No. 11-2020

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The Substitutability between Brick-and-Mortar Stores and e-Commerce – The Case of Books

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March 16, 2020

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Abstract

We analyze the substitutability between brick-and-mortar stores and e-Commerce. Using a novel data set on the German book market we find that between 26 and 55% of the decrease in book sales from 2014-2017 can be explained by the decrease in the number of bookstores. This indicates that brick-and-mortar stores and e-Commerce are imperfect substitutes. One explanation could be that some consumers prefer to purchase books offline because of the service provision in brick-and-mortar stores (e.g., advice, atmosphere, presentation, sales-effort, etc.). We also find that the degree of substitutability differs between different types of books. When a bookshop closes the decrease in sales of fiction titles is more than 2 times larger than the decrease in sales of non-fiction titles. Our findings indicate that regulatory measures and vertical restraints that increase the number of bookstores can have a positive effect on the demand for books even in the presence of e-Commerce.

Keywords: Experience goods, Retailing, e-Commerce

1 Introduction

With the rise of e-Commerce, conventional brick-and-mortar (B&M) retail sectors have experienced a substantial increase in competitive pressure across various industries (see, e.g., Burt and Sparks 2003; Srinivasan et al. 2002). It remains an open question whether and in which industries consumers perceive e-Commerce and B&M stores as perfect substitutes (see, e.g., Brynjolfsson et al. 2009; Sinai and Waldfogel 2004; Wang and Goldfarb 2017). Against this background, we investigate the substitutability between e-Commerce and B&M retailers in the German book market.

Upon investigating the degree of substitutability between e-Commerce and and B&M retailers, we assess the roles e-Commerce and B&M stores play in shaping the demand for books. Gilbert (2015) states that while e-Commerce reduces the importance of B&M stores, e-Commerce might expand overall demand for books because new customers are attracted to the market. However, if the online and the offline channel are imperfect substitutes, the decrease in the number of (offline) bookstores, which is associated with the rise of e-Commerce, will also have a negative impact on demand because (potentially captive) consumers of the offline channel might reduce their demand for books. It is thus crucial to analyze the substitution pattern between the two retail channels in order to evaluate the net effect the increasing importance of e-Commerce has on the demand for books.

Our results play an important role in evaluating the efficacy of fixed book price systems, which are a tool of cultural and competition policy and which

usually occur in the form of resale price maintenance.[1] In this respect, from the perspective of competition policy, the welfare effects of vertical restraints such as resale price maintenance are influenced by the the degree of substitutability between retail channels. For instance, resale price maintenance might increase welfare when it positively influences the number of offline retailers and when this leads to a net increase in demand, i.e., when the drop in demand of consumers in B&M stores offsets the demand expansion that is potentially associated with price competition on the retail-level. [2]

We analyze the degree of substitutability between B&M retailers and e-Commerce from the viewpoint of consumers by investigating how the closure of B&M retailers affects total demand for books. If one finds that a shop closure *ceteris paribus* leads to a drop in total demand, this means that B&M retailers generate additional demand. In that case, one can argue that e-Commerce and B&M retailers are not perfect substitutes. We analyze this pattern using a novel data set which consists of monthly sales data of B&M and e-Commerce retailers covering a period from 2011 to 2017. The data set also contains information on the number of B&M retailers. We us a cross-federal state panel data analysis to identify the effect of the number of book shops on the total demand for books. To account for potential endogeneity problems, we employ an instrumental variable approach using the population

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[1]In Germany there is a fixed book price system in place. The "Buchpreis-bindungsgesetz" lays down the specifities and goals of the regulation, see https://www.gesetze-im-internet.de/buchprg/BJNR344810002.html. A more detailed discussion will be presented in Section 5

[2]Resale price maintenance prevents price competition between retailers and therefore may increase retail prices. If the detrimental effect of a price-increase on welfare is not offset by an increase in demand resale price maintenance will not increase welfare. This is comparable to third-degree price discrimination (Schmalensee, 1981; Varian, 1985).

size as an instrument.

There are some reasons why consumers may perceive B&M retailers as imperfect substitutes to e-Commerce in the book market. Books can be seen as horizontally and vertically differentiated goods whose quality can only be asserted after consumption (i.e., after the consumer read the book). Such goods are sometimes referred to as experience goods (Nelson, 1974), which means that there is substantial uncertainty prior to purchase. There are multiple measures that can be used to solve the problems arising from this uncertainty (see, e.g., Bagwell and Riordan, 1991; Bester, 1998 or Riordan, 1986). An external signal such as expert opinion is one appropriate measure in the book market to reduce the consumers' uncertainty (Clement et al., 2007). In general, expert opinion might affect demand in two ways. First, consumers may learn that a certain type of good exists (Hilger et al., 2011). Second, the opinion can act as a signal of quality (Reinstein & Snyder, 2005). A reputable book dealer in a nearby book store may offer such expert opinion.[3] Also the mere choice of which books to sell may act as a signal of quality if the book seller has a reputation to only stock books that satisfy a certain quality standard (Marvel & McCafferty, 1990).

Another reason why the online and the offline channel may not be perfect substitutes is ad-hoc sales. While consumers may use online search engines to find the best prices for specific products (see, e.g., Tang et al. 2010), the number of impulse purchases in the offline channel may be higher (see, e.g.,

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[3]In the book industry, expert opinion offered at B&M retailers is only one source of reviews. Our analysis is thus complementary to studies which analyze the impact of book reviews on a title's success or publicity generated by bestseller-lists (see, e.g., Berger et al. 2010 for an overview).

Burt and Sparks 2003). Fourth, B&M retailers also have the opportunity to provide showrooms where consumers can physically investigate a product, which might positively influence demand (Bell et al., 2017). Although online retailers such as *Amazon.com* offer the opportunity to read the first few pages of a book for free, it may still be the case that some consumers may prefer to investigate the printed book.

