanation for the ambiguous results of previous ex-post merger evaluations.

We use a rich consumer-level panel data set which allows us to construct measures of prices per product and retailer for several thousand geographical markets at the municipality level and to control for various aspects of regional heterogeneity. The empirical analysis focuses on four product categories: milk, yogurt, coffee, and toilet paper, and thus includes a mix of differentiated and rather

experimental analysis in industrial organization in general and merger analysis in particular (e.g., Angrist and Pischke, 2010; Einav and Levin, 2010; Nevo and Whinston, 2010), most scholars agree that additional insights from retrospective merger analyses is important.

[4]See also the overview of related literature on mergers in various industries in Ashenfelter et al. (2014). Recent contributions that compare the results of merger simulations and retrospective analysis include Björnerstedt and Verboven (2016) and Friberg and Romahn (2015).

[5]See, for instance, Bundeskartellamt (2014a) on denied mergers or Bundeskartellamt (2005, 2010) on conditionally excepted mergers.

[6]Due to contractual agreements with the data provider, Gesellschaft für Konsumforschung (GfK, Germany), we are unable to name the merging firms, although we are allowed to state identifying information such as firms characteristics and year of the merger.

homogeneous products. There are several interesting features of the merger and German retail markets which we exploit in our identification strategy. First, the merger has been decided at the national level and was therefore unlikely to be related to regional pre-merger market characteristics. Moreover, most German retailers employ a regional pricing strategy that is adapted to local market conditions while decisions about warehousing and bargaining with suppliers are usually made at a higher geographical level. Finally, there are several regional markets with pre-merger presence of both acquirer and target, only one of the merging firms, and none of both firms, respectively. We use difference-in-differences (DiD) estimators to exploit geographical and cross-time variation of consumer prices within products sold by each retail chain.

Our baseline specification to identify price effects of the merger follows the previous empirical literature on retrospective merger analysis (e.g., Dafny et al., 2012; Allain et al., 2017; Ashenfelter et al., 2015; Argentesi et al., 2016). It is based on a comparison of geographical markets in which both the acquirer and the target operated in the pre-merger period to control markets that did not experience a change in market concentration. In a subsequent setup, we explore price changes through concentration effects in more detail. For this purpose, we compare local markets in which both firms were active pre-merger to a comparison group of geographical markets in which exactly one of the merging parties was operating. The former group of regions was affected both by a change in market concentration and by potential efficiency gains, while the latter group was presumably affected by nationwide cost savings in one of the retail chains but did not face systematic changes in local market concentration.

To investigate the importance of price declines due to cost savings, we compare markets in which one but not both merging firms operated in the pre-merger period to markets in which neither the acquirer nor target were active. The former but not the latter group was potentially affected by nationwide cost savings of the merging firms and corresponding price responses of insiders and outsiders. Since neither one of the groups experienced a change in local market concentration, price effects identified by our DiD estimator in this setup are likely due to changes in costs that are partly passed on to consumers. These cost savings may stem from economies of scale and scope, e.g., from sharing warehouse capacities, or from higher bargaining power vis-à-vis upstream manufacturers.

Our results indicate that merging retailers and their competitors raised average consumer prices in affected markets. While the estimated price changes are, on average, quite small (about 0.4%), prices increased substantially in regions with high predicted changes in market concentration. For the region with the largest increase in retail market concentration in our sample, the estimated price increase amounts to 7.04% for supermarkets, which is substantial given that estimates of recent retail markups lie below 0.3 for the median firm (see, for instance, Hottman, 2017). Price adjustments are

concentrated in products sold by supermarkets, but there is little evidence of changes in the pricing strategies of discounters. A possible explanation for this heterogeneity is the large overlap between the acquired soft discounter's product portfolio and those of supermarkets. Furthermore, German hard discounters are likely to enjoy considerable market power in many product categories. We also investigate the effects of remedies imposed by the German cartel office which involved the sale of target firm's retail stores to a competitor in regional markets with high pre-merger market shares of acquirer and target. The results suggest that prices were not less likely to rise in these markets, indicating that imposed remedies might not have been sufficient to prevent anti-competitive effects of the merger.

Comparing price effects of the merger across alternative treatment and control groups, we find—as expected—significant downward pressure on prices in markets that are likely to be affected by potential efficiency gains. The negative effect on prices is higher in more competitive markets which is consistent with the imperfect pass-through of cost savings. In contrast, firms significantly raised prices in regions with pre-merger overlap, and this effect increases with expected changes in the concentration of local retail markets. Consistent with price increases due to market power, the estimated relative price growth is higher when we compare regions with changes in market concentration to regions that experienced no change in market structure but were likely to be affected by nationwide cost savings to a similar extent as the treatment group. Our results are robust to controlling for a large set of potentially confounding variables, including retailer-product-region fixed effects, retailer-year fixed effects, brand-year fixed effects and various factors capturing variation in demand across geographical markets and time. We also obtain similar results when we use alternative regional market definitions, exclude control markets that are geographically close to treatment markets, or use a propensity score reweighting estimator.

The rest of this paper is organized as follows. Section 2 discusses the German retail market and the merger case. In section 3, we provide a description of our consumer-level panel data set, and section 4 details our identification strategy. Results of the empirical analysis are presented in section 5, and section 6 concludes.

2 The merger and the German retail market

In this section, we first provide detailed background information on the merger in section 2.1 before we describe pre- and post-merger market structure (section 2.2) and characterize the local component of price competition among retailers (section 2.3).

2.1 The merger and the German retail market

Over time, the German retail sector has developed into a highly concentrated market structure. Induced by an expansive M&A strategy, the five largest retailers in Germany have increased their market shares in the two preceding decades from 50% to over 80% in 2014 (Inderst, 2013), which is above the average of 70% in other western European countries and well above the US average of 33% (Allain et al., 2017). Prominent examples of recent mergers in Germany are the cases of Edeka/Trinkgut (Bundeskartellamt, 2010), Edeka/Tengelmann (Bundeskartellamt, 2014a), and Wasgau/Rewe.[7] We analyze the merger of two retailers $R1$ and $R2$ with pre-merger market shares of 25% and 5% which was proposed at the end of 2007 and was approved by competition authorities in mid-2008.

The three largest competitors, outsiders O1, O2, and O3 have market shares of 20%, 15%, and 15%, respectively. The acquirer $R1$ is a multi-line retailer with two different retailing formats, supermarkets and discounters, which we label $R1^S$ and $R1^D$. The target $R2$ can be classified as a soft discounter which charges relatively low prices compared to supermarkets but has a broader assortment and sells a relatively high share of national brands compared to hard discounters. Since aggregated post-merger market shares exceeded the safe-harbor threshold of 22% (Competition Commission, 2008), the merger was in the focus of the national cartel office which identified regions where the firms had large market shares and concluded that competition would be potentially distorted by the merger. The merger was approved under the condition that $R1$ divests and sells 378—out of 2,700 stores in question—to outsider $O1$. $R1$ converted and relabeled 1,800 stores to $R1^D$, the remaining stores kept their former label $R2$ but were effectively under the control of $R1$. The outsider $O1$ pursued the same strategy in remedy regions, where it acquired the target's stores. It relabeled the acquired stores under thr name of its own soft discount retail chain $O1^D$. Basically, the imposed remedies implied a second merger between $O1$ and $R2$ in remedy regions. Consequently, we will treat remedy regions as part of the treatment group in our baseline specification. However, in an extension of our analysis, we also investigate remedy and non-remedy regions separately.

2.2 Pre- and post-merger market structure

There are 34 different retailers active in the German grocery retailing market which can be grouped into three formats: discounters, drugstores, and supermarkets with market shares of 51.76%, 3.02%, and 44.56%, respectively. Furthermore, there are some specialized retailers, such as, for instance, cash-and-carry stores, pharmacies, and online retailers. However, neither these specialized retailers

[7] http://www.bundeskartellamt.de/SharedDocs/Meldung/DE/Pressemitteilungen/2013/29_04_2013_Rewe_Wasgau.html

nor internet purchasing can be regarded as close substitutes for grocery purchases at supermarkets and discounters during our sample period. Thus, we exclude from our analysis all products from these distribution channels. We define insiders as the two merging firms, which are a supermarket and a discounter, and refer to the remaining firms as outsiders.

Table 1 shows average market shares per category, distinguishing between national brands and private labels, and the retailing format pre and post-merger. The table shows that private labels are an important element of the market. In particular, discounters' assortment consists of a high share of private labels, but we see that supermarkets also offer a high proportion of private labels in some product categories. Discounters have the highest shares in the markets for toilet paper, yogurt and milk where they mostly sell their private label products. Supermarkets dominate in the coffee market by selling national brands.

Table 2 shows average prices per category separately for the treatment and control group and the retailing format before and after the merger. We see that pre and post-merger, in treatment and the control group, discounters have lower prices in all categories. Post-merger, supermarkets slightly raise their prices for toilet paper, yogurt, and milk in treatment markets relative to control markets.

2.3 Local market definition and national bargaining

In order to identify the causal effect of the merger on retail prices, an accurate market definition is essential—both with respect to retail sales to consumers and regarding procurement from suppliers. We argue that similar to the US (Dafny et al., 2012), the Netherlands, and France (Allain et al., 2017)—but unlike in the UK (Dobson and Waterson, 2005)— German retailers adopt a local pricing strategy (see also Bundeskartellamt, 2014a) and that retail purchasing takes place in national procurement markets. This assumption is supported by anecdotal evidence from two large German retailers—Edeka and Rewe. Edeka and Rewe evolved from former buying cooperatives of local merchants, which were subsequently transformed into national retail chains with centralized headquarters. Due to this historical development, local merchants can independently set prices and choose the assortment, while national retailers bundle the purchasing activities of local retailers.

These characteristics are also in line with information from one of the acquiring firm's web page. $R1$ owns 11,400 stores operated by roughly 4,500 independent merchants who adapt the day-to-day business activities to local markets.[8] The retail brand $R1$ has evolved from regional cooperatives that were created for the purpose of joint purchasing activities. At the time of the merger, there were seven

[8]Due to confidentiality agreements, we are not allowed to display names or links to homepages of the merging parties.

regional wholesale cooperatives—formed by previous regional buying groups—, who delivered items to the stores of independent merchants and coordinated central issues regarding distribution and sales. These wholesale cooperatives may also own retail outlet stores and production facilities. The distribution is effected from 38 distribution warehouses managed by the seven wholesale cooperatives. Furthermore, there is a central headquarter coordinating commodities transactions ("Nationales Warengeschäft") at the national level. The headquarter employs a national purchasing strategy for many food and all non-food product categories.

From the facts above we can draw two main conclusions which play an important role in our identification strategy described next in section 4. First, local merchants receive their stock from central distribution warehouses which are coordinated by the national headquarters. Wholesale prices are thus likely to be determined at the national level if there is no price discrimination among local merchants. The assumption is in line with practices of the German antitrust authorities who define procurement markets at the national level (Bundeskartellamt, 2014b, p.132). Another indication of national procurement markets are so-called "wedding rebates," where some retailers were under suspicion of demanding better purchasing conditions for all stores after the acquisition of the target, which led to extensive debates in public.[9] Second, despite national wholesale prices, local retailers can set prices, including regular prices and discounts, independently. Hence, local retail prices are likely to vary across regions within retailers even for products with a wholesale list price that is determined at the national level.

