E-book Pricing and Vertical Restraints*

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Abstract

This paper empirically analyzes how the use of vertical price restraints has impacted retail prices in the market for e-books. In 2010, five of the six largest publishers simultaneously adopted the agency model of book sales, allowing them to directly set retail prices. This led the Department of Justice to file suit against the publishers in 2012, the settlement of which prevents the publishers from interfering with retailers' ability to set e-book prices. Using a unique dataset of daily e-book prices for a large sample of books across major online retailers, we exploit cross-publisher variation in the timing of the return to the wholesale model to estimate its effect on retail prices. We find that e-book prices for titles that were previously sold using the agency model decreased by 18 percent at Amazon and 8 percent at Barnes & Noble. Our results are robust to different specifications, placebo tests, and synthetic control groups. Our findings illustrate a case where upstream firms prefer to set *higher* retail prices than retailers and help to clarify conflicting theoretical predictions on agency versus wholesale models.

Keywords: e-books, agency, vertical restraints, most favored nation, media economics, resale price maintenance, Amazon

JEL Classification: D43, L41, L42

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1 Introduction

In April 2012, the Department of Justice (DOJ) sued Apple and five of the six largest U.S. book publishers for conspiring to raise e-book prices. The lawsuit was prompted by the publishers' switch from the wholesale model of selling e-books to the agency model two years prior. Under the wholesale model, publishers sell e-books to retailers at a wholesale price and retailers set the retail price at which they sell e-books to the consumer. In contrast, the agency model gives publishers the ability to directly set retail prices. The retailer merely acts as an agent for the publisher and receives a commission for every e-book sold.

The adoption of the agency model reflects the tension between upstream firms and downstream firms with regard to who is in control of retail prices. In the textbook example of the double marginalization problem, which arises because upstream firms prefer lower retail prices than downstream firms, vertical price restraints can be used to force downstream firms to set lower retail prices than they otherwise would (Spengler, 1950; Mathewson and Winter, 1984). In this particular case, the publishers adopted the agency model to do exactly the opposite: to set *higher* e-book retail prices. Publishers believed that the low e-book prices set by retailers before the adoption of the agency model, particularly Amazon's $9.99 pricing for new releases, eroded consumers' perception of the value of books, cannibalized hardcover sales, and would eventually lead to a downward pressure on wholesale prices. The agency model seems to have succeeded in at least some of these regards. In the year after its adoption, prices for *New York Times* best sellers rose by more than 40 percent, which led in part to the DOJ lawsuit.[1] Three of the publishers settled shortly after the antitrust case was filed, while the other two followed later the same year.[2] As part of the settlements, the five publishers could not restrict a retailer's ability to set e-book prices for a period of two years, which effectively meant a return to the wholesale model.[3]

In this paper, we estimate differences in retail prices under the agency and wholesale models,

[1] DOJ Complaint, U.S. v. Apple, Inc., et al., April 11, 2012. According to this complaint, "defendants' conspiracy and agreement to raise and stabilize retail e-book prices by collectively adopting the agency model [...] led to an increase in the retail prices of newly released and bestselling e-books."

[2] Apple did not settle with DOJ. After a bench trial in the U.S. District Court for the Southern District of New York, the court concluded on September 5, 2013 that Apple violated § 1 of the Sherman Antitrust Act. The U.S. Court of Appeals for the Second District affirmed the decision of the district court on June 30, 2015.