Online retailers such as *Amazon.com* present online-reviews written by other readers and recommend books to the customer based on the same customer's or other readers' past purchases, which can also be considered a form of service provision or expert opinion (see, e.g., P.-Y. Chen et al. 2004). They also have other advantages over B&M retailers. For instance, online shopping can be more convenient for customers (no travel costs, etc.), comparing prices may be easier and if the customer knows what she is searching for she can find the desired product faster than at B&M outlets.

Our findings indicate that when a B&M retailer leaves the market the demand for books decreases, which indicates that e-Commerce and B&M retailers are imperfect substitutes, i.e., at least some consumers perceive the benefits of B&M retailers to outweigh those of e-Commerce. In particular, we find that 33.4% of the general decrease in book sales over the observation period can be attributed to the drop in the number of B&M retailers. When accounting for e-Book sales, we find that this share is 26-55.6%, depending on how we combine survey and scanner data in our estimations. This means that when book stores close some consumers buy less books or stop purchasing books at all, which indicates that, from the viewpoint of these consumers, e-Commerce is no perfect substitute for B&M retailers.

Moreover, our results indicate that the degree of substitutability differs depending on the genre of the book. In particular, in the period 2011–2017, we find that when an average bookstore closes aggregate sales of fiction titles decrease by 4,249 books whereas the sales of non-fiction titles decreases by only 1,338 books. This finding indicates that the service provision of B&M retailers is more important for fiction titles. Consumers are more inclined to buy non-fiction titles online than it is the case of fiction titles. This result is comparable to Reinstein and Snyder (2005) who also finds genre-specific differences of movie reviews on box office revenues.

Generally, our findings are in line with evidence for related products, namely wine and movies. Hilger et al. (2011) find empirical support for the hypothesis that expert opinion has a positive effect on the demand for wine. In particular, they show that expert opinion helps customers to find the desired wine, i.e., demand for wine whose quality is considered low (high) by experts are purchased less (more) often. The authors (ibid.) find that there is no one-for-one substitution pattern, so that overall demand increases when expert opinion is available. This may be due to existing consumers purchasing not only the wines with perceived high quality but also additional wine or due to new consumers who would not have bought wine in the absence of expert opinion. In another related paper, Reinstein and Snyder (2005) empirically analyze the effect of expert movie reviews on box office revenue. They find that the magnitude of the effect differs. For narrowly-released movies and dramas they find a significant correlation between expert reviews and box office sales whereas for widely-released movies and other genres such as action movies they do not find a significant correlation.

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From a policy perspective, our results suggest that if the number of bookstores decreases this will lead to a decrease in the consumption of books. Based on the ideas of Telser, 1960 who argues that some dealers, i.e., e-Commerce in the current market environment, may free ride on the provision of, e.g., expert opinion provided by B&M retailers, our findings can even be interpreted as a form of market failure. Given that there is evidence that fixed book price systems dampen the drop in B&M retailers by offering them a higher margin (Davies et al., 2004), this effect has to be taken into account when evaluating the efficacy of fixed book price systems. This applies to vertical restraints in general, especially when it is considered a political goal to increase the consumption of a specific good such as books.

The article is structured as follows. Section 2 provides an overview on the data set. In Section 3 the empirical approach is outlined and in Section 4 robustness checks are presented. A discussion of our results in the context of fixed book price systems can be found in Section 5. Section 6 concludes.

2 Data and Descriptive Statistics

In order to analyze how the closure of bookstores effects demand for books and book sales in Germany, we combine data from several sources. We use data on the entry and exit of members from the German Publishers and Booksellers Association[4] as a proxy for market entry and exit. Roughly 85 to 90 percent of all book retailers in Germany are member of the German Publishers and Booksellers Association. The data also includes informa-

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[4]Börsenverein des Deutschen Buchhandels, (https://www.boersenverein.de).

tion on outlets of chain stores as well es independent book stores. To draw information on the remaining book sellers, which are no members of the association, we use data of the two largest book wholesalers in Germany[5]. This data also allows us to identify retailers that left the association but continue their operation.
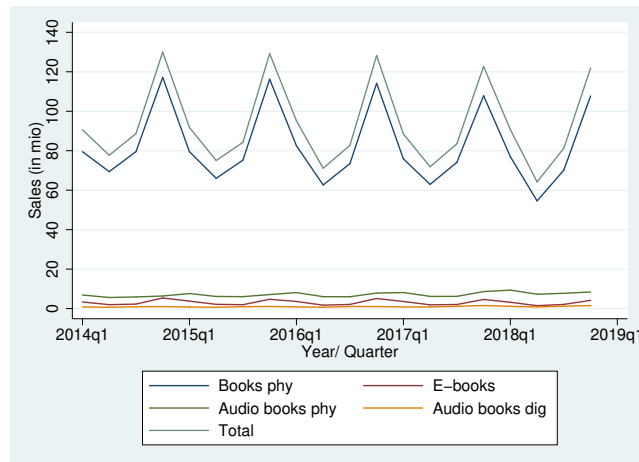

Figure 1: Evolution of sales volumes by format over time. Source: GfK

Detailed sales scanner data is provided by a market research company[6], that tracks book sales in real time. The database comprises data on consumer sales of independent book stores, chain stores as well as online retailers, including Amazon. In contrast to sales data for physical books, retailers like Amazon ("Kindle eBook reader") do not publish any scanner data on the sales of e-Books. To capture e-Book sales, we merge the physical books scanner data with consumer panel data, which are provided by another market research company.[7] The consumer panel contains information on the

[5]G. Umbreit GmbH & Co. KG (https://www.umbreit.de) and Koch, Neff & Volckmar GmbH (KNV, http://www.knv.de).

[6]media control GmbH (https://www.mc-metis.de).