Since local market definition (and the nature of retail price setting) is crucial to merger evaluation, we provide descriptive insights into the local dimension of retail price setting practices from our micro data. For this purpose, we regress prices on retailer-brand fixed effects for each product category and time period. This simple regression yields an R^2 indicating the explanatory power of the national pricing component at the retail-brand level. The remaining residual variation of the regression is the share of variance which cannot be explained by national pricing strategies. Figure 1 plots $1 - R^2$ over time and product categories indicating the decomposition of price variation into national and regional variation. For all product categories, we find a high share of variance which can be explained by local components, ranging from roughly 25% for milk and yogurt to around 65% for toilet paper. To provide evidence on the determinants of price differences across regions, we also regress prices on regional characteristics. Table A1 shows that regional prices vary with local market conditions, such as the share of households with children, population density, and market concentration. While this regression does not allow us to infer causal relationships between prices and market structure variables, it indicates that geographic variation in retail prices is related to local demand conditions.

[9] See for instance `http://www.bundeskartellamt.de/SharedDocs/Meldung/EN/Pressemitteilungen/2013/24_07_2013_Edeka.html?nn=3591568`.

The Bundeskartellamt acknowledges these local components of retail competition and defines 345 local catchment areas, which are the basis for decisions on mergers or abuse of dominance (Bundeskartellamt, 2007). In contrast to this rather broad market definition, we define local markets at a more disaggregated level, which corresponds to the classification of municipalities. According to this classification, there are roughly 12,000 local markets and the set of competitors therefore contains all stores located in this municipality. Municipalities have an average size of 32.10 square kilometers (median of $18.10 km^2$) and a standard deviation of $40.58 km^2$.[10] Our definition of local markets is also relatively narrow compared to the definition of the European competition commission (European Commission, 1999) which proposes a definition of the retail market using circles around stores with radii that correspond to 20 minutes driving time by car (roughly 15-20 kilometers) since we believe that most German consumers are likely to do their shopping within a smaller neighborhood close to their residence. However, our market definition could be too narrow for some rural areas but at the same time too wide for big cities such as Hamburg or Berlin. We therefore conduct two sensitivity analyses with respect to market size definition. First, we exclude all regions within a 15km circle around the treatment group. As these regions are potentially affected by the observed mergers, they should not be contained in the control group. Second, we exclude all urban regions from the estimation sample. If regions are defined too widely, we erroneously assign regions not affected by the merger to the treatment group, and our estimates capture a lower bound. Results presented in section 5.3 are consisted with this argument.

Based on these stylized facts discussed above, we develop an empirical strategy which is consistent with observed market characteristics and evidence on retailers' strategies.

3 Data

To estimate the effects of the merger, we exploit a rich data set consisting of a household panel survey complemented with regional information from additional sources. We present and describe this dataset in section 3.1 before reporting details on the construction of products and prices in section 3.2.

3.1 Data description

The primary dataset is a representative survey of households distributed across all regions of Germany obtained by GfK Panel Services. GfK Panel Services collects information on all transactions

[10] We have calculated these numbers using additional information received from DESTATIS `https://www.destatis.de/DE/ZahlenFakten/LaenderRegionen/Regionales/Gemeindeverzeichnis/Gemeindeverzeichnis.html`, accessed March 31, 2017.

of up to 20,000 households which are selected to be representative of the German population with respect to geographical, social, and economic characteristics. This rich dataset entails two distinct features which makes it well-suited for the purpose of our analysis. First, all panel members track their entire purchase history using home-scanning devices. Thus, it contains detailed information on the name of the brand, the label type (national brand or private label), the retailer (e.g., supermarket, discounter, drugstore, or specialized shop), and type of product (including package size among other characteristics) as well as the actual transaction price (including any discounts and promotions). Thus, it gives a more accurate picture of household shopping behavior compared to checkout scanner data—which can only track purchases within a particular store—or datasets from other marketing agencies in Germany, which do not provide information on all discounters (see e.g., Draganska et al., 2011). Second, the data encompass detailed information on panel member characteristics, including the postal code of their residence, their annual income, number of children, and job occupation.

We merge our data with information obtained from INKAR providing regional information at the level of counties ("Kreise") and municipalities ("Gemeinden"). For this purpose, we match postal codes with a municipality identifier for which we use a matching key provided by Deutsche Post, Germany's largest postal service company. Within our sample period, there have been a number of reforms where postal codes were reallocated to other municipalities or where new municipalities were created by merging existing ones. To address this issue, we retrospectively allocate postal codes to the definition of the year of 2010. Furthermore, there are some cases where the local postal code may belong to two (or more) municipalities. Since these postal codes are unlikely to be systematically related to the assignment of the treatment and control group, we drop these cases, which leaves us with 78% of the total observations.

Having matched the postal code to the municipality level also allows us to identify all purchases and prices within a regional market. While we lack precise information about the location of stores, we can assign consumer-level purchases to regions and retail chains. We assume that a retail chain owns at least one store located in a specific region if we observe purchases at the retail chain in the region. Finally, we use additional data from the German cartel office—available at the 2-digit postal code level—to identify regions with remedies.

3.2 Construction of products and prices

Our empirical analysis focuses on four product categories: milk, yogurt, coffee, and toilet paper. The selected products reflect a mix of rather homogeneous base products - milk and toilet paper - and more differentiated products - yogurt and coffee.

Observing an—albeit representative—subsample of the German population has the disadvantage that for some regions and some products we observe low (or sometimes zero) frequencies per day within a region. Consequently, to ensure a sufficient number of observations, we define products as the category-brand combination and aggregate the data to quarterly time periods. Between 2005 and 2010, we observe 3,019,952 purchases. The distribution of purchases across product categories is: 9.1% toilet paper, 9.2% coffee, 44.7% yogurt, and 36% milk purchases. On average, we observe 65 purchases per period and local market ranging between 1 and 9,185 with a standard deviation of 224. To account for panel attrition—that is, entry and exit of panel members into the sample—we restrict our observations to purchases of households that were active at the beginning and at the end of the sample period.

We construct mean prices per product, retailer, and region in eurocents per unit of size. This unit of size depends on the product category. It is either grams or milliliters for food products, i.e., coffee and dairy products. For toilet paper, a per-unit price is used. Our price definition is the transaction price, which is the effective price paid at the checkout counter. In our baseline setting we build separate mean prices for the target and acquirer. To check whether changes in prices reflect composition effects (e.g., because the merger target had fewer national brands in its portfolio than the acquirer), we treat the merging parties as a single firm in markets with pre-merger overlap as a robustness check which we discuss in section 5.3. As a further robustness check, we use prices weighted by the number of purchases, as in Allain et al. (2017).

4 Empirical Strategy

The aim of this study is (i) the ex-post evaluation of the price effects of the merger between retailers $R1$ and $R2$ and (ii) the decomposition of the overall effect into price changes due to changes in (a) local competition and (b) cost savings. For this purpose, we develop a novel and unique identification strategy which we discuss in section 4.1. Section 4.1.1 summarizes the basic assumptions of our identification strategy. Sections 4.1.2 and 4.1.3 give a detailed description of the definition of our treatment and control groups for different market structures. First, we use a standard definition of the treatment and control group in the retrospective retail merger evaluation literature, defining the treatment group as any local market that experienced a change in local concentration after the merger. This approach identifies an average treatment effect assuming retailers do not employ national strategies (section 4.1.2). Since retailers' strategies might be neither completely local nor completely national, we adopt the framework of Allain et al. (2017) to measure the price effect which allows for merger effects at the national level in section 4.1.2. Within this framework, we

are also able to analyze efficiency gains and market power effects by identifying regions where we expect market power to be a dominant force and regions where we expect efficiency gains to play an important role. Section 4.2 presents the empirical specification.

4.1 Identification

A simple before-after analysis is not sufficient to estimate the effects of mergers on prices. Observed price changes might also be attributed to shifts in demand or costs. Therefore, we aim to compare price changes around the merger to a counterfactual scenario in which no merger took place. For this purpose, we exploit the fact that neither the target nor the acquirer owned retail stores in each local market prior to the merger. We thus compare regions which experienced a change in market concentration, i.e., markets in which both $R1$ and $R2$ were active before the merger, to markets without a pre-merger overlap. Our identification strategy therefore relies on the assumption that firms use a regional pricing strategy such that changes in product prices are independent across regional markets—conditional on a range of observable characteristics and fixed effects. The stylized facts in section 2.3 and the market definition exercises of the European competition commission (European Commission, 1999) as well as the German cartel office (Bundeskartellamt, 2014b) provide strong evidence of local pricing decisions, such that we can rule out pure national pricing strategies.

The causal price effect due to the merger is identified by the implementation of a simple difference-in-differences (DiD) estimator. The DiD approach compares the pre- and post-merger prices of treated regions (i.e., regions affected by the merger) to pre- and post-merger prices in a control group. Taking double differences isolates the merger effect from other factors that might impact prices, such as characteristics of regional markets and retail chain-specific demand and cost shocks. However, the estimator relies on a parallel trend assumption, which implies that prices in the treatment and control group would have moved identically in the absence of the merger. For this reason, we describe how we define local markets and their assignment to the treatment or control group in the following subsections.

4.1.1 Treatment and control groups in the baseline scenario

Local markets are defined by the borders of municipalities. The dataset—albeit containing rich information about product and consumer characteristics—lacks information on the location of retail stores. However, it provides the location of every consumer at the postal code level, which allows us to infer store locations by assuming that households buy products in the local market of their residence. We match the postal code to regional data at municipality level via a matching key. Subsequently, we are able to identify all purchases and prices within a local market and for each

quarter. From purchases within the municipality we infer the location of insider firms $R1$ and $R2$. The set of competitors therefore contains all stores located in this municipality.

We follow the literature on retail merger evaluation (e.g. Houde, 2012) to define the **treatment group** as those local markets affected by the merger. More precisely, the baseline specification of our treatment group contains regions which experienced a change in market concentration, i.e. markets in which both $R1$ and $R2$ were active before the merger. As the merger was approved under the condition to sell roughly 300 stores to competitors in some local markets, our definition of treatment groups includes local markets where the competitor acquired the target. Consequently, we add remedy regions to the treatment group, which implies that merging firms in these regions are referred to as $R1$ and $R2$.

Treatment groups are compared to the **control group** of markets without pre-merger overlap, where we assume parallel price trends for the treatment and control group absent the merger. The broadest definition of a control group would contain all local markets without a pre-merger market overlap of acquirer and target. However, we follow Allain et al. (2017) and exclude regional markets that are located geographically close to treatment markets, which could be indirectly affected by the merger and could thus contaminate results. To this extent, we assume that each store is located at the municipality center and we define so-called catchment areas around these stores.[11] As a robustness check, we also construct an algorithm which (i) identifies the center of each municipality, (ii) calculates the distance to all other municipalities, and (iii) eliminates all municipalities within a distance of less than 15 kilometers. Results, however, are robust to this robustness check.