[3] Although this new model is dubbed the modified or revised agency model by the industry, we refer to it as a modified wholesale model, since the defining element of the agency model—resale price maintenance—is no longer present. The settlements still refer to this pricing agreement as an agency model as publishers are allowed to set a list price for a title and retailers are permitted to set retail prices. The only allowed restriction was that a retailer's aggregate discounts—retail prices below list price—for a given publisher's titles could not exceed the aggregate commission received from the publisher.

by exploiting the switch from the agency model around the time each of the publishers settled with the DOJ. In the next section, we discuss recent developments in the book industry that led to the adoption of the agency model, its effects on prices leading up to the DOJ complaint, its settlement, and the subsequent switch to the modified wholesale model. In Section 3, we describe our unique dataset, which contains daily e-book prices for more than 2,000 current and former *New York Times* best sellers sold by the major e-book retailers in the United States for a period of two years. Our sample begins in January 2012, which predates the finalization of the first settlement by about nine months, and ends in December 2013, more than three months after the last settlement. The data include titles issued by the publishers that were part of the lawsuit, as well as titles issued by other publishers.

In Section 4, we present our estimation strategy, which uses cross-publisher variation in the timing of the switch to estimate the difference in retail prices under the two selling models. Both variation in the time of the decision to settle the lawsuit and variation in the time it took to renegotiate contracts between publishers and retailers after the settlement led to substantial variation in the timing of the switch: the first publisher made the switch to the wholesale model in September 2012, whereas the last publisher did so in September 2013. We employ this variation in timing in a difference-in-differences framework and find that for publishers that were using the agency model, Amazon prices decreased on average by 18 percent after retailers regained control of prices, while Barnes & Noble prices decreased by 8 percent. Placebo tests support our main findings. Our estimates are robust to several specifications that deal with any serial correlation concerns that may arise due to the panel structure of our data.

In Section 5 we aim to distinguish between different mechanisms that help explain our empirical findings. We investigate the pricing strategies of the retailers and publishers and discuss how the observed pricing strategies fit into explanations put forward by the theoretical literature on agency versus wholesale models as well as on vertical price restraints. Several recent theoretical papers have analyzed differences in retail prices between the agency and wholesale models. One strand of the literature argues that even though prices may initially be higher under the agency model, consumers are likely to be worse off in the long run under the wholesale model than under the agency model. For instance, Johnson (2013) argues that retailers who use the wholesale model will initially set low prices to lock in consumers, but find it optimal to raise prices in the long run once a sufficient number of consumers are locked in. On the other hand, publishers under the agency model sell to multiple retailers and thus do not face such incentives, which fosters direct retail

competition between publishers and therefore lower prices in the long run. Gaudin and White (2014) point out that a retailer's incentive to set low initial prices is larger when e-books can only be read through the retailer's proprietary reader, as was the case when e-books purchased from Amazon could only be read on a Kindle device. However, Gaudin and White argue that the switch to the agency model coincided with Amazon's release of Kindle apps for other platforms (most importantly Apple's iPad) and hence greatly reduced Amazon's incentive to keep retail prices low under the wholesale model. We do not find any evidence that prices reflect complementary goods issues, as in Gaudin and White (2014), or that the pricing strategies of the retailers are primarily intended to lock in consumers, as argued by Johnson (2013).[4] Amazon's retail prices decreased after it regained the ability to set retail prices, and have remained consistently low despite having Amazon's means to leverage the Kindle platform due to the availability of Kindle apps for mobile phones, tablets, and other platforms.

Our empirical findings provide more support for another strand of the literature that argues that consumers are likely to be better off when retail prices are set according to the wholesale model. Foros, Kind, and Shaffer (2014) assert that the structure of the e-book market is such that retail prices will be higher when agency contracts are used. More specifically, they find that publishers will set higher retail prices than retailers would set if they were in control if competition is stronger among retailers than among manufacturers, as they argue is the case in the market for e-books. This means that if the retailers' goal is to increase prices, then price control should be given to the level in the distribution channel that faces the least competitive pressure, as is the case in the agency model.[5]

We also explore alternative theoretical explanations for our findings in Section 5. For instance,

[4] Although our findings so far do not provide evidence for such behavior, we cannot rule out the findings of Johnson (2013) as it mostly applies to the long run. Note that a direct test of Gaudin and White's (2014) theoretical prediction would be to compare prices that were set during the original wholesale model to those set in the second period in which the wholesale model was used after the switching from agency. Unfortunately, we do not observe prices from the original wholesale period, so we are unable to make such a direct comparison.