[7]GfK SE (https://www.gfk.com/de).

purchases of physical books, e-Books and audiobooks of roughly 20,000 consumers being surveyed on a monthly basis in the period from 2014 to 2017. Figure 1 shows GfK's estimates of sales volumes of physical books, e-Books as well as physical and digital audiobooks. The market shares of e-Books are increasing since 2014, however, in volume terms they are not higher than 8 percent on average. The revenue shares are even lower.

Since the survey data contains estimates rather than exact sales figures, we need to level both data sets in order to combine them. In particular, we calculate the relation of e-Books to physical books purchases from the survey data and use this proportion to compute sales of e-Books based on the scanner data (see Table 2).

As a robustness check, we use the sales data estimates provided by the market research company which are solely calculated on basis of the consumer panel data. Given that we do not know how exactly the provider of the consumer panel data (GfK) uses the consumer panel data to estimate total sales data, we will rely on the scanner data in our main estimations. These data should be far more accurate because, as explained above, they capture nearly every purchase of physical books in Germany. Although the consumer panel data set is not as accurate as the scanner data, they should nevertheless capture the trends in book purchases, i.e., using the differences in monthly sales should contain valuable information to complement our analyses based on scanner data.

For our empirical analysis, we use monthly data on the number of book retailers and the sales and revenues of books on a federal state level. To be able to control for different types (e.g., genre) of books, we distinguish between 9

different product groups (fiction, non-fiction, guidebooks, school books, social sciences, natural sciences, humanities, travel and children books). The database covers the period from January, 2011 to December, 2017. In what follows, some descriptive statics are presented.
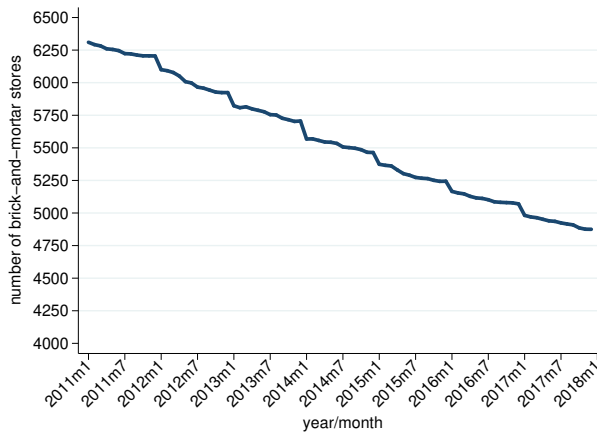

Figure 2: Development of books stores over time.

Table 1: Summary statistics of book stores on the federal state level.

	min	max	range	mean	count
Baden-Wuerttemberg	698	905	207	797.6	84
Bavaria	769	967	198	855.6	84
Berlin	230	274	44	248.4	84
Brandenburg	80	101	21	91.9	84
Bremen	49	58	9	53.0	84
Hamburg	105	139	34	122.4	84
Hesse	439	576	137	505.5	84
Mecklenburg-Western Pomerania	66	86	20	74.0	84
Lower Saxony	439	579	140	504.0	84
North Rhine-Westphalia	1038	1362	324	1193.6	84
Rhineland-Palatinate	284	383	99	329.8	84
Saarland	77	91	14	84.4	84
Saxony	238	307	69	271.2	84
Saxony-Anhalt	97	136	39	115.5	84
Schleswig-Holstein	176	219	43	197.3	84
Thuringia	88	127	39	107.1	84

Figure 2 shows the development of the number of books stores in Germany

over time. Between 2011 and 2017 the number of bookstores decreased from more than 6,200 in the beginning of 2011 to less than 5,000 by the end of 2017. Table 1 summarizes the development on the federal state level. In the table, the column "range" reflects the number of book stores that were closed. On average, the number of bookstores decreased by 20% over the course of the observation period.

Sales figures of books in the period 2011–2017 are provided in Table 2. It becomes obvious that total book sales in Germany exhibit a decreasing trend. Revenues show a similar pattern with the exception of the year 2016, where revenues slightly increased. In 2011, 291.6 million physical books were sold with a corresponding revenue of 3,607.2 million Euros. This implies an average book price of 12.37 Euro. In 2017, 257.8 million books were sold with a revenue of 3,469.7 million Euros (i.e. 13.45 Euro per book). It thus seems to be the case that the decline in sales was at least partly offset by a price increase so that revenues remained roughly constant.

Table 2: Aggregated sales by year in million Euros and million books sold.

year	Scanner data		e-Book (estimate)		Total (estimate)	
	revenue	quantity	revenue	quantity	revenue	quantity
2011	3607.2	291.6	-	-	-	-
2012	3570.8	282.8	-	-	-	-
2013	3484.2	273.5	-	-	-	-
2014	3374.4	267.8	164.3	19.9	3538.7	287.7
2015	3386.7	266.5	174.5	21.9	3561.2	288.4
2016	3516.8	265.2	182.1	22.9	3698.9	288.1
2017	3469.7	257.8	177.8	23.7	3647.5	281.5

Scanner data does not include data on Thuringia and Saarland. e-Book sales have been scaled to the coverage of the scanner data, using market shares from the GfK consumer panel.

E-Book sales have increased by nearly 4 million copies from 2014 to 2017.

Our total sales estimates[8] show that e-Book sales did not compensate the decline in sales of physical books completely so that we still observe a net decrease in book sales during the observation period 2014–2017.
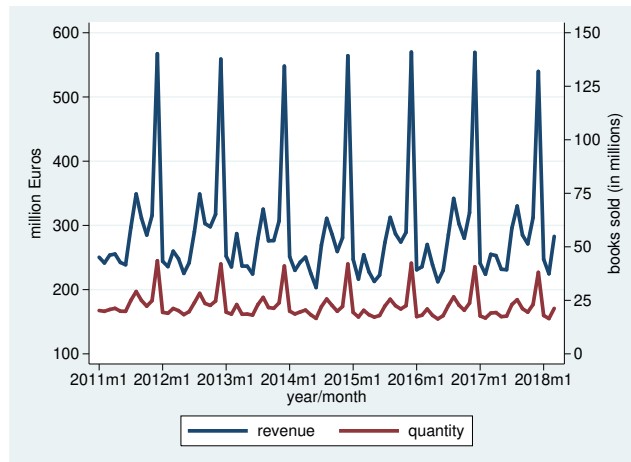

Figure 3: Aggregated sales data (physical books). Thuringia and Saarland excluded.