Figure 2(a) illustrates how we define the treatment and control groups for our baseline specification. Treatment regions, which consist of local markets where both $R1$ and $R2$ were active, are colored in red. Control groups—colored in green—are defined as all products in markets without pre-merger overlap. According to this definition, control groups are defined as local markets with (i) only outsiders, (ii) outsiders and either $R1$ *or* $R2$, or (iii) either $R1$ *or* $R2$, but no outsiders. The circle around the treatment groups containing the arrow indicates the aforementioned robustness check, where we exclude counties which have no pre-merger overlap between $R1$ and $R2$ but share a border with a merger county or are located less than 15 kilometers away from a market directly affected by the merger (gray-colored local markets), to ensure that our control group is not contaminated by indirect merger effects (see section 5.3).

The treatment and control group as defined above, identifies price effects due to changes in local market power and regional efficiency gains—if there are any. This specification also serves as a

[11] We use the user-written STATA command opencagegeo (available from http://fmwww.bc.edu/RePEc/bocode/o/opencagegeo.pdf) to obtain the longitude and latitude of each municipality.

simple test for this hypothesis. In case of pure national pricing, we expect to find no significant price differences between the treatment and control group. However, although stylized facts and reduced-form regression provide strong evidence against a pure national pricing strategy, prices might be, at least partially, determined at the national level, and the internalization of competition effects may be adapted globally. If this was the case, insider firms would potentially internalize competition externalities and efficiency gains regardless of their location, implying that prices would uniformly change at a national level. In that case, control markets in which at least one of the insiders operates would be confounded. The subsequent section 4.1.2 provides a setup to address this effect.

4.1.2 Concentration effects, efficiency gains, and net effects with partly national strategies

The above specification incorporates insiders in some of the regional markets. If retailers' prices are affected by national retail strategies or efficiency gains, all local markets with stores that belong to the acquirer's or target's retail chain may be affected by the merger. In this section, we first illustrate how we address this issue. The baseline scenario merely sums up the efficiency gains and concentration effects, where the sign of the overall effect indicates which channel dominates. However, it does not allow disentangling the magnitude of price changes due to efficiency gains from those that stem from a change in market power. Therefore, we also present a novel identification strategy, which is based on modified treatment and control groups, to explore the effect of (the pass-through of) efficiency gains and concentration effects.

Insiders may have benefited from global efficiency gains, which are potentially (partly) passed-on to consumers. In order to learn more about the magnitude of the pass-through of global efficiency gains, we exclude all local markets from the control group which contain either $R1$ or $R2$ (see Figure 1(b)). Intuitively, we now compare markets with a pre-merger overlap to a control group of unaffected markets without insiders. In this setup, the price effect is only identified by the price adjustments of competitors since we estimate price effects at the market-retailer-brand level and insiders are not present in the control group. Thus, we compare the prices of outsiders in the treatment and control group. We expect to see price effects if outsiders respond strategically to the merger. Excluding regions with insiders from the control group eliminates the effect of potential regional efficiency gains and allows us to focus on efficiency gains at the national level. Abstracting from regional efficiency gains—such as an increase in local bargaining power or cost savings from local transportation—seems reasonable for the merger as we have outlined in section 2.3. Since $R1$ pursues a national purchasing strategy, distribution cost savings are likely to be internalized at the national level. The same applies to cost reductions that can be achieved through increased

bargaining power with respect to suppliers. Even though the specification excludes both insiders, control markets are a reasonable comparison for treatment markets since (i) we have a sufficient number of cases (see Table 3) and (ii) outsider $O1$—a close competitor with a similar business strategy and format as $R1$—is active in many of those regions. Further figures 3–6 show that trends in pre-merger prices are very similar between treatment and control markets. In this specification, price effects should be lower—compared to the baseline scenario—since insiders potentially benefit from nationwide efficiency gains and these might be (partly) passed on to consumers. Such global cost savings are likely to be partially canceled out in the previous specification, whereas they are likely to affect only the treatment group when regional markets with insiders are excluded from the control group.

Second, we further adjust the definition of the control group to identify upward-pricing pressure induced by the merger. More precisely, we adjust the control group such that it contains all local markets where at least one of the insiders operates (see Figure 1(c)). This is the opposite of the aforementioned case in which control groups are defined as local markets with outsiders only. The specification identifies price increases due to an increase in market power. Since insiders' stores are present in both the treatment and control group, global efficiency gains are canceled out. Identification of this effect hinges on the assumptions (i) that retailers employ a national bargaining strategy on the supply side instead of leaving negotiations to local merchants and (ii) there is equal pass-through of efficiency gains in treatment and control group. While we confidently assume the former given anecdotal evidence discussed above, the latter assumption might be violated. However, if there are indeed local efficiency gains in markets with both acquirer and target stores, this would imply relatively lower prices in the treatment group, and our estimates of price increases due to increased market power can be interpreted as a lower bound.

Finally, we investigate the pass-through of efficiency gains. In this specification, our control group consists of markets with outsiders only, while the treatment group contains markets in which one but not both of the merging parties were active before the merger (Figure 1(d)). Since, in this specification, we compare markets without a pre-merger overlap of acquirer and target to a control group of markets without insiders, there are no systematic changes in local competition that affect the estimates. Hence, relative price changes stem from changes in outsiders' responses to price decreases due to insiders' efficiency gains.

Figure 3 summarizes the different definitions of the treatment and control markets for our various settings. Markets of type A are those where we expect efficiency gains and market power effects to be present. Markets of type B are markets that presumably are affected by efficiency gains but not by changes in market power, since there is no pre-merger overlap of acquirer and target in these

markets. Markets of type C contain outsiders only and thus we expect neither market power nor efficiency effects to play an important role. Concentration effects are identified by comparing type A markets to type B markets. Efficiency gains are identified by a comparison of type B markets with type C markets. Figures 3–6 show pre-merger price trends for the different market types. For all settings, pre-merger price trends are similar between the treatment and control group for all product categories.

It is worth noting that the year of the financial crisis in 2008 is covered in our estimation sample. However, we believe that this incidence does not drive our results for three reasons. First, its impact on Germany's economy is lower relative to other European countries.[12] Second, although it might be that the financial crisis impacted treatment and control regions to a different extent, figure 7 shows that economic indicators evolved similarly within both types of regions. Third and finally, despite the fact that economic indicators do not impact the treatment and control group differently, we nonetheless include unemployment rate and household income as control variables into our regression analysis to account for the fact that they might have a potential impact on the results conditional on other control variables and fixed effects.

4.2 Empirical implementation

For our baseline specification, we use a simple difference-in-differences (DiD) estimator to analyze the effects of the merger on regional consumer prices. The assignment of local markets to treatment and control group in this baseline specification corresponds to the definition in Figure 2(a). In section 5.2, we present further results on varying local market types (Figure 2(b)–Figure 2(d). The baseline specification estimates:

$$ln(p_{igjt}) = \alpha_{igj} + \theta\, post_t \times MA_g + \delta_t + [x'_{gt}\beta + \eta_{it} + \omega_{kt}] + \varepsilon_{igjt} \tag{1}$$

where $ln(p_{igjt})$ denotes the logarithmic product price set by retail chain i in regional market g (defined at the county level, e.g., Cologne), for brand j at quarterly time period t. Since both merging retailers have different product portfolios pre- and post-merger, we calculate mean prices for both retailers' product portfolios in the estimation sample. However, since there might be a composition effect, we implement a robustness check, where we treat branded products of the merging retail chains like a product of one retailer in markets with a pre-merger overlap of $R1$ and

[12] Both national and international newspapers reported that Germany's strategies to recover from the financial crisis worked quite well. See, for instance, `http://www.nytimes.com/2010/08/14/world/europe/14germany.html` or `http://www.spiegel.de/international/business/global-debt-disaster-what-the-financial-crisis-means-for-germany-a-779306.html`, both accessed November 12, 2017.

$R2$. Private labels sold by the target retail chain in re-branded stores will not enter the estimation since they disappear in the post-merger period.

α_{igj} is a retailer-market-product fixed effect, $post_t$ takes on a value of one in all post-merger periods, MA_g is a dummy variable indicating regions affected by the merger and δ_t denotes a full set of time dummies. In some specifications, we add the terms in brackets: x'_{gt} controls for time-varying demand heterogeneity at the regional level through changes in average income, population density and unemployment. η_{it} denotes retail chain-time fixed effects which control for nationwide price changes across retailers. Note that these also capture any concentration and efficiency effects of the merger which do not vary across regions. ω_{kt} controls for overall price changes in product categories (k) across time.[13] Finally, ε_{igjt} is an error term. Our main coefficient of interest is the DiD-parameter θ which indicates differences between adjustments of consumer prices within retailer-products across regions at the time of the merger. Since our dependent variable is retailer-product-region specific, while our treatment indicator only varies across regions within years, we compute standard errors that are clustered at the region level.

We extend our baseline specification in several dimensions. First, we analyze heterogeneous effects across private label products and national brands by estimating the following specification:

$$ln(p_{igjt}) = \alpha_{igj} + \theta_1\, post_t \times MA_g + \theta_2\, post_t \times MA_g \times PL_j + \delta_t + [x'_{gt}\gamma + \eta_{it} + \omega_{kt}] + \varepsilon_{igjt} \quad (2)$$

where PL_j takes on a value of one if product j is sold under a private label. In this specification, θ_1 measures the treatment effect for products sold under national brand names, while θ_2 indicates differences between price effects for private label products relative to those for national brands.

Next, we extend equation (1) to allow for heterogeneous retail chain-specific treatment effects:

$$ln(p_{igjt}) = \alpha_{igj} + \varphi_1\, post_t \times MA_g + \varphi_2\, post_t \times MA_g \times DC_i + \delta_t + [x'_{gt}\pi + \eta_{it} + \omega_{kt}] + \varepsilon_{igjt} \quad (3)$$

where DC_i takes on a value of one for discounters and φ_2 measures differences in price changes between supermarkets and discounters. We also use a similar specification in which we replace DC with a dummy variable for insiders to distinguish between the effects on merging parties and non-merging competitors.

In another extension of our baseline model, we investigate whether price increases are more likely to occur in markets with high expected changes in concentration. For this purpose, we follow Dafny et al. (2012) and construct the predicted change in the Herfindahl-Index (HHI) induced by

[13] To capture product-specific trends, we had to aggregate products j to product categories k since we do not observe the purchases of all products in all regions.

the merger:

$$\Delta simHHI_{gk} = 2 \times Acqshare_{gk} \times Tarshare_{gk} \tag{4}$$

where $Acqshare_{gk}$ and $Tarshare_{gk}$ denote the pre-merger market shares for region g and product category k of acquirer and target, respectively. For instance, if the acquirer and target have pre-merger market shares of 10% each, HHI, the sum of squared market shares, would be expected to change by 0.02. We use this predicted change in concentration to test the hypothesis that price increases are more likely to occur in regional markets with substantial changes in retail concentration in the following equation:

$$ln(p_{igjt}) = \alpha_{igj} + \tau_1\, post_t \times MA_g + \tau_2\, post_t \times MA_g \times \Delta simHHI_{gk} + \delta_t + [x'_{gt}\kappa + \eta_{it} + \omega_{kt}] + \varepsilon_{igjt} \tag{5}$$

In this specification, τ_1 estimates the effect of the merger on prices that is independent of initial market shares of acquirer and target. τ_2 captures heterogeneity of the treatment effects with respect to variation in expected regional retail market concentration.