[5] Several other recent theoretical papers have considered the relationship between agency and wholesale models in related settings (Gans, 2012; Abhishek, Jerath, and Zhang, 2015; Condorelli, Galeotti, and Skreta, 2015; Johnson, 2017). Gans (2012) focuses on the pricing of mobile applications on platforms and finds that a hold up problem may arise if consumers have to purchase a device to access the platform. However, restrictions on pricing, such as a most favored nation (MFN) clause, may help overcome the hold up problem. Abhishek, Jerath, and Zhang (2015) find that the agency model leads to lower retail prices, although retail prices may be higher under the agency model if there are positive externalities from sales of complementary products (such as e-readers in the case of e-books). Condorelli, Galeotti, and Skreta (2015) let the decision whether to use agency or wholesale models be endogenous in an environment where the retailer has privileged information about consumers' valuations and show that retailers prefer the agency model. Liu and Shuai (2015) study pricing and welfare for different pricing strategies in vertical markets. Finally, although not about e-book pricing, Adner, Chen, and Zhu (2015) develop a theoretical model which centers around compatibility decisions between Apple and Amazon on their e-book readers.

an important factor in understanding publishers' pricing strategies under the agency model is whether higher retail prices go together with higher wholesale prices. This is related to Jullien and Rey's (2007) finding that upstream firms may engage in resale price maintenance at high retail prices as part of a collusive upstream agreement that prevents them from engaging in secret wholesale price cuts. However, we do not find any indication that wholesale prices increased, even though publishers' coordinated move towards the agency model raised retail prices. In fact, due to the relatively higher retailer's commission, we find that on average e-book wholesale profit margins were lower during the agency period than afterward. It is therefore likely that the publishers' adoption of the agency model can be explained by fears that lower e-book prices cannibalize print books sales and erode consumers' perceptions of the value of a book. On the retailer side of the market, Amazon prices 15 percent of the most popular e-books below wholesale cost, suggesting the use of a loss-leader strategy. Amazon sets e-book prices lower than other retailers, which is consistent with a comprehensive strategy of customer acquisition and retention within Amazon's ecosystem, and is not necessarily intended to subsidize consumers' adoption of the Kindle platform or sale of older (or backlisted) e-books with higher margins (see, e.g., Abhishek, Jerath, and Zhang, 2015). Amazon has arguably the largest breadth and depth of product variety and thus could benefit from selling other—perhaps more profitable—products to its e-book customers.

In Section 6, we conclude and outline the contributions of the paper. Although a number of recent theoretical papers have studied the effects of vertical restraints on prices using recent developments in the e-book market as a motivation, our paper is the first to quantify how e-book prices have developed before and after the switch from the agency to the wholesale model.[6] Moreover, the settlements only prohibit the use of vertical price restraints by publishers for a period of two years and the use of MFN clauses for a period of five years. It is therefore important to know how the selling mechanism affects prices. Although our analysis focuses on the market for e-books, our results are useful for other markets that use some form of the agency model, such as eBay (Buy It Now), Amazon (Amazon Marketplace), newspapers, and smartphone and tablet apps (e.g., Apple's app store).

[6]See Poort and van Eijk (2015) for a discussion of resale price maintenance in the book market. Examples of empirical studies on vertical price restraints in other markets include Mortimer (2008) and De los Santos, Kim, and Lubensky (2016). For instance, Mortimer (2008) examines how the introduction of revenue-sharing contracts in the video industry affected firms' profits and consumer welfare.