In what follows, we focus on the scanner data set (e-Books excluded). Figure 3 shows that a large share of the revenues in both retail channels (B&M-stores and e-Commerce) is generated around Christmas in December. This particularly strong "Christmas effect" is widely acknowledged by scholars of the book market (see, e.g., Beck 2007). The sales and revenue patterns are characterized by another smaller peak at the beginning of a year's summer, when the new school year begins. Until 2013, a decline of sales in peak times can be observed. Between 2014 and 2016 peak revenues increased again slightly, while sales remained roughly constant. In our sample, an average bookstore generates a revenue of 63,800 Euros per month (including e-Commerce), selling 5,050 books.

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[8]A detailed description on how we used consumer panel data to compute e-Book sales based on scanner data can be found in Section 3.

	mean	min	max	observations
fiction				
revenue	6.727	0.866	57.02	1176
quantity	0.578	0.0742	4.701	1176
humanities				
revenue	0.984	0.0542	7.308	1176
quantity	0.0530	0.00292	0.361	1176
children books				
revenue	3.060	0.251	22.23	1176
quantity	0.325	0.0269	2.129	1176
natural sciences				
revenue	0.887	0.0531	4.519	1176
quantity	0.0301	0.00204	0.171	1176
guidebooks				
revenue	3.056	0.239	22.40	1176
quantity	0.221	0.0187	1.555	1176
travel				
revenue	1.225	0.120	7.424	1176
quantity	0.0811	0.00773	0.430	1176
non-fiction				
revenue	2.083	0.211	17.21	1176
quantity	0.131	0.0135	1.029	1176
school books				
revenue	2.143	0.0657	29.57	1176
quantity	0.170	0.00538	2.135	1176
social sciences				
revenue	0.589	0.0306	3.115	1176
quantity	0.0302	0.00154	0.189	1176
all				
revenue	20.76	2.080	135.1	1176
quantity	1.620	0.174	10.38	1176

Thüringen and Saarland excluded.

Table 3: Summary statistics of monthly sales by product group in million Euros and million books sold.

On average, 1.620 million books are sold per federal state and month, with an average revenue of 20.76 million Euros (see Table 3). Fiction, children books, guidebooks, school books and non-fiction books make up for the largest share of revenues with 6.727 million Euros per federal state and month. In contrast, on average, only 0.0302 million social science books are sold per federal state and month with a corresponding average revenue of 0.589 million Euros. In the month with highest sales in our data set, 10.38

million books were sold in Northrhine-Westfalia generating a revenue of 135.1 million Euros.

3   Empirical Analysis

The goal of our empirical analysis is to analyze the influence of the number of bookstores on book sales. One would conclude that e-Commerce and B&M-stores are perfect substitutes if, *ceteris paribus*, a change in the number of bookstores does not affect total sales. However, there may be issues of reverse causality – not only does the number of book stores affect sales but also do monthly sales reflect demand and, therefore, affect the number of retailers on the supply side of the market. To resolve this potential source of endogeneity between sales and the number of bookstores we will follow an instrumental variable approach in our estimations.

Before turning to the presentation of our estimations, it is insightful to formalize the hypothesis that is to be tested. If e-Commerce and B&M-stores were perfect substitutes, the drop in the number of retailers should not have any impact on book sales because consumers will switch to the e-Commerce channel, where they either buy physical books or e-Books. The hypothesis to be tested is thus:

Hypothesis 0 (H_0): *There is no correlation between book sales and the number of B&M-stores retailers.*

If there is a positive correlation between the number of B&M-stores and book sales, H_0 can be falsified, which is an indication that e-Commerce

and B&M-stores are imperfect substitutes. Observing a negative correlation would either be a sign of an unobserved variable driving the result or it would mean that bookstores are inferior retailers. The latter explanation, however, seems to be inappropriate because if this was the case, every consumer with access to the internet (which would be nearly every consumer) would purchase online so that the decline in B&M-stores would be much more pronounced.

The relationship between e-Books and physical books may be an important driver of the results. The closer the degree of substitutability between e-Books and physical books the more likely it is that the decrease in book sales is compensated (or even over-compensated) by an increase in e-Book sales. Gilbert (2015) conjectures that e-Books are not perfect substitutes for hardcover books, which is empirically supported by Li (2015) and H. Chen et al. (2019). However, Li (2019) finds a high degree of substitutability between e-Books and paperback books. Therefore, we test to which degree the decrease in sales of physical books is dampened by sales of e-Books.

In what follows, we first present the results of our analyses using data ranging from 2011–2017. As described above, this analysis does not contain any information on e-Book sales due to the lack of data. Instead we use Google Trends as a proxy in a first step. In a second step we analyze a more detailed but shorter data set that covers the period 2014–2017 and includes e-Book sales (see Section 3.2). Section 4 includes a robustness check of our analysis when only consumer panel data on sales of physical books and e-Books is used. Even though the effect is slightly weaker because e-Book sales partly replace sales at B&M stores, the order of magnitude is about the same

and the results remain statistically significant.