Finally, we analyze whether remedies imposed by the German cartel office, which required the sale of several retail stores to a competitor in regional markets with high pre-merger market shares of the acquirer and target, had the desired effects. For this purpose, we estimate:

$$ln(p_{igjt}) = \alpha_{igj} + \lambda_1 post_t \times MA_g + \lambda_2 post_t \times MA_g \times Rem_g + \delta_t + [x'_{gt}\nu + \eta_{it} + \omega_{kt}] + \varepsilon_{igjt} \tag{6}$$

where Rem_g takes on a value of one if remedies were imposed in market g and MA_g indicates regions affected by the merger which includes regions with and without remedies. Thus, λ_1 measures the estimated impact of the merger in non-remedy regions and λ_2 indicates whether there are different effects in regional markets in which remedies have been imposed.

5 Results

This section presents the empirical findings. We first discuss the baseline results in section 5.1 where we analyze average and heterogeneous treatment effects by comparing relative price changes of the treatment group with a control group focusing on local effects and abstracting from national pricing strategies and efficiency gains. We introduce and discuss heterogeneous treatment effects for varying market power, remedy and non-remedy regions, and discounters and supermarkets. The

next section, 5.2, discusses the results of a setup in which market concentration effects and efficiency gains are identified using different definitions of the treatment and control groups along with the net effect accounting for national strategies. Finally, we present a series of robustness tests in section 5.3.

5.1 Baseline Results

Table 4 summarizes the baseline results which are based on the assumption that there are no nationwide price effects of the merger. Regions affected by the merger might be systematically different from regions without stores operated by the merging parties. To account for this possible confounding, we include fixed effects for region-retailer-brand, retailer-time, and category-time. We also control for time-varying variables at the regional level including population density, mean income, mean age, unemployment rate, and the average number of children per household. Thus, we assume that assignment to treatment and control group is random conditional on our rich set of covariates.

Models 1 shows a positive significant treatment effect for the baseline specification. Model 2 includes an interaction term with the expected change in concentration, ΔHHI. Markets with relatively high pre-merger market shares of the merging parties should be affected relatively more by the merger if prices respond to changes in market concentration. The positive significant interaction term confirms this intuition. The interaction effect is also economically significant. For instance, for a market in which $R1$ and $R2$ hold pre-merger market shares of 30% and 15%, respectively, the model predicts a price increase of 1%. For the highest value of ΔHHI in the sample, which corresponds to a region in which the acquirer's and target's pre-merger market shares were close to 50% each, the estimates indicate that prices increased by about 4.24% due to the merger.

Model 3 extends model 1 through an interaction term between treatment regions and discounters. The average treatment effect for non-discounters is 0.77% and highly statistically significant, indicating that supermarkets have, on average, slightly raised prices due to the merger. The insignificant result for discounters indicates that this retail format is perceived as a limited substitute for supermarkets. Model 4 combines models 2 and 3 and includes separate interaction terms with expected changes in market concentration for discounters and supermarkets. The results indicate that supermarkets, but not discounters, increased prices in regions with high expected change in retail concentration. For instance, the model predicts a price increase of 1.9% in a market where acquirer and target had pre-merger market shares of 30% and 15% and a maximum price increase of 7.6% in a hypothetical market where $R1$ and $R2$ both have a 50% market share before the merger. Models 5 and 6 are based on the same estimation equations as models 1 and 3, respectively, but are based on a treatment group that consists of remedy regions only and excludes non-remedy regions

that contain stores of both $R1$ and $R2$. The estimated effect in regions where remedies have been imposed is larger than the average effect in the baseline specification. As discussed in section 2.1, remedy regions consist of relatively highly concentrated local markets (Bundeskartellamt, 2007). Our results indicate that the remedies imposed were not sufficient to offset the anti-competitive effects of the merger.

5.2 Market concentration, Efficiency Gains, and Net Effect with National Strategies

In this subsection, we provide further evidence for heterogeneous treatment effects which are related to local market structure. We first present the net effect of market concentration and efficiency gains, which allow for nationwide effects of the merger. As outlined in section 4.1.2, identification of the net effect and efficiency gains is based on the assumption that outsiders adjust their prices to insiders' cost savings, for which we provide evidence in Table A2.

Model 7 in Table 5 identifies the net effect of market concentration and efficiency gains, taking into account national strategies. In this specification, the treatment group consists of outsiders in markets with a pre-merger overlap of acquirer and target, while the control group includes outsiders in markets without any presence of the merging parties. Differences between the treatment and control group are therefore likely to stem from both changes in market concentration and from outsiders' reaction to efficiency gains and corresponding price adjustments of insiders. The estimated average effect is negative but non-significant. Model 8 includes an interaction term with the expected change in market concentration which again indicates that price increases are more likely in regions where acquirer and target have higher pre-merger market shares.

In specification 9, we restrict the control group to regions in which exactly one of the merging retailers was active. If we expect efficiency gains to play a role, the estimated coefficient should be lower in magnitude in the net effect specification (model 7) compared to the market power specification (model 9) where we identify price effects that stem from an increase in market concentration net of nationwide cost savings. Intuitively, insiders in both treatment and control group can benefit from lower costs due to nationwide efficiency gains or higher bargaining power after the merger. If these cost savings are passed on to consumers, outsiders in both treatment and control group are likely to adjust their prices as well. At the same, market concentration changes systematically in the treatment group but not in the control group. As expected, there is a larger treatment effect in this specification than in the net effect model. Prices in regions affected by market concentration increase, on average, by 0.55%. Model 10 includes an interaction term with the expected change in concentration which is again significant and positive. Hence, we indeed find support for the hy-

pothesis of price increases in regions where changes in market concentration are likely to dominate efficiency gains from the merger. This result is in line with several studies on retailing markets which indicate that higher seller concentration (less competition) is associated with higher prices (von Ungern-Sternberg, 1996; Dobson and Waterson, 1997). Our results are also in line with Dafny et al. (2012) and Ashenfelter et al. (2015) who find that prices increased substantially in markets with high predicted changes in market concentration.

In models 11 and 12, we use the same control group as in models 9 and 10, but the treatment group now consists of markets in which only one of the merging retailers was active prior to the merger. In this specification, retailers in the treatment group operate in a market where the parties potentially experience a reduction in costs which might induce price reactions from both insiders and outsiders, but there is no systematic change in market concentration in either the treatment or control group. This allows us to identify downward pressure on prices due to nationwide efficiency gains. The treatment effect is (weakly significantly) negative, indicating a decrease in relative prices of 1.0% on average. Intuitively, we would expect that the pass-through of lower costs to consumer prices is higher in competitive markets. Model 12 includes an interaction term with the pre-merger *level* of the HHI.[14] The base effect increases in absolute terms and becomes more significant. The interaction term is positive and statistically significant which indicates lower price reductions induced by cost savings in ex ante more concentrated markets. Hence, we find support for pass-through of cost savings in markets where merging firms are likely to benefit from cost savings, a result which is consistent with the argument of Williamson (1968). It seems noteworthy that this specification does not allow us to identify the magnitude of efficiency gains since we measure the pass-through of cost-savings on consumer prices. Moreover, although we quantify the decrease in prices for consumers of certain markets, we are not able to identify the source of these price changes, which presumably stem from efficiency gains or increased bargaining power.

Price reactions to the merger presumably take time as retailers have to adjust to the new industry structure. This is particularly true in the case of cost savings which might not be realized immediately after the merger. Table 6 shows heterogeneous treatment effects across time for the market concentration, the net, the efficiency, and the baseline specification. The market power specification shows that prices already increased in the year 2009 but to a larger extent in 2010, statistically and economically. The efficiency specification shows that the average effect is driven by the year 2010 indicating that efficiency gains took one year to be realized.

Table A3 in the appendix shows interaction terms between discounters and indicators for treatment regions in columns 1 and 2. Time heterogeneous treatment effects for discounters and non-

[14]Note that the predicted change in market concentration, ΔHHI, is zero for all markets in this specification.

discounters are depicted in columns 3–5. The first column indicates that the market power effect is mainly driven by supermarkets, whereas results are less clear for responses to potential cost savings. Columns 3–5 indicate that treatment effects are more pronounced in 2010 compared to 2009.

Our study contributes to understanding the ambiguous results produced by an increasing number of studies on ex-post merger analysis in the retail sector. For instance, Allain et al. (2017) report a significant price increase after a merger among French retailers while Argentesi et al. (2016) find no significant price changes within product categories after mergers in the Dutch retail market and Hosken et al. (forthcoming) analyze 14 retail mergers and find that prices decreased after some mergers while they increased or remained unchanged in other cases. Our results indicate that the mixed results might be explained by a combination of efficiency gains and market concentration effects which are not uniform across local markets and, to some extent, by heterogeneous responses of supermarkets and discounters.

5.3 Robustness Checks

In this section, we discuss the results of various robustness checks. First, we use alternative measures of aggregate prices. For instance, we replace mean prices with median prices and construct prices weighted by the number of purchases. Furthermore, we treat the merging parties as a single firm in both pre and post-merger periods. Second, we remove neighboring markets from the control group to account for possible spillovers. Third, we employ a propensity score re-weighting estimator. Finally, we perform placebo tests in order to check whether our results can be explained by heterogeneity in unobserved trends.

In the baseline specification, we use average unit prices across purchases within a region. Estimates using mean prices could potentially be affected by outliers. To mitigate this concern, Table A4 shows results using median prices instead of mean prices. In the baseline specification, we do not account for quantities purchased at a certain price when we construct mean prices at the regional level. Table A5 shows results for weighted average prices where we calculate prices as the ratio between sales and quantity purchased. Our main results, obtained in models 1–4 of Table 4 are robust toward these alternative measures of local prices.

The estimates could be driven by composition effects, for instance, if the merging retailers—instead of raising the prices within products—adapt their portfolio toward more expensive products. To assess whether such a strategy affects our results, we treat the merging parties as a single retailer and re-implement our DiD analysis. Results of this specification are shown in Table A6. To further investigate variety effects, in Table A7 we test whether retailers adapt the number of products sold post-merger. The results show that there is a change in the variety of inside discounters. The effect

is more pronounced in markets with a larger expected change in market concentration. However, the price changes cannot be explained by this change in variety. The positive price effect is driven by insider and outsider supermarkets, whereas variety changes are driven by inside discounters. The price changes due to efficiency gains are identified by outsiders but the variety results indicate that outsiders do not change the variety.

Another potential concern relates to the definition of local markets and spillovers to regions which are part of the control group. If retailers in neighboring markets, assigned to our control group, adjust their prices in response to prices in treatment regions, they do not provide an accurate estimate of the counterfactual. To address this problem, we remove all markets from the control group which are within a 15km radius of markets in the treatment groups, in a further robustness check. Table A8 shows specifications which correspond to models 1–4 of Table 4. In this specification, the average treatment effect increases compared to the baseline specification. Heterogeneous effects indicated by interaction terms are of similar magnitude as in the baseline specification. In another specification we remove all cities from the sample. Table A9 shows the results of this robustness check. The average effect disappears, but the effect in the highly concentrated markets remain.