2 Recent Developments in the Book Industry

One of the most significant changes in the book industry in the past ten years is the transition from print to electronic books, or e-books.[7] Even though e-books have been around since the early 1970s, they gained greater popularity when E Ink, or electrophoretic ink, became available and offered a much better reading experience while using less battery power. Amazon released its Kindle in November 2007 and Barnes & Noble followed two years later with the Nook. Although e-readers are primarily designed for the purpose of reading e-books, there are many other ways of reading e-books, including computers, smartphones, and tablet computers. Even though tablets are gaining popularity among readers of e-books, by the end of 2013 the Kindle e-reader was still the most popular device for reading e-books.[8] Amazon is also the dominant player in terms of e-book sales. Initially Amazon was responsible for more than 90 percent of all e-books sales in the United States, and by the end of 2013 held 65 percent of the market. Since April 2011, Amazon's sales of e-books exceeds those of print books, which shows the growing importance of e-books for Amazon.[9]

The relatively fast growth of the e-book market is due in part to Amazon's strategy of aggressively discounting popular e-books since Kindle's launch. E-books, like print books, were sold using the traditional wholesale model, in which publishers sold e-books to retailers, which in turn were free to set the retail prices faced by consumers. Amazon's pricing strategy included selling most *New York Times* best sellers and new releases for $9.99. According to Amazon's executives, $9.99 was roughly a break-even price early on: for a hardcover new release with a list price of $25, the digital list price was 20 percent less, or $20. Book industry trade terms are usually in the range of a 50 percent purchase discount, which meant the cost to the retailer was $10.[10] However, this strategy also meant that a fraction (roughly 10 percent) of books was sold at a loss, consistent with a loss-leader strategy and potentially subsidizing consumers' adoption of the Kindle platform.

According to the DOJ complaint, the major publishers preferred higher retail prices for their popular books. In January 2009, they raised the digital list price of their books to the print list price in an unsuccessful attempt to pressure Amazon to increase its retail prices. The publishers'

[7] See Baye, De los Santos, and Wildenbeest (2015) for a more general overview of recent events in the book industry.

[8] Specifically, almost 40 percent of adult Americans who read e-books own a Kindle e-reader, which is the highest percentage of any single device. Figures are from the "Consumer Attitudes Toward E-Book Reading" survey (Book Industry Study Group, August 2013).

[9] See http://phx.corporate-ir.net/phoenix.zhtml?c=176060&p=irol-newsArticle&ID=1565581.

[10] Direct testimony by Amazon's vice president of Kindle Content, David Naggar. Available at http://www.justice.gov/atr/cases/apple/exhibits/px-0837.pdf.

main rationale for higher e-book retail prices was to prevent the erosion of the perceived value of books. In addition, the publishers believed that higher retail prices would diminish Amazon's dominance, prevent future downward pressure on print and e-book prices, and reduce cannibalization of hardcover book sales.

In April 2010, Apple entered the e-book market when it launched its tablet computer, the iPad. Apple did not want to directly compete with Amazon as long as Amazon was heavily discounting e-books. The major publishers disagreed with Amazon's pricing strategy as well, for reasons described above. Their shared motivations led Apple and five of the Big Six publishers to develop the agency model. Key to the agency model is that retail prices are set directly by the publishers, making the retailer an agent for the publisher. In exchange, the retailer receives a commission, which was set at approximately 30 percent of the e-book price.

Apple realized that the agency model would only help it gain market share from Amazon if Amazon did not have lower prices than Apple. According to court documents, Apple negotiated an MFN clause with the publishers to make sure prices were not set higher than Amazon's. In this particular context, the MFN clause held that if other retailers were selling a particular e-book at lower prices, then Apple could sell at those lower prices as well. However, Apple would still get to keep 30 percent of the sale revenues. This guaranteed that Apple would sell at the lowest price set by any retailer. This condition ensured that even if a competing retailer sold at a loss, Apple would make a profit, which created a powerful incentive for the publishers to make sure Amazon would also switch to the agency model.