3.1 Estimation without e-Books

Since there is no systematic data available on e-Book sales for the whole period from 2011-2017, we use the Google Trends index, which tracks the number of Google queries for the topic "book", as a proxy to control for e-Book sales in our basic estimation approach. As can be seen in Figure 4, this index shows an increasing trend and seasonal patterns comparable to what we would expect for e-Book sales.
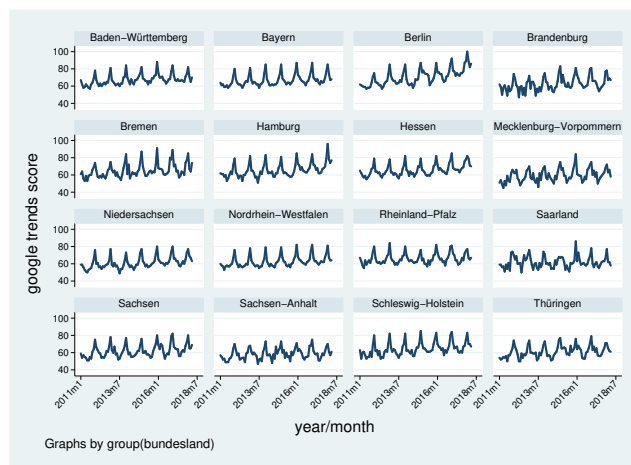

Figure 4: GoogleTrends score for the topic books.

Throughout our empirical analysis, the regression model is estimated in first differences, i.e., the change in a parameter is measured as the difference between its value in month t subtracted be its value in month $t - 1$. This step is reasonable because book sales show very strong seasonal patterns. In particular, sales peak at Christmas and at the beginning of a school year (see Figure 2 in Section 2).

Beyond, book sales are measured per capita using labor force data because this ensures the comparability of the effects between different federal states. We also use the population size in a federal state as an instrument for the number of book shops to avoid inconsistent estimates due to reverse causality.[9] On the one hand, this instrument should have no partial effect on the amount of sales per capita because an increase in the population of a federal state should, *ceteris paribus*, not systematically increase book sales per capita (orthogonality assumption). On the other hand, this instrumental variable is correlated with the number of bookstores per month and federal state, since the population size affects the number of bookstores in a federal state.

Following the approach explained above, the linear projection in the first stage regression of our basic model can be formalized as follows:

$$grwstores_{i,t} = \delta_1 X_t' + \delta_2 \triangle pop_{i,t} + \delta_3 \triangle gtrends_{i,t} + \alpha_i + \triangle \varepsilon_{i,t} \qquad (1)$$

In equation (1), the dependent variable $grwstores_{i,t}$ refers to the percentage change in the number of book stores in federal state i in month t relative to month $t - 12$, i.e., $grwstores_{i,t} = \frac{(bookstores_{i,t} - bookstores_{i,t-12})}{bookstores_{i,t-12}}$. The vector X_t' contains the covariates, i.e., dummy variables for each year of the observation period t. The variable $\triangle pop_{i,t}$ denotes the absolute change in the population size in federal state i in month t relative to month $t - 12$, the

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[9]There is no data available for the population size of German federal states on a monthly basis. Therefore, from the German Federal Statistical Office we use monthly data on a federal state's labor force (see https://bit.ly/2OZ5w6n, e.g., for more detailed information on the calculation of the measure) as a proxy variable for the population size. On a yearly basis, the correlation (Pearson correlation coefficient) between the labor force and the population size is 0.9672 for Germany.

regressor $gtrends_{i,t}$ captures the change in the Google Trends index for the topic "book" and α_i depicts time-invariant fixed effects for each federal state i.[10]

The structural equation of our basic model then takes the following form:

$$\triangle quantity_{i,t} = \beta_1 X'_t + \beta_2 gr\widehat{wstore}s_{i,t} + \beta_3 \triangle gtrends_{i,t} + \alpha_i + \triangle u_{i,t}, \quad (2)$$

where the dependent variable is the difference in sales of physical books per capita in federal state i, $\triangle quantity_{i,t} = \frac{quantity_{i,t}}{pop_{i,t}} - \frac{quantity_{i,t-12}}{pop_{i,t-12}}$, with $pop_{i,t}$ denoting the population size in federal state i at time t. The fitted variables from the first-stage are captured by $gr\widehat{wstore}s_{i,t}$.

Table 4 presents the regression results based on our basic structural equation. We run the regression for three different product groups: all products, fiction and non-fiction.[11] The results show that sales indeed depend on the number of bookstores, i.e., if 1% of all bookstores close compared to the same month in the previous year, *ceteris paribus* this leads to a decline in monthly book sales. This correlation is significant at the 0.1%-level over all three different product groups.

These results indicate that when the number of book stores in a federal state decreases by 1% compared to the same month in the previous year, *ceteris paribus* an average of 0.01124 less physical books are sold per unit

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[10]Note that we only investigate 14 federal states. Our scanner dataset shows inconsistencies for two federal states (Saarland and Thuringia), so we exclude these from our analyses.

[11]Note that this is not inclusive, i.e., not every title that is not a fiction book is a non-fciton book. Besides these two product groups there are 7 further groups, see Section 2.

Table 4: Main estimations with sales volumes on physical books per capita as dependent variable.

	(1) All books	(2) Fiction	(3) Nonfiction
grwstores	1.124***	0.543***	0.168***
	(0.291)	(0.0899)	(0.0274)
2013	0.00114	-0.0147***	0.00194*
	(0.00768)	(0.00252)	(0.000773)
2014	0.0465***	0.00989***	0.00953***
	(0.0100)	(0.00277)	(0.000860)
2015	0.0275***	0.00919***	0.00697***
	(0.00617)	(0.00204)	(0.000680)
2016	0.00573	0.00609*	-0.0000525
	(0.00913)	(0.00250)	(0.000969)
2017	0.00381	0.00328	0.00234***
	(0.00567)	(0.00178)	(0.000569)
$\triangle$ gtrends	0.00117	0.000354	0.000113
	(0.000893)	(0.000238)	(0.0000817)
Anderson-Rubin Wald F-statistic	14.11	40.65	35.09
Kleibergen-Paap rk Wald F-statistic	107.9	107.9	107.9
# of observations	1008	1008	1008

Standard errors in parentheses. We apply a 2-step GMM estimation.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

of labor force in a given month and federal state.[12] While this effect seems to be small at first glance, the real impact of closing bookstores on the sales of books becomes clearer by determining the average effect per store: if an average book stores closes, the sales of books will decrease by 8,812 on average.[13] This gives an overall decrease in sales of physical books by 11,279,360 between 2011 and 2017.[14] This means that the decrease in the

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[12]The coefficients for the explanatory variable 'grwstores' in Table 4 indicate the size effect (per capita) if the number of bookstores decreases by 100% compared to the same month in the previous year.