As a further robustness check, we use a propensity score re-weighting estimator. This estimator assigns higher weights to control markets that are more similar to markets in the treatment group. Matching has been performed on average pre-merger growth rates of prices and demographics. Table A10 shows the results of the matching procedure indicating that the variables are balanced between the treatment and control group after reweighting. Table A11 shows regression results in which observations in the treatment group are assigned a weight equal to 1 and control markets are assigned a weight of p/(1-p), where p is the estimated probability of being treated. The main results hold in this set up suggesting that the treatment effect is not driven by fundamental differences in the characteristics of treatment and control markets.

In addition to these alternative specifications, we performed two placebo tests. In the first test, we randomly assign a market to the treatment group but use the actual time of the merger to define pre- and post-treatment observations. We perform this procedure 10 times and estimate model 3 of Table 4 for each random draw. Table A12 presents the results of this test. None of the draws shows significant results, indicating that our results with the correct definition of the treatment group have not been obtained by chance.

A potential concern in DiD regressions is that estimated effects picks up heterogeneous trends in the treatment and the control group. To check whether heterogeneous trends can explain our results, we vary the treatment time definition by assigning it to dates before the actual merger took place and discard all observations in the merger year 2007 and post-merger observations. Thus, we use the

correct regional definition of the treatment and control groups but restrict the sample to pre-merger years. If there are systematically different pre-merger time trends between the treatment and control group, this should result in a significant estimated treatment effect in this placebo test. Table A13 shows the result of three different definitions of the treatment time period. All specifications yield insignificant estimated treatment effects indicating that pre-merger time trends are unlikely to affect our results. Note, we cannot conduct the placebo tests adding the interaction of treatment effect with the expected change in the HHI since that variable is solely defined for regions in the treatment group.

6 Conclusion

In this paper we analyze the impact of a retail merger, in which a supermarket acquired a soft discounter, on consumer prices in Germany. We exploit geographical and time series variation in price setting by retail chains, and the fact that both the acquirer and target were not active in all regional markets before the merger, to estimate the causal effect of the retail merger on prices. We find a small average prices increase and considerable heterogeneity of merger effects. The estimated effects increase significantly with predicted changes in market concentration and amount to about 4% in markets with the highest pre-merger market shares of the acquirer and target. Our results indicate that the treatment effect is driven by supermarkets rather than discounters and that average price reactions are more pronounced in remedy regions where the acquirer had to sell the target's stores to an outsider. We also provide evidence that efficiency gains have partly offset price increases due to market power in some regions. It seems that the merger even resulted in lower prices in regions that were potentially affected by nationwide efficiency gains but not by a change in local market concentration. We find the largest relative price increases when we compare regions with ex ante predicted changes in markets concentration to regions that are not affected by a change in market structure but are presumably similarly affected by nationwide cost savings of the merged entity. This cross-regional heterogeneity of merger effects can potentially explain the ambiguous results of previous ex post merger evaluations in the retail sector.

Our results have important implications for economic policy and competition authorities in particular. First, they indicate that increasing retail concentration in general is a potential concern for consumer welfare as it will likely lead to higher prices. Second, our results suggest that price increases after mergers can be predicted by the pre-merger market shares of acquirer and the target. Moreover, our results indicate that cost savings induced by retail mergers can be significant and can partly offset anti-competitive effects. Finally, we also provide evidence that remedies imposed by

competition authorities were not sufficient to offset anti-competitive effects.

There are several possible directions for future research. First, we would like to develop a structural model that is able to disentangle the channels of price changes in more detail and to decompose cost savings into efficiency gains and changes in bargaining power. Second, it would be valuable to analyze whether cross-regional variation in price changes can be predicted by merger simulation tools adjusted to the retail sector. Finally, given the increased availability of consumer and store level data, it will be interesting to see to which extent our results apply to different merger cases in various countries.

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7 Figures

Figure 1: Analysis of Variance in Local and National Component

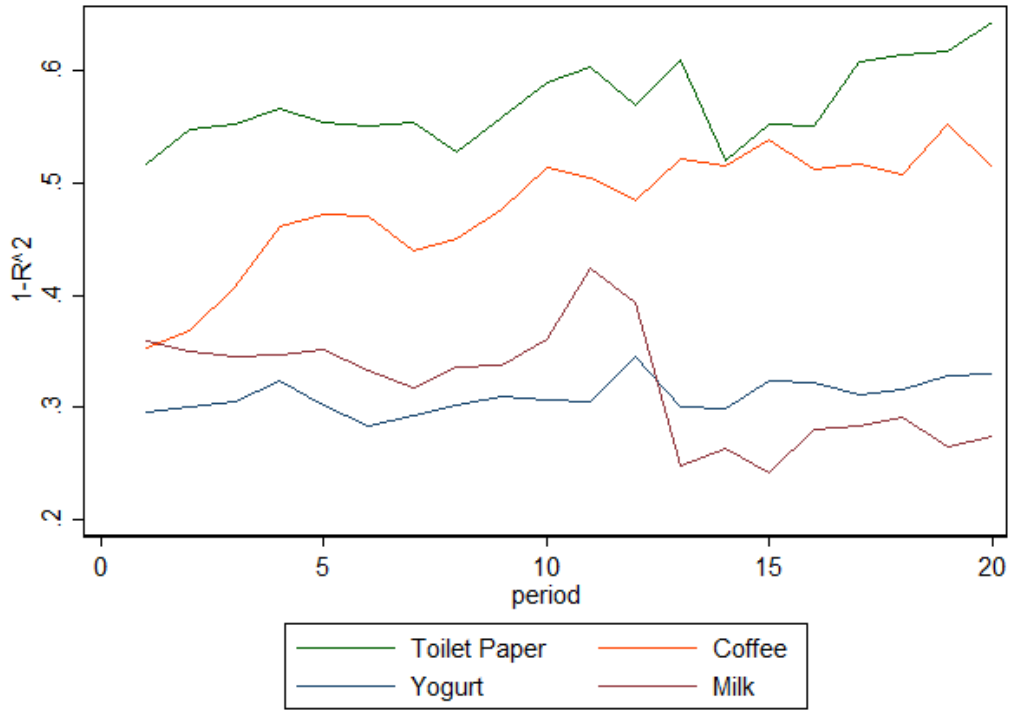
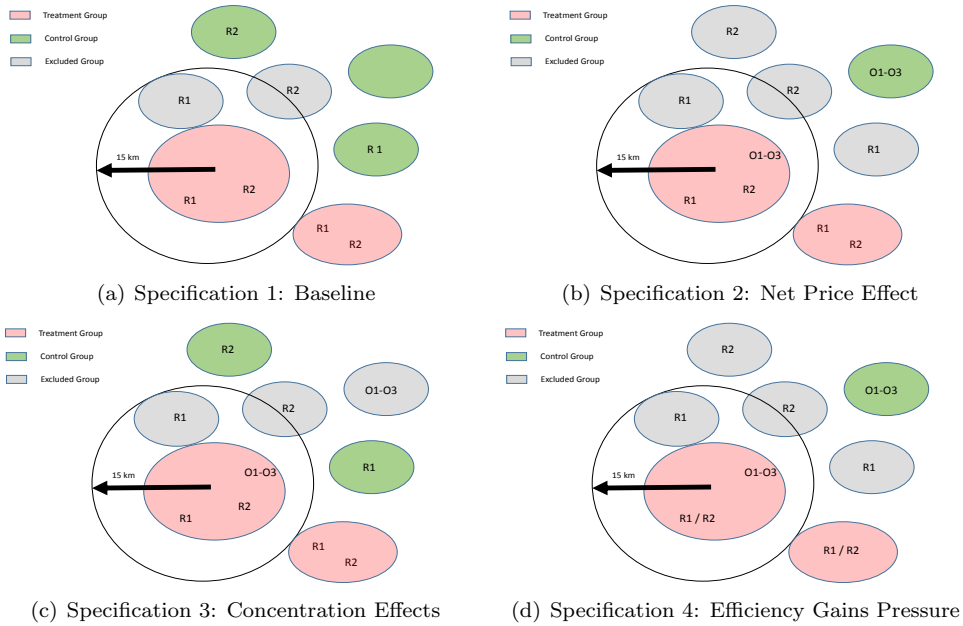


Figure 2: Definition of Treatment and Control Groups



(a) Specification 1: Baseline

(b) Specification 2: Net Price Effect

(c) Specification 3: Concentration Effects

(d) Specification 4: Efficiency Gains Pressure

Figure 3: Parallel Trends over Categories in Baseline Specification

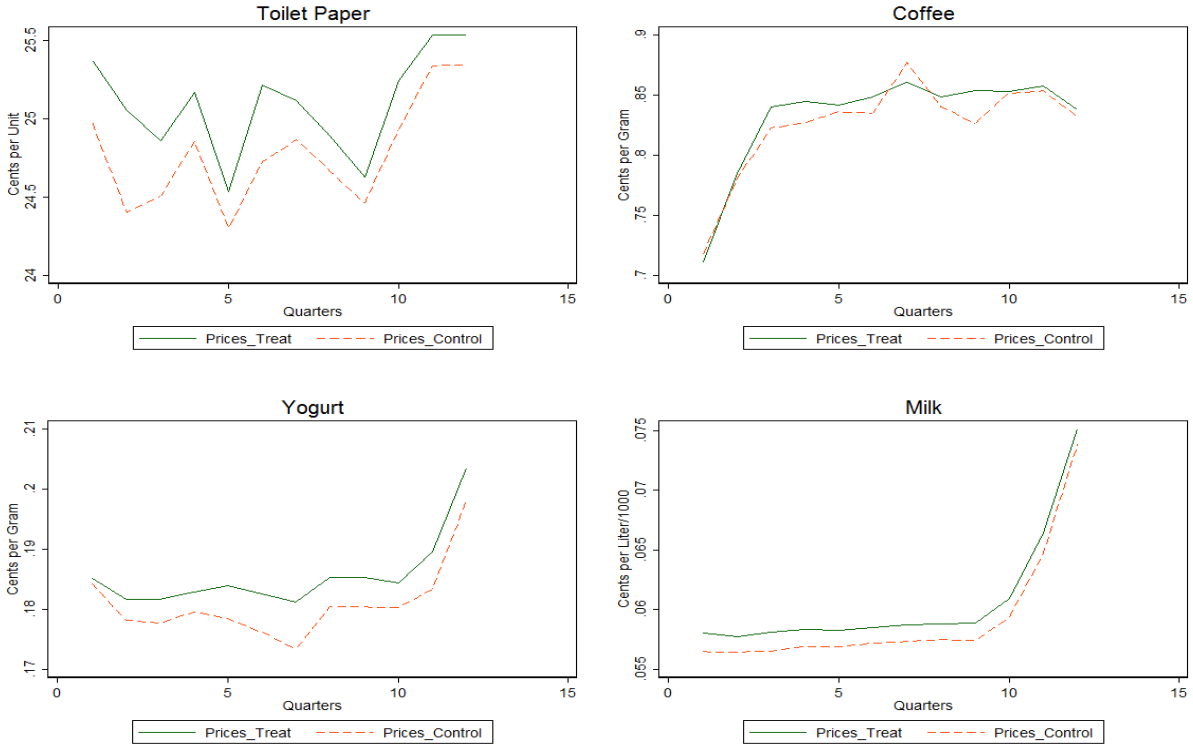


Figure 4: Parallel Trends over Categories in Net Effect with National Strategies Specification