After a nearly simultaneous decision around Apple's launch of the iPad on January 27, 2010, the five publishers negotiated the adoption of the agency model with the other book retailers—most predominantly Amazon, but also Barnes & Noble and Google's eBookstore, among others.[11] Amazon made the switch to the agency model in April 2010, and other retailers adopted the agency model shortly afterward. Prices of these publishers' e-books increased almost immediately to the maximum price tiers set by the agency agreement with Apple (most predominantly $12.99 and $14.99). On average, prices for these publishers increased 18.6 percent at Amazon and 19.9 percent at Barnes & Noble. The largest price increase was 42.7 percent for *New York Times* best sellers at Amazon. E-book prices for other publishers remained a similar levels during this period: prices at

[11] According to the direct testimony of David Naggar, Amazon's vice president of Kindle Content (see also footnote 10), the negotiation also included a threat to pull their e-books from any retailers that did not adopt the agency model. Amazon initially stopped sales of Macmillan's books on January 28, but subsequently acquiesced to their demands after coming to the realization that the other major publishers (with the exception of Random House) were making similar demands.

Random House—the only "Big Six" publisher that did not immediately adopt the agency model—increased 0.01 percent at Amazon and decreased 0.2 percent at Barnes & Noble. Amazon's e-book prices for other publishers decreased 0.2 percent and increased 2.3 percent at Barnes & Noble.[12]

The developments in the e-book market led the DOJ to sue Apple and the five publishers in April 2012, alleging that they conspired to fix e-book prices. Three of the publishers settled immediately (Harper Collins, Hachette, and Simon & Schuster). These settlements were finalized in September 2012 and prohibited the publishers from restricting a retailer's ability to set the retail price of any e-book for a period of two years, while the use of MFN clauses were prohibited for a period of five years. The settlement specifically mentioned that agency agreements are still allowed, but that the retailer's aggregate expenditure on discounts and promotions for e-books sold under the agency model cannot exceed the retailer's aggregate commission. In fact, the settling publishers were not required to switch back to the original wholesale model, but rather to a modified agreement that effectively restricts them from directly controlling retail prices. In this agreement, publishers set a list price for each e-book and pay the retailer a commission (around 30 percent of the list price) for every book sold but retailers are free to set retail prices directly. Although this new model is dubbed the modified or revised agency model by the industry, we prefer to refer to it as a modified wholesale model, since the defining element of the agency model—resale price maintenance—is no longer present. Still, even though retailers are free to discount e-books, restrictions on the aggregate discount for a given publisher's sales mean that retailers cannot discount e-books too heavily.

The two remaining publishers that were part of the lawsuit (Penguin and Macmillan) settled in early 2013. Apple went to court and was found guilty of fixing prices in July 2013. Apple appealed this decision, arguing that its entrance into the e-book market led to more innovation and more competition, but lost the appeal in June 2015.

Random House, the only Big Six publisher that did not participate in the talks with Apple, adopted the agency model in March of 2011, almost a year later than the other Big Six publishers. Since it was not part of the lawsuit, it was not forced to abandon the original agency model. However, as part of its July 2013 merger with Penguin, Random House joined Penguin in the switch to the modified wholesale model in September 2013.

[12]Table 5 of the direct testimony of Richard Gilbert (available at http://www.justice.gov/atr/cases/apple/exhibits/px-1105.pdf). As part of his direct testimony, Orley C. Ashenfelter found an average price increase of 16.8 percent for e-books published by the five publishers in the six-month period before and six-month period after the implementation of the agency model (http://www.justice.gov/atr/cases/apple/exhibits/px-1097.pdf).

3 Data

The dataset contains daily prices of e-books for a large number of titles. The data were obtained (using a web scraper) throughout 2012 and 2013 for Amazon, Barnes & Noble, and Books-A-Million; for Apple we only have price data for 2012. In addition to e-book prices, we observe several characteristics for each title, such as publisher, number of pages, and customer ratings. We also have detailed information for the print version of the title, including price, format (hardcover or paperback), edition, weight, dimension, sales rank, etc. Table 1 gives descriptive statistics for the variables we use for our empirical analysis, summarized by publisher. As shown in the table, Amazon has the lowest average prices of the four retailers for books published by all of the Big Six publishers, as well as other publishers. Hachette e-books have the lowest average prices across retailers, while those published by Random House have the highest average prices. Book characteristics are very similar across publishers.