[13]The average effect per bookstore can be calculated using the formula $\frac{\beta_2}{\#bookstores_{avg}} \times pop_{avg}$ which, given our data, yields $\frac{1.12}{5,309} \times 41,771,111 = 8,812$.

[14]Given the decline in sales is 8,812 per bookshop on average, the total decline will be 11,279,360 because 1,280 bookstores were closed from 2011–2018.

number of bookstores accounts for 33.4% of the overall decrease in the book sales from 2011–2017.[15]

From a technical perspective, we find that the endogenous variable in equation (2), $\widehat{grwstores}_{i,t}$, is identified by the instrument as indicated by the Kleibergen-Paap rk Wald F-statistic which clearly exceeds the IV critical value from Stock and Yogo (2005). Furthermore, the null hypothesis of the Anderson-Rubin Wald F-statistic can be rejected, indicating that the endogenous regressor is relevant in the structural equation. Additionally, a test for exogeneity of the variable $\widehat{grwstores}_{i,t}$ using the difference of two Sargan-Hansen statistics (often called *GMM distance* or *C statistic*)[16] can be rejected. Thus, the estimation method is IV-GMM applying a robust covariance matrix estimator.

The estimation results for the two genres (product groups) fiction and non-fiction, given in the columns (2) and (3) of Table 4, also show a significant and positive correlation between the growth rate of B&M stores and the sales of books per capita, even though the effects are smaller than in the regression where we do not distinguish between genres. As above, the estimated coefficients imply that the average effect per store is higher for fiction (4,249 books) than for non-fiction (1,338) titles, i.e., when book stores close the average decrease in sales of fiction titles is more than 2 times larger than the decrease in sales of non-fiction titles. This finding is comparable to Reinstein and Snyder (2005), who investigate the movie industry and find that

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[15]Sales of physical books have decreased by almost 34 million from 2011 to 2017 in Germany, see Table 2 in Section 2.

[16]This endogeneity test statistic is numerically equal to a Durbin-Wu Hausman test under conditional homoskedasticity (Hayashi, 2000).

expert opinion (which, in our case, could be provided by bookstores) has different effects on box office revenues depending on the genre of a given movie. Moreover, the decrease in the number of book stores accounts for $\sim 22.6\%$ ($\sim 58.5\%$) of the decrease in sales of fiction (non-fiction) titles. This means that other factors such as changes in leisure activities affect fiction sales more strongly than non-fiction sales.

3.2   Estimation with e-Books

It is possible that consumers have substituted physical books by e-Books or that the digitization has attracted additional purchases. If this is the case, the results presented above would overestimate the effect of B&M-stores on book demand. The Google Trends index that we have used as a proxy for e-Book purchases in Section 3.1 is insignificant (see Table 4).

Thus, in what follows we incorporate e-Book sales into our regressions to show that our results are robust. As explained in Section 2, systematic information on e-Book sales are available only for the period after 2014 and have to be extracted from consumer survey data. We thus repeat the analysis for the period 2014–2017 by combining the scanner data with e-Book sales estimates.

In the following, we present the results of two estimations. In the first estimation, we use the relation of e-Books sales to physical books purchases obtained from the consumer panel data to calculate the sales of e-Books using scanner data in each quarter.[17] In a second estimation, we compute e-Book sales as was done in the first estimation only for the quarters 1–4,

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[17]The estimated e-Book sales in Table 2 are based on this first approach.

2014. For all subsequent quarters, we use the growth rates of e-Book sales obtained from consumer panel data to compute the e-Book sales with 2014 as base year. The difference between the two approaches is that in the second approach the evolution of e-Books sales depends less strongly on physical book sales obtained from scanner data. Given that consumer panel data are only available on a quarterly basis, we assume that the ratio of e-Book sales to sales of physical books is constant in a given quarter in order to compute monthly e-Book sales with both approaches.

Table 5: Estimation with total book sales (physical books and e-Books) per capita as dependent variable.

	(1) All books (incl. e-Books)	(2) All books (incl. e-Books_grw.)
grwstores	0.729*	0.722*
	(0.336)	(0.323)
2016	-0.0214*	-0.0230**
	(0.00884)	(0.00861)
2017	-0.0222***	-0.0237***
	(0.00659)	(0.00623)
Anderson-Rubin Wald F-statistic	4.872	5.290
Kleibergen-Paap rk Wald F-statistic	61.18	61.18
# of observations	504	504

Standard errors in parentheses. We apply a 2-step GMM estimation.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5 presents the results of the two estimations described above. The results confirm that the growth rate of book sales per capita is positively correlated with the number of bookstores (significant on a 5%-level). Moreover, both approaches of computing e-Book sales yield similar results. The effects remain statistically significant, which means that the results for the period 2011-2017 presented in Section 3.1 are robust. On average, when the number of bookstores in a federal state decreases by 1% compared to the same month

in the previous year *ceteris paribus* approximately 0.0072–0.0073 less books will be sold per capita in a given month per federal state. This indicates that some consumers have substituted physical books by e-Books in the period 2014–2017, so that the influence of B&M-stores on book sales is less pronounced. Nevertheless, the effect can still be considered economically significant: when a bookstore exits the market, book sales will decrease by 6,116 on average, which, in total, leads to a drop in book sales in the magnitude of 3,455,374 books for the period 2014–2017, in which 565 bookstores were closed. This implies that the decrease in the number of bookstores accounts for 55.6% of the overall decrease in book sales (including e-Book sales) from 2014-2017.