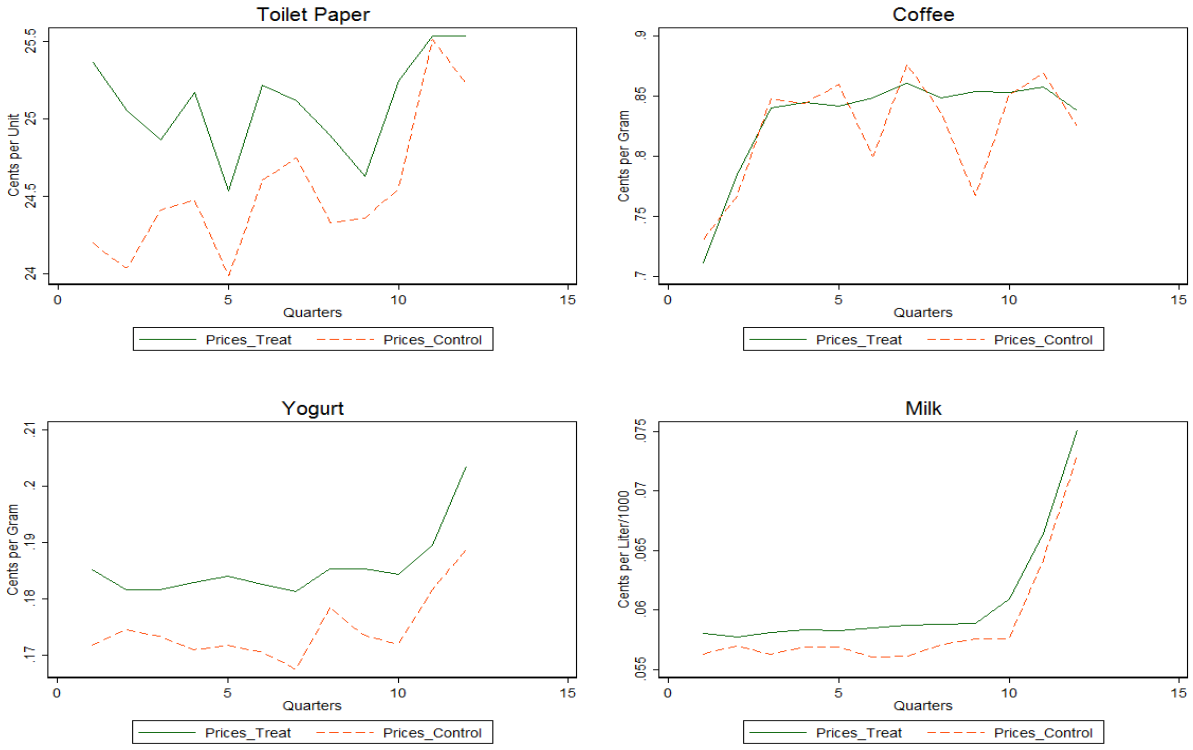


Figure 5: Parallel Trends over Categories in Market Concentration Specification

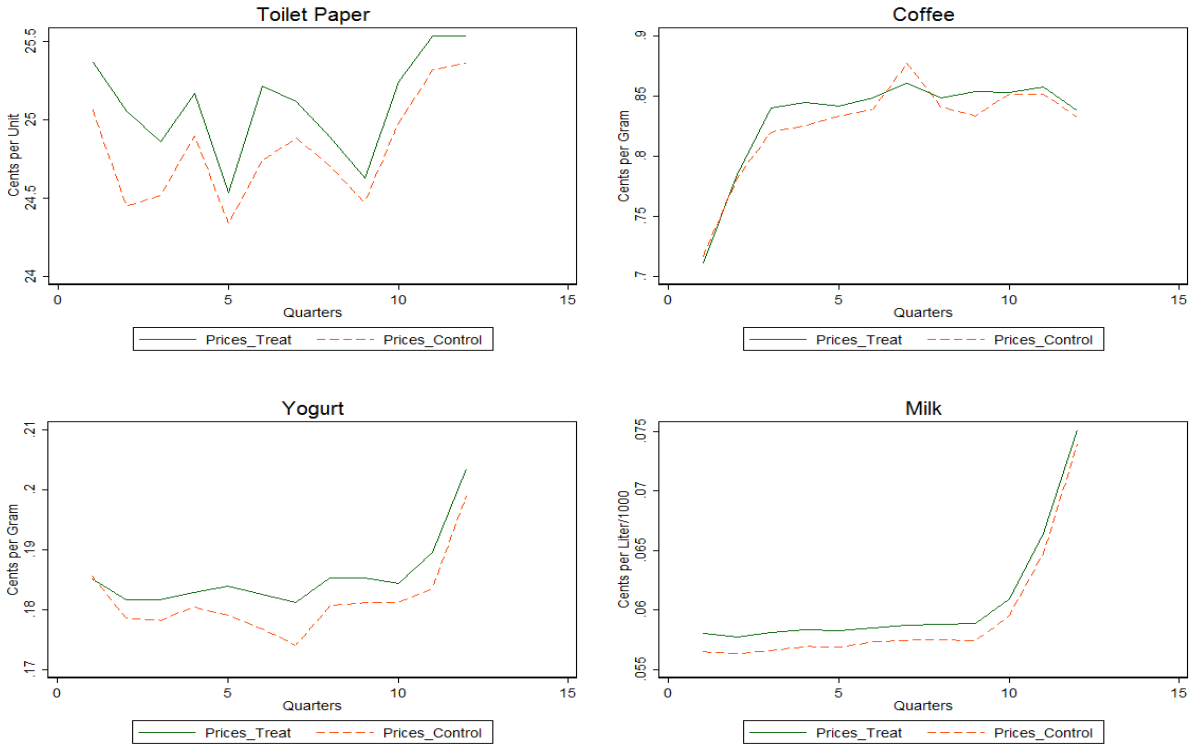


Figure 6: Parallel Trends over Categories in Efficiency Gains Specification

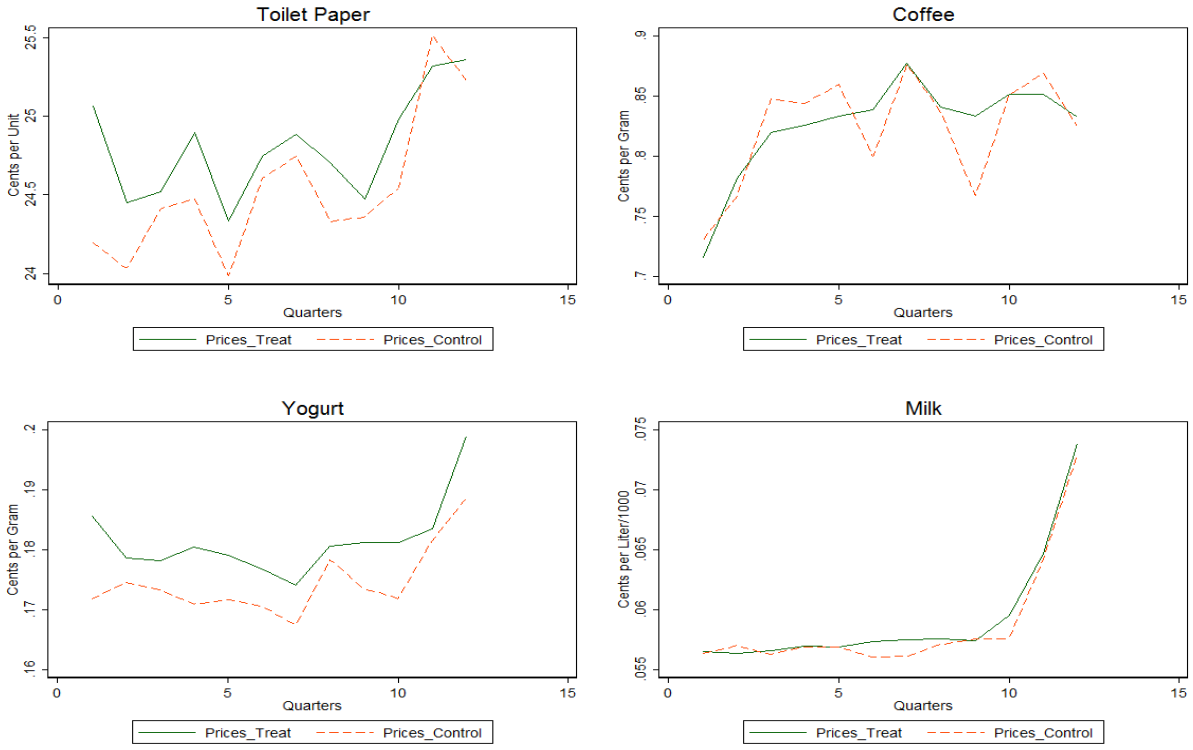
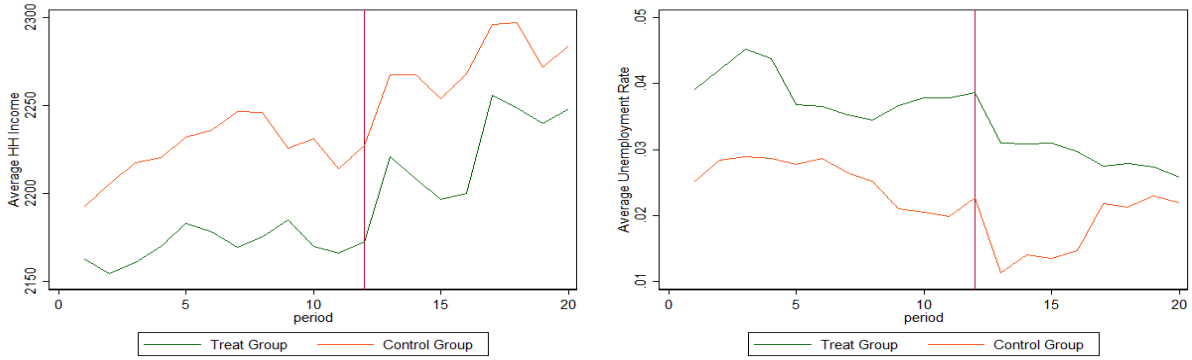


Figure 7: Average Income and Unemployment Rate



8 Tables

Table 1: Market shares in percent

		Supermarkets		Discounters	
		Pre	Post	Pre	Post
Toilet Paper	National Brands	15.48	12.76	2.36	2.31
	Private Labels	26.67	29.76	55.49	55.17
Coffee	National Brands	52.92	49.82	16.49	22.28
	Private Labels	3.72	2.57	26.87	25.33
Yogurt	National Brands	37.03	33.63	9.26	11.02
	Private Labels	6.61	10.47	47.11	44.89
Milk	National Brands	15.97	12.45	2.55	2.17
	Private Labels	27.63	30.53	53.86	54.84

Notes: Market shares were calculated using revenue data from all shopping trips conducted by the representative panel members selected by the Gesellschaft für Konsumforschung (GfK). Shares were calculated from sales data from January 2005 through December 2010 without the year 2008. A market here is defined by pre and post-merger and product category.