Table 1: Summary Statistics

	Harper Collins	Hachette	Simon & Schuster	Macmillan	Penguin	Random House	Other publishers
Price e-book (st.dev.)							
Amazon	8.86	8.08	10.04	9.22	9.87	11.05	8.49
	(3.09)	(2.85)	(2.63)	(2.36)	(2.69)	(2.76)	(3.14)
Barnes & Noble	10.16	8.87	11.35	10.06	10.70	11.59	10.51
	(3.8)	(3.15)	(2.76)	(2.33)	(2.69)	(2.61)	(4.40)
Books-A-Million	10.46	9.36	11.62	10.41	10.80	11.89	10.07
	(4.10)	(2.64)	(2.75)	(2.37)	(2.66)	(2.39)	(4.02)
Apple	10.05	10.38	11.22	10.66	11.05	11.90	10.34
	(2.75)	(2.05)	(2.42)	(2.03)	(2.69)	(2.40)	(2.75)
Book characteristics							
Ratings	4.08	4.02	4.12	3.96	4.03	4.10	4.29
	(0.45)	(0.50)	(0.49)	(0.52)	(0.55)	(0.45)	(0.41)
Number of reviews	365	667	441	369	385	708	398
	(485)	(990)	(755)	(613)	(764)	(1,512)	(1,234)
Number of years since release	0.54	0.77	0.80	0.91	0.55	0.85	0.78
	(0.96)	(1.66)	(1.62)	(2.46)	(1.19)	(1.78)	(1.90)
Print book characteristics							
Sales rank	73,237	58,155	58,020	83,607	63,531	38,799	72,479
	(161,348)	(96,302)	(96,322)	(121,165)	(97,918)	(87,587)	(136,691)
Number of pages	391	416	391	389	406	406	338
	(126)	(139)	(145)	(101)	(128)	(171)	(137)
Book weight (oz.)	15.51	16.46	17.29	16.68	15.42	18.83	14.49
	(8.18)	(8.96)	(9.54)	(8.56)	(8.76)	(9.95)	(9.46)
List price	21.14	20.10	21.80	21.47	19.66	21.98	18.35
	(8.28)	(7.67)	(7.57)	(7.87)	(9.12)	(7.60)	(8.29)
Number of titles	200	244	276	163	444	449	451
Number of observations	115,789	141,250	159,790	94,365	257,055	259,929	261,096

Notes: The table presents the means of each variable, standard deviation in parentheses.

Our sample consists of titles that have been on one of the *New York Times* Best Sellers lists for at least one week since 2011.[13] We track the prices for these titles starting from the time of their appearance on the best seller list until the end of the sample period. Since new titles appear on the best seller lists every week, the number of titles in our dataset increases over time—from 417 on January 1, 2012 to 2,068 on December 31, 2013.

After the switch to the agency model, Amazon began to mention on its product pages whether it or a publisher set the price of a particular e-book. Figure 1 presents an example of this by showing screenshots for the book *True Compass: A Memoir* by Edward Kennedy during the period in which agency prices were used (in Figure 1(a)) and afterwards (in Figure 1(b)). In addition Amazon prominently displayed each book's publisher (in the example, Hachette Book Group) and who set the price if the book was under an agency agreement. Using this information, we observe the exact date of the switch away from the original agency model for each title in our sample. This is important, because there can be several months between the settlement date and the actual switch date due to the time it takes to renegotiate contracts between publishers and retailers. This is also shown in Table 2, which for each publisher gives the exact date of the announcement of the settlement, the finalization of the settlement, and the earliest date on which Amazon stated that it, rather than the publisher, set the price of a book. Notice that there is a lot of heterogeneity in the time it took to write new contracts: Amazon started discounting again just four days after finalizing its settlement with Harper Collins, while Penguin took almost four months. The actual switch to the wholesale model for e-books published by Macmillan, the last publisher to settle, occurred four months before the finalization of the settlement, in part due to restrictions imposed by the judge that were meant to speed up the transition. Random House adopted the agency model in 2011 after the other publishers but was not a named defendant in the lawsuit as it was the only "Big Six" publisher that did not participate in the talks with Apple. Although this meant Random House could keep using the agency model, it adopted the terms of the settlement after its merger with Penguin and switched to the wholesale model on September 2013.