4 Robustness Checks

So far we have shown that a drop in the number of bookstores *ceteris paribus* decreases book sales per capita. This positive correlation is also significant when e-Books sales are taken into account. In what follows, we repeat our analyses (applying equations 1 and 2) using only consumer survey data to test for robustness of our results. In this regression, we use data on sales of physical books and e-Books, which were taken directly from the consumer survey data for the period 2014–2017.[18] The results for the estimations using consumer panel data are reported in Table 6 below.[19]

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[18]Given that it is unclear how exactly the data provider GfK used the consumer survey data to compute total sales data, we use this data set to control for robustness of our results presented above.

[19]Note that the number of observations has increased compared to the results presented above because the consumer panel data also contains information on the two federal states Saarland and Thuringia, which we had to exclude from the regressions where scanner data

Table 6: Estimation with total book sales (physical books and e-Books) per capita as dependent variable using consumer survey data.

	(1) All books (GfK data)
grwstores	1.067**
	(0.381)
2016	-0.00264
	(0.0105)
2017	-0.0258*
	(0.0111)
Anderson-Rubin Wald F-statistic	8.605
Kleibergen-Paap rk Wald F-statistic	65.20
# of observations	576

Standard errors in parentheses. We apply a 2-step GMM estimation.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

As shown in Table 6, the effect of the number of bookstores on book sales remains statistically significant and its magnitude does not differ much compared to the results presented in Section 3. On average, a decline in the number of bookstores by 1% compared to the same month in the previous year *ceteris paribus* leads to a decrease in book sales of 0,0107 books sold per capita in a given month per federal state (significant on the 1%-level). The result presented in Table 6 implies that on average 9,095 less books are sold when one bookstore closes, which, given that 589[20] stores have closed between 2014–2017, corresponds to a decrease in book sales of 5,357,101 books. Thus, the decrease in the number of bookstores accounts for 26% of the overall decrease in book sales (including e-Book sales) from 2014-2017.

is used.

[20]Recall that this estimation includes two more federal states than the estimations presented in Section 3 so that the number of bookstores closing between 2014–2017 increases to 589.

5   Discussion – Fixed Book Price Systems

Our findings provide important insights regarding the evaluation of the efficacy of fixed book price systems. Our findings indicate that e-Commerce and B&M retailers are no perfect substitutes because a drop in the number of physical outlets leads to a decrease in demand.

There is evidence that fixed book price systems *ceteris paribus* lead to a higher number of B&M stores. Davies et al. (2004), Fishwick et al. (1997) and Dearnley and Feather (2002) evaluate the effect of abolishing the so-called Net Book Agreement, which was the fixed book price system in the UK and Ireland. The system was abandoned in mid 1990. The authors find an increase in the intensity of price competition for the top-5 paperback fiction books, a significant decrease in the number of B&M booksellers, a decrease in the market shares of small booksellers as well as an increase in the floor space of larger bookstore chains. Using newer data, Fishwick (2008) confirms that consumer prices increased and wholesale prices decreased after the abandoning of the fixed book price system, thereby increasing the revenues of some retailers and reducing the revenues of publishers. More importantly, the author (ibid., 2008) argues that concentration on the retail level increased, which is associated with a decrease in the number of bookshops.

If e-Commerce and B&M-retailers are no perfect substitutes, which our results indicate, a decline in the number of book stores following an abrogation of a fixed book price system would be harmful to consumers in a sense that demand for books would decrease. This negative efficiency effect has to be compared to potential efficiency gains such as decreasing consumer prices,

which could be the result of price competition.[21] If, however, the political goal is to increase book sales, then our results indicate that measures which increase the number of B&M stores, such as fixed book price systems, might help to achieve that goal.

6   Conclusion

The goal of this article was to study the degree of substitutability between B&M retailers and e-Commerce in the book market. Based on a data set covering monthly book sales and the number of book shops from 2011 to 2017, our analysis indicates that the closure of book stores explains 26-55.6% of the decrease in sales. When a bookstore closes, we find that, on average, aggregate book sales decrease by 8,812, with an associated decrease of 4,249 in fiction book sales and 1,338 in non-fiction book sales.[22] This implies that bookstores have a greater positive impact on sales of fiction that than on non-fiction titles, which could be explained by genre-specific differences in, e.g., the effectiveness of expert opinion and sales effort provided of B&M retailers.[23]   This finding also indicates that the degree of substitutability between the two retail channels is higher for non-fiction titles than it is for

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[21]Fishwick (2008) argues that average book prices did not decrease following the abrogation of the Net Book Agreement. In particular, he shows that the gap between book prices and the consumer price index increased over time and that average book prices in UK exceed those in Germany and France, which both have a fixed book price agreement in place.

[22]The residual 3,225 books being dropped per bookstore can be assigned to one of the other book genres guidebooks, school books, social sciences, natural sciences, humanities, travel and children books

[23]see, e.g., par. 23 in the German Monopolies Commission report on the German fixed book price system, https://www.monopolkommission.de/images/PDF/SG/s80_fulltext. pdf (last accessed on November 1, 2019).

fiction titles.

These results indicate that, overall, e-Commerce is not a perfect substitute for B&M bookstores. It seems to be the case that some consumers prefer to buy books at B&M bookstores so that the closure of book stores has a negative impact on the total demand for books. Potential reasons for this finding could be that some consumers prefer B&M bookstores over e-Commerce because they benefit from expert opinion, a more careful selection and presentation of titles, ad-hoc purchases or simply because consumers value the atmosphere of bookshops. It remains an open question as to what extent the existing, relatively high number of bookshops in Germany[24] was able to dampen the decrease in book sales because customers were able to switch to other B&M bookstores. Our results indicate that a drastic decrease in the number of bookshops, for instance due to an abrogation of a fixed book price agreement, might have a pronounced negative effect on the demand for books.