Table 2: Average prices by product category

		Supermarkets		Discounters	
		Pre	Post	Pre	Post
Toilet paper	Control	25.82	28.31	23.64	26.65
	Treat	25.92	28.53	23.48	26.74
Coffee	Control	92.84	101.6	70.82	74.05
	Treat	92.15	100.6	72.45	75.27
Yogurt	Control	20.3	22.33	15.03	16.81
	Treat	20.23	22.27	14.99	16.91
Milk	Control	6.31	6.32	5.47	5.3
	Treat	6.2	6.35	5.47	5.27

Notes: The table reports average prices by retail format, product category, and treatment status. Average prices are calculated from the observed purchases by consumers in our sample. According to the respective order, pricing units are: cents per unit, cents per 100 gram, cents per 100 gram, cents per unit, cents per 100 ml

Table 3: Market Types

Type	Players	Concentration	Efficiency	Frequency
A	R1 **and** R2, O	X	X	1816
B	R1 **or** R2, O	-	X	1417
C	O	-	-	424

Table 4: Baseline Results

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Treat	0.0047**	0.0039*	0.0077***	0.0063**	0.0042	0.013***
	(0.0021)	(0.0021)	(0.0030)	(0.0030)	(0.0035)	(0.0048)
Treat × ΔHHI		0.077**		0.14***		
		(0.039)		(0.048)		
Treat × *DC*			-0.0061*	-0.0046		-0.016***
			(0.0035)	(0.0036)		(0.0056)
Treat × *DC* × ΔHHI				-0.15**		
				(0.063)		
Region	all	all	all	all	remedy	remedy
FEs for Region-Retailer-Brand, Category-Time, Retailer-Time + Regional Controls						
N	816103	816103	816103	816103	289771	289771
R^2	0.994	0.994	0.994	0.994	0.994	0.994

Notes: The dependent variable are log mean prices at the region-retailer-brand level. Treat is a dummy variable taking the value 1 post-merger for local markets that contain both the merging parties. ΔHHI is the expected change in market concentration. Regional controls consist of population density, the mean income, the mean age, the unemployment rate, and the average number of children per household. DC is a dummy variable taking value 1 if the supermarket is a discounter. Standard errors are clustered at regional level and shown in parentheses. Significant at 1% ***, Significant at 5% **, Significant at 10% *.

Table 5: Disentangling Price Effects

Effect	Model 7 Net	Model 8 Net	Model 9 M Power	Model 10 M Power	Model 11 Efficiency	Model 12 Efficiency
Treat	-0.0041	-0.0048	0.0055**	0.0048**	-0.0100*	-0.016***
	(0.0054)	(0.0054)	(0.0022)	(0.0022)	(0.0056)	(0.0058)
Treat $\times$ ΔHHI		0.073*		0.076*		
		(0.039)		(0.039)		
Treat $\times$ *HHI*						0.022***
						(0.0059)
FEs for Region-Retailer-Brand, Category-Time, Retailer-Time + Regional Controls						
N	627463	627463	794766	794766	209947	209947
R^2	0.994	0.994	0.994	0.994	0.996	0.996

Notes: The dependent variable are log mean prices at the region-retailer-brand level. In columns 1, 2, 3, 4 Treat is a dummy variable taking the value 1 post-merger for local markets that contain both the merging parties. In columns 5 and 6 Treat takes value 1 post-merger in markets where only one of the merging parties is present. In columns 3 and 4 the control group consists of markets with exactly one of the merging parties present. In all other columns the control group are markets where no merging party is active. ΔHHI is the expected change in market concentration. HHI is the HHI index in levels. Regional controls consist of population density, the mean income, the mean age, the unemployment rate, and the average number of children per household. Standard errors are clustered at regional level and shown in parentheses. Significant at 1% ***, Significant at 5% **, Significant at 10% *.

Table 6: Disentangling Time Heterogeneous Price Effects

Effect	Model 7 M Power	Model 9 Net	Model 11 Efficiency	Model 1 Baseline
Treat × *2009*	0.0041*	-0.0017	-0.0063	0.0036*
	(0.0022)	(0.0055)	(0.0057)	(0.0022)
Treat × *2010*	0.0071***	-0.0067	-0.014**	0.0058**
	(0.0025)	(0.0061)	(0.0064)	(0.0024)
FEs for Region-Retailer-Brand, Category-Time, Retailer-Time + Regional Controls				
N	794766	627463	209947	816103
R^2	0.994	0.994	0.996	0.994

Notes: The dependent variable are log mean prices at the region-retailer-brand level. In columns 1, 2, and 4 Treat is a dummy variable taking the value 1 post-merger for local markets that contain both the merging parties. In column 3 Treat takes value 1 post-merger in markets where only one of the merging parties is present. In column 1 the control group consists of markets with exactly one of the merging parties present. In columns 2 and 3 the control group are markets where no merging party is active. The control group in the baseline scenario are all markets without overlap of the merging parties. Regional controls consist of population density, the mean income, the mean age, the unemployment rate, and the average number of children per household. Standard errors are clustered at regional level and shown in parentheses. Significant at 1% ***, Significant at 5% **, Significant at 10% *.

A Appendix

Table A1: Regional Characteristics

Population Density	0.12***	0.11***	0.010***	0.0092***	0.0096***
	(0.0098)	(0.0096)	(0.0014)	(0.0012)	(0.0012)
Unemployment Rate	0.066	0.066*	-0.0090	-0.0099	-0.0098
	(0.042)	(0.039)	(0.0078)	(0.0077)	(0.0076)
Average Children	-0.0046	-0.0069	-0.0070***	-0.0072***	-0.0072***
	(0.0096)	(0.0092)	(0.0018)	(0.0018)	(0.0017)
HH Income	0.0015	0.0016	0.0054***	0.0067***	0.0066***
	(0.0090)	(0.0090)	(0.0017)	(0.0016)	(0.0016)
Age	-0.47	0.00072	-0.0011***	-0.0010***	-0.99***
	(0.73)	(0.71)	(0.14)	(0.13)	(0.13)
HHI	0.48***	0.58***	-0.010***	-0.0084**	-0.0092***
	(0.034)	(0.031)	(0.0040)	(0.0035)	(0.0035)
Time FE	yes	yes	yes	no	no
Retailer FE	no	yes	yes	yes	no
Brand FE	no	no	yes	yes	yes
Category-Time FE	no	no	no	yes	yes
Retailer-Time-PL	no	no	no	no	yes
N	816103	816103	816103	816103	816103
R^2	0.005	0.092	0.979	0.986	0.986

Notes: The dependent variable are log mean prices at the region-retailer-brand level. Standard errors are clustered at regional level and shown in parentheses. Significant at 1% ***, Significant at 5% **, Significant at 10% *.

Table A2: Heterogeneous Effects for Insiders and Outsiders

	Model 1	Model 2	Model 3	Model 6
Treat × *Outsider*	0.0049**	0.0045**	0.0082***	0.011**
	(0.0021)	(0.0021)	(0.0031)	(0.0051)
Treat × *Insider*	0.0032	0.0013	0.0065	0.022*
	(0.0035)	(0.0036)	(0.0045)	(0.012)
Treat × *Outsider* × ΔHHI		0.055		
		(0.061)		
Treat × *Insider* × ΔHHI		0.10**		
		(0.045)		
Treat × *Outsider* × *DC*			-0.0062*	-0.016***
			(0.0036)	(0.0060)
Treat × *Insider* × *DC*			-0.0082	-0.019
			(0.0064)	(0.017)
Region	all	all	all	remedy
FEs for Region-Retailer-Brand, Retailer-Time, Category-Time + Regional Controls				
N	816103	816103	816103	289771
R^2	0.994	0.994	0.994	0.994

Notes: The dependent variable are log mean prices at the region-retailer-brand level. Treat is a dummy variable taking the value 1 post-merger for local markets that contain both the merging parties. Insider and Outsider are dummy variables taking the value 1 post-merger for inside and outside firms, respectively. DC is a dummy variable taking the value 1 for products sold at a discounter. ΔHHI is the expected change in market concentration. Regional controls consist of population density, the mean income, the mean age, the unemployment rate, and the average number of children per household. Standard errors are clustered at regional level and shown in parentheses. Significant at 1% ***, Significant at 5% **, Significant at 10% *.

Table A3: Disentangling Time Heterogeneous Price Effects for DC and Non-DC

Effect	Model 13 MP	Model 14 Efficiency	Model 13 MP	Model 14 Efficiency	Model 15 Baseline
Treat × *NON-DC*	0.0085***	-0.010			
	(0.0030)	(0.0093)			
Treat × *DC*	0.0026	-0.0098*			
	(0.0026)	(0.0058)			
Treat × *NON-DC* × *2009*			0.0064*	-0.0077	0.0059*
			(0.0033)	(0.0092)	(0.0032)
Treat × *DC* × *2009*			0.0018	-0.0051	0.0014
			(0.0027)	(0.0065)	(0.0026)
Treat × *NON-DC* × *2010*			0.011***	-0.013	0.0098***
			(0.0035)	(0.011)	(0.0034)
Treat × *DC* × *2010*			0.0035	-0.015**	0.0020
			(0.0029)	(0.0061)	(0.0028)
N	794766	209947	794766	209947	816103
R^2	0.994	0.996	0.994	0.996	0.994

Notes: The dependent variable are log mean prices at the region-retailer-brand level. In columns 1, 3, and 5 Treat is a dummy variable taking the value 1 post-merger for local markets that contain both the merging parties. In column 2 and 4 Treat takes value 1 post-merger in markets where only one of the merging parties is present. In columns 1 and 3 the control group consists of markets with exactly one of the merging parties present. In columns 2 and 4 the control group are markets where no merging party is active. The control group in the baseline scenario are all markets without overlap of the merging parties. DC is a dummy variable taking the value 1 for discounters. NON-DC is a dummy variable taking value 1 for non-discounters. Regional controls consist of population density, the mean income, the mean age, the unemployment rate, and the average number of children per household. Standard errors are clustered at regional level and shown in parentheses. Significant at 1% ***, Significant at 5% **, Significant at 10% *.

Table A4: Baseline Results: Median Prices

	Model 1	Model 2	Model 3	Model 4
Treat	0.0041*	0.0035	0.0068**	0.0054*
	(0.0022)	(0.0022)	(0.0030)	(0.0031)
Treat $\times$ ΔHHI		0.067*		0.13***
		(0.039)		(0.049)
Treat $\times$ *DC*			-0.0053	-0.0038
			(0.0037)	(0.0038)
Treat $\times$ *DC* $\times$ ΔHHI				-0.15**
				(0.064)
	FEs for Region-Retailer-Brand, Category-Time, Retailer-Time + Regional Controls			
N	816103	816103	816103	816103
R^2	0.993	0.993	0.993	0.993

Notes: The dependent variable are log median prices at the region-retailer-brand level. Treat is a dummy variable taking the value 1 post-merger for local markets that contain both the merging parties. ΔHHI is the expected change in market concentration. Regional controls consist of population density, the mean income, the mean age, the unemployment rate, and the average number of children per household. Standard errors are clustered at regional level and shown in parentheses. Significant at 1% ***, Significant at 5% **, Significant at 10% *.