Since we only observe the exact switch dates at Amazon, we cannot be certain that the other retailers switched at the same time. However, reports from trade sites for the publishing industry indicate that in most cases the other retailers followed the same day, or at most within a few days.[14]

[13]The *New York Times* Best Sellers lists we have used are hardcover fiction; hardcover nonfiction; trade paperback fiction; mass market paperback fiction; paperback nonfiction; hardcover advice, how-to, and miscellaneous; and paperback advice, how-to, and miscellaneous.

[14]See, for instance, https://gigaom.com/2012/09/10/that-was-fast-amazon-is-already-discounting-harpercollins-ebooks/.

Table 2: Settlement and Switch Dates

	Settlement announcement	Settlement finalization	Amazon switch
Harper Collins	Apr 11, 2012	Sep 06, 2012	Sep 10, 2012
Hachette	Apr 11, 2012	Sep 06, 2012	Dec 04, 2012
Simon & Schuster	Apr 11, 2012	Sep 06, 2012	Dec 17, 2012
Macmillan	Feb 08, 2013	Aug 12, 2013	Apr 04, 2013
Penguin	Dec 18, 2012	May 17, 2013	Sep 01, 2013
Random House	–	–	Sep 01, 2013

Source: Department of Justice Antitrust Case Filings United States versus Apple, Inc., et al. See also http://www.justice.gov/atr/cases/applebooks.html.

4 Empirical Analysis

4.1 Empirical Strategy

All five of the Big Six publishers that were part of the lawsuit have settled since the announcement of the lawsuit in April 2012 and again allow retailers to offer discounts, as in the original wholesale model. The sixth Big Six publisher, Random House, was not part of the lawsuit, but did use the agency model at the beginning of the sample and abandoned the original agency model in September 2013, after its merger with Penguin.

Since book prices change frequently, simply comparing prices before and after the switch could lead to misleading results. Instead, we exploit cross-publisher variation in the timing of the switch to different selling models. Using a difference-in-differences regression framework, prices for each of the Big Six publishers are compared to prices for the other publishers before and after the publisher's switch from the agency to the modified wholesale model.

The specification we estimate is

$$\ln(price_{jt}) = \gamma \cdot (wholesale_{jt} \times bigsix_j) + \beta \cdot X_j + \lambda_p + \lambda_w + \varepsilon_{jt},$$

where $price_{jt}$ is the e-book price of title j at time t; $wholesale_{jt}$ is an indicator for whether at time t the price of title j was set by the retailer, as in the modified wholesale model; $bigsix_j$ is an indicator for the title being published by one of the Big Six publishers; X_j includes book characteristics such as days since release, sales rank, weight of the related printed book, ratings, and list price; λ_p are publisher fixed effects; λ_w are week fixed effects; and ε_{jt} is an error term. Since only Big Six publishers were using the agency model, the variable $wholesale_{jt}$ captures the switch for each of the publishers to the modified wholesale model, so $wholesale \times bigsix$ can be

interpreted as a difference-in-differences estimator.

4.2 Main Results

Table 3 presents results for the estimation of the main difference-in-differences specification. Since retailers may have different pricing strategies, we separately estimate the model for prices at Amazon and Barnes & Noble, the two largest sellers of e-books. We estimate two specifications for each retailer: a specification in which we allow for publisher fixed effects, and a specification that allows for book fixed effects. When allowing for publisher fixed effects, the estimated coefficients on $(wholesale_{jt} \times bigsix_j)$ imply that the switch to the wholesale model reduced average e-book prices on Amazon by around 18 percent and on Barnes & Noble by approximately 8 percent.[15] Both coefficients are highly significant. Allowing for book fixed effects reduces the magnitude of the effect, but not by much: as a result of the switch, the average percentage price decrease is 17 percent for e-books sold on Amazon and 7 percent on Barnes & Noble.