References

Bagwell, K., & Riordan, M. H. (1991). High and declining prices signal product quality. *The American Economic Review*, 224–239.

Beck, J. (2007). The sales effect of word of mouth: A model for creative goods and estimates for novels. *Journal of Cultural Economics*, *31*(1), 5–23.

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[24]According to our data, in Germany we have approximately one bookstore per 16,400 inhabitants in 2018, where the German population peaked and the number of bookstores is at its minimum. For instance, in the USA the number of bookstores peaked at 12,000 in 1992 (see Wu, 2018, so that there was approximately one bookstore per 21,400 inhabitants.

Bell, D. R., Gallino, S., & Moreno, A. (2017). Offline showrooms in omnichannel retail: Demand and operational benefits. *Management Science, 64*(4), 1629–1651.

Berger, J., Sorensen, A. T., & Rasmussen, S. J. (2010). Positive effects of negative publicity: When negative reviews increase sales. *Marketing Science, 29*(5), 815–827.

Bester, H. (1998). Quality uncertainty mitigates product differentiation. *The RAND Journal of Economics*, 828–844.

Brynjolfsson, E., Hu, Y., & Rahman, M. S. (2009). Battle of the retail channels: How product selection and geography drive cross-channel competition. *Management Science, 55*(11), 1755–1765.

Burt, S., & Sparks, L. (2003). E-commerce and the retail process: A review. *Journal of Retailing and Consumer Services, 10*(5), 275–286.

Chen, H., Hu, Y. J., & Smith, M. D. (2019). The impact of e-book distribution on print sales: Analysis of a natural experiment. *Management Science, 65*(1), 19–31.

Chen, P.-Y., Wu, S.-y., & Yoon, J. (2004). The impact of online recommendations and consumer feedback on sales. *ICIS 2004 Proceedings*, 58.

Clement, M., Proppe, D., & Rott, A. (2007). Do critics make bestsellers? opinion leaders and the success of books. *Journal of Media Economics, 20*(2), 77–105.

Davies, S., Coles, H., Olczak, M., Pike, C., & Wilson, C. (2004). The benefits from competition: Some illustrative uk cases. *DTI Economics Papers, 9.*

Dearnley, J., & Feather, J. (2002). The UK Bookselling Trade Without Resale Price Maintenance: An Overview of Change 1995–2001. *Publishing Research Quarterly, 17*(4), 16–31.

Fishwick, F. (2008). Book prices in the UK since the end of resale price maintenance. *International journal of the economics of business, 15*(3), 359–377.

Fishwick, F., Fitzsimons, S., & Muir, L. H. (1997). *Effects of the Abandonment of the Net Book Agreement: First Interim Research Report.* Book Trust London.

Gilbert, R. J. (2015). E-books: A tale of digital disruption. *Journal of Economic Perspectives, 29*(3), 165–84.

Hayashi, F. (2000). Econometrics,—— princeton university press: Princeton.

Hilger, J., Rafert, G., & Villas-Boas, S. (2011). Expert opinion and the demand for experience goods: An experimental approach in the retail wine market. *Review of Economics and Statistics, 93*(4), 1289–1296.

Li, H. (2015). Cannibalization or market expansion? the impact of e-books on print book sales. *The Impact of E-Books on Print Book Sales (February 20, 2015).*

Li, H. (2019). Intertemporal price discrimination with complementary products: E-books and e-readers. *Management Science, 65*(6), 2665–2694.

Marvel, H. P., & McCafferty, S. (1990). Resale price maintenance and quality certification. *J. Reprints Antitrust L. & Econ., 20*, 251.

Nelson, P. (1974). Advertising as information. *Journal of Political Economy, 82*(4), 729–754.

Reinstein, D. A., & Snyder, C. M. (2005). The influence of expert reviews on consumer demand for experience goods: A case study of movie critics. *The journal of industrial economics, 53*(1), 27–51.

Riordan, M. H. (1986). Monopolistic competition with experience goods. *The Quarterly Journal of Economics, 101*(2), 265–279.

Schmalensee, R. (1981). Output and welfare implications of monopolistic third-degree price discrimination. *The American Economic Review, 71*(1), 242–247.

Sinai, T., & Waldfogel, J. (2004). Geography and the internet: Is the internet a substitute or a complement for cities? *Journal of Urban Economics, 56*(1), 1–24.

Srinivasan, S. S., Anderson, R., & Ponnavolu, K. (2002). Customer loyalty in e-commerce: An exploration of its antecedents and consequences. *Journal of retailing, 78*(1), 41–50.

Stock, J. H., & Yogo, M. (2005). Testing for weak instruments in linear iv regression, in dwk andrews and jh stock, eds., identification and inference for econometric models: Essays in honor of thomas j. rothenberg. cambridge: Cambridge university press. Cambridge University Press, Cambridge, UK.

Tang, Z., Smith, M. D., & Montgomery, A. (2010). The impact of shopbot use on prices and price dispersion: Evidence from online book retailing. *International Journal of Industrial Organization, 28*(6), 579–590.

Telser, L. G. (1960). Why should manufacturers want fair trade? *The journal of law and economics, 3*, 86–105.

Varian, H. R. (1985). Price discrimination and social welfare. *The American Economic Review, 75*(4), 870–875.

Wang, K., & Goldfarb, A. (2017). Can offline stores drive online sales? *Journal of Marketing Research, 54*(5), 706–719.

Wu, S. X. (2018). Adaptation or death? bookstore chains meet online competition. *Economic Research Initiatives at Duke (ERID) Working Paper*, (273), 18–70.