Table A5: Baseline Results: Weighted Prices

	Model 1	Model 2	Model 3	Model 4
Treat	0.0045**	0.0039*	0.0077***	0.0064**
	(0.0021)	(0.0021)	(0.0030)	(0.0030)
Treat $\times$ ΔHHI		0.068*		0.13***
		(0.039)		(0.048)
Treat $\times$ *DC*			-0.0063*	-0.0049
			(0.0035)	(0.0036)
Treat $\times$ *DC* $\times$ ΔHHI				-0.14**
				(0.063)
	FEs for Region-Retailer-Brand, Category-Time, Retailer-Time + Regional Controls			
N	816103	816103	816103	816103
R^2	0.994	0.994	0.994	0.994

Notes: The dependent variable are log mean prices weighted by the number of purchases at the region-retailer-brand level. Neighboring markets are dropped from the sample. Treat is a dummy variable taking the value 1 post-merger for local markets that contain both the merging parties. ΔHHI is the expected change in market concentration. Regional controls consist of population density, the mean income, the mean age, the unemployment rate, and the average number of children per household. Standard errors are clustered at regional level and shown in parentheses. Significant at 1% ***, Significant at 5% **, Significant at 10% *.

Table A6: Baseline Results: Mean Prices for Merging Discounters

	Model 1	Model 2	Model 3	Model 4
Treat	0.0026	0.0023	0.0076**	0.0062**
	(0.0021)	(0.0021)	(0.0030)	(0.0030)
Treat $\times$ ΔHHI		0.031		0.14***
		(0.039)		(0.048)
Treat $\times$ *DC*			-0.0098***	-0.0076**
			(0.0035)	(0.0036)
Treat $\times$ *DC* $\times$ ΔHHI				-0.22***
				(0.067)
	FEs for Region-Retailer-Brand, Category-Time, Retailer-Time + Regional Controls			
N	814780	814780	814780	814780
R^2	0.994	0.994	0.994	0.994

Notes: The dependent variable are log mean prices at the region-retailer-brand level. The discounter of the merging parties are treated as one retailer. Treat is a dummy variable taking the value 1 post-merger for local markets that contain both the merging parties. ΔHHI is the expected change in market concentration. Regional controls consist of population density, the mean income, the mean age, the unemployment rate, and the average number of children per household. Standard errors are clustered at regional level and shown in parentheses. Significant at 1% ***, Significant at 5% **, Significant at 10% *.

Table A7: Variety Results

Treat	-0.0018	0.0013	-0.00042	0.0011	
	(0.0019)	(0.0029)	(0.0020)	(0.0029)	
Treat × *DC*		-0.0060		-0.0030	
		(0.0039)		(0.0039)	
Treat × Δ*HHI*			-0.14**	0.024	
			(0.062)	(0.081)	
Treat × *DC* × Δ*HHI*				-0.32***	
				(0.100)	
Treat × *Insider*					-0.0036
					(0.0049)
Treat × *Outsider*					0.0029
					(0.0032)
Treat × *Insider* × *DC*					-0.060***
					(0.0094)
Treat × *Outsider* × *DC*					0.0033
					(0.0043)
Treat × *Insider* × Δ*HHI*					0.11
					(0.093)
Treat × *Outsider* × Δ*HHI*					-0.091
					(0.11)
Treat × *Insider* × *DC* × Δ*HHI*					-0.51***
					(0.12)
Treat × *Outsider* × *DC* × Δ*HHI*					0.18
					(0.12)
FEs for Region-Retailer-Brand, Category-Time, Retailer-Time + Regional Controls					
N	814794	814794	814794	814794	814794
R^2	0.500	0.500	0.500	0.500	0.501

Notes: The dependent variable are log mean number of sub-brands at the region-retailer-brand level. Treat is a dummy variable taking the value 1 post-merger for local markets that contain both the merging parties. ΔHHI is the expected change in market concentration. Regional controls consist of population density, the mean income, the mean age, the unemployment rate, and the average number of children per household. DC is a dummy variable taking value 1 if the supermarket is a discounter. Standard errors are clustered at regional level and shown in parentheses. Significant at 1% ***, Significant at 5% **, Significant at 10% *.

Table A8: Baseline Results: Removing Neighboring Markets

	Model 1	Model 2	Model 3	Model 4
Treat	0.0062**	0.0056*	0.0080*	0.0066
	(0.0028)	(0.0029)	(0.0041)	(0.0042)
Treat × ΔHHI		0.067*		0.12**
		(0.040)		(0.049)
Treat × *DC*			-0.0032	-0.0018
			(0.0049)	(0.0049)
Treat × *DC*× ΔHHI				-0.13**
				(0.064)
	FEs for Region-Retailer-Brand, Category-Time, Retailer-Time + Regional Controls			
N	640371	640371	640371	640371
R^2	0.994	0.994	0.994	0.994

Notes: The dependent variable are log mean prices at the region-retailer-brand level. Neighboring markets are dropped from the sample. Treat is a dummy variable taking the value 1 post-merger for local markets that contain both the merging parties. ΔHHI is the expected change in market concentration. Regional controls consist of population density, the mean income, the mean age, the unemployment rate, and the average number of children per household. Standard errors are clustered at regional level and shown in parentheses. Significant at 1% ***, Significant at 5% **, Significant at 10% *.

Table A9: Baseline Results: Removing Cities

	Model 1	Model 2	Model 3	Model 4
Treat	0.0037	0.0027	0.0045	0.0025
	(0.0028)	(0.0028)	(0.0038)	(0.0039)
Treat × ΔHHI		0.097**		0.17***
		(0.045)		(0.051)
Treat × *DC*			-0.0016	0.00047
			(0.0043)	(0.0045)
Treat × *DC* × ΔHHI				-0.18**
				(0.078)
N	401580	401580	401580	401580
R^2	0.995	0.995	0.995	0.995

Notes: The dependent variable are log mean prices at the region-retailer-brand level. Cities are removed from the sample. Treat is a dummy variable taking the value 1 post-merger for local markets that contain both the merging parties. ΔHHI is the expected change in market concentration. Regional controls consist of population density, the mean income, the mean age, the unemployment rate, and the average number of children per household. Standard errors are clustered at regional level and shown in parentheses. Significant at 1% ***, Significant at 5% **, Significant at 10% *.

Table A10: Matching Results

Variable	Unmatched Matched	Mean Treated	Control	%bias	%reduct bias	t-test t	p>t
Pscore	U	.57779	.5347	42.8		10.91	0.000
	M	.56703	.56694	0.1	99.8	0.03	0.980
Δ Log(Price)	U	.01298	.01128	7.2		1.88	0.060
	M	.01302	.0128	0.9	87.0	0.32	0.750
$\Delta Log(Price)^2$	U	.00051	.00092	-16.6		-4.49	0.000
	M	.00052	.00052	-0.1	99.2	-0.08	0.933
Pop density	U	331.71	219.81	35.3		8.73	0.000
	M	278.9	277.04	0.6	98.3	0.20	0.839
Unemployment	U	.03701	.02914	5.3		1.36	0.174
	M	.03722	.03406	2.1	59.9	0.54	0.589
HH Income	U	2157	2170.1	-1.7		-0.45	0.655
	M	2158.2	2139.7	2.4	-41.4	0.66	0.512
Age	U	47.006	47.245	-2.0		-0.53	0.599
	M	46.957	47.231	-2.3	-14.7	-0.63	0.529
Children	U	.71855	.66429	6.3		1.63	0.104
	M	.72493	.76969	-5.2	17.5	-1.36	0.175

Notes: The table shows the results of a propensity score matching performed in the year 2006. The first column contains the matching variables. Δ Log(Price) is the average growth rates of prices before treatment. The other variables are pre-treatment averages as well. For each matching variable there are two rows that show unmatched (U) and matched (M) means of treated and control markets. The last two columns show a t-test with H0: means of the respective matching variable of treated and control markets are equal.

Table A11: Baseline Results: Propensity Score Reweighting

	Model 1	Model 2	Model 3	Model 4
Treat	0.0038	0.0031	0.0077**	0.0064*
	(0.0024)	(0.0024)	(0.0033)	(0.0034)
Treat × ΔHHI		0.078**		0.14***
		(0.039)		(0.049)
Treat × *DC*			-0.0077**	-0.0065
			(0.0039)	(0.0040)
Treat × *DC* × ΔHHI				-0.13**
				(0.065)
	FEs for Region-Retailer-Brand, Category-Time, Retailer-Time + Regional Controls			
N	661079	661079	661079	661079
R^2	0.994	0.994	0.994	0.994

Notes: The dependent variable are log mean prices at the region-retailer-brand level. Treatment markets receive a weight of 1 and control markets a weight of p/(1-p), where p is the probability of being treated. Treat is a dummy variable taking the value 1 post-merger for local markets that contain both the merging parties. ΔHHI is the expected change in market concentration. Regional controls consist of population density, the mean income, the mean age, the unemployment rate, and the average number of children per household. Standard errors are clustered at regional level and shown in parentheses. Significant at 1% ***, Significant at 5% **, Significant at 10% *.

Table A12: Random Treatment Groups at Original Treatment Time

Random Draw	1	2	3	4	5
Treat	-0.00046	-0.00030	-0.00075	-0.00042	0.00028
	(0.00067)	(0.00069)	(0.00067)	(0.00065)	(0.00066)
Random Draw	6	7	8	9	10
Treat	-0.00041	0.000020	0.00041	0.00024	-0.00050
	(0.00065)	(0.00066)	(0.00067)	(0.00064)	(0.00065)
FEs for Region-Retailer-Brand, Retailer-Time, Category-Time, Time + Regional Controls					

Notes: The dependent variable are log mean prices at the region-retailer-brand level. Treat is a dummy variable taking randomly the value 1 post-merger. Regional controls consist of population density, the mean income, the mean age, the unemployment rate, and the average number of children per household. Standard errors are clustered at regional level and shown in parentheses. Significant at 1% ***, Significant at 5% **, Significant at 10% *.

Table A13: Changing Treatment Time with Original Treatment Group

Treat Time	>=2005 Q3	>=2006 Q3	>=2007 Q3
Treat	0.00099	-0.0013	-0.0018
	(0.0019)	(0.0015)	(0.0018)
FEs for Region-Retailer-Brand, Retailer-Time, Category-Time + Regional Controls			
N	475655	475655	475655
R^2	0.995	0.995	0.995

Notes: The dependent variable are log mean prices at the region-retailer-brand level. Treat is a dummy variable taking the value 1 post-merger for local markets that contain both the merging parties. Post-merger time varies as displayed in the first row. Regional controls consist of population density, the mean income, the mean age, the unemployment rate, and the average number of children per household. Standard errors are clustered at regional level and shown in parentheses. Significant at 1% ***, Significant at 5% **, Significant at 10% *

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