The estimated coefficients for the other controls shown in the table are very similar across retailers and specifications, and indicate that books with higher sales ranks sell at lower prices. Although the number of pages in the book only affects Barnes & Noble prices, the weight of the related printed book is positively related to prices of books at both retailers which could reflect that the value of having a (zero weight) digital book is increasing with the weight of the printed alternative. Ratings on Amazon do not seem to matter for prices, although there is a small negative association between the number of reviews and price. The list price of the related printed book is positively related to the price of the corresponding e-book. The coefficient on the number of years since release in the specifications with book fixed effects quantifies the negative relationship between the age of a book and its price.

A crucial assumption in our difference-in-differences framework that helps us to identify the price change following a switch from agency to the modified wholesale model is that if none of the Big Six publishers would have switched, they would all have continued on the same trend. Unfortunately this assumption is not directly testable, but we can get an idea of whether this parallel-trend assumption is plausible by looking at publisher-specific trends in the first few months of the sample, when all Big Six publishers were still selling e-books using the original agency model. We do this by adding a linear pre-trend for each of the publishers in the period before any of the Big Six publishers had switched—if we cannot reject that all of the publishers were on the same

[15] The percentage change in price is calculated as $100 \cdot [\exp(\hat{\gamma}) - 1]$, where $\hat{\gamma}$ is the estimated coefficient on $(wholesale_{jt} \times bigsix_j)$ as reported in Table 3.

Table 3: Main Results

	Amazon		Barnes & Noble	
	Publisher fixed effects	Book fixed effects	Publisher fixed effects	Book fixed effects
Difference-in-differences estimator				
Wholesale×Big Six	−0.199***	−0.191***	−0.088***	−0.077***
	(0.006)	(0.006)	(0.007)	(0.007)
Other controls				
ln(Sales rank)	−0.032***	−0.024***	−0.031***	−0.021***
	(0.002)	(0.002)	(0.002)	(0.002)
Number of pages in the book (×1000)	−0.064		−0.076**	
	(0.042)		(0.039)	
Weight of the book (ounces)	0.003***		0.003***	
	(0.001)		(0.001)	
Rating on Amazon	0.006		0.010	
	(0.007)		(0.007)	
Number of reviews on Amazon (×1000)	−0.043***	−0.025***	−0.044***	−0.026***
	(0.009)	(0.008)	(0.009)	(0.006)
List price	0.015***		0.016***	
	(0.001)		(0.001)	
Years since release	−0.002	−0.193***	0.002	−0.131***
	(0.003)	(0.017)	(0.003)	(0.018)
Constant	2.350***	2.762***	2.339***	2.686***
	(0.048)	(0.026)	(0.047)	(0.026)
R-squared	0.525	0.733	0.450	0.693
Number of observations	620,992	620,992	607,656	607,656

Notes: Dependent variable is ln(*price*). All specifications include week fixed effects. Standard errors (clustered by book) in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

trend in the pre-treatment period, we can have more confidence that the parallel trend assumption holds in the period after the first switch as well. Table 4 gives the results for the pre-trend analysis. While we cannot reject that most of the publishers are on the same pre-trend, prices for e-books published by Simon & Schuster are on a slightly more negative trend than the others at both retailers. However, as is also shown in Table 4, excluding Simon & Schuster from the analysis only results in larger estimated price effects of the switch, whereas adding the pre-trend does not affect the difference-in-differences estimator.

Robustness

In this section we present a robustness analysis of the main results under various specifications. As our analysis relies on a relatively long time series of prices, we first address how susceptible our analysis is to bias due to serial correlation. In addition to the long time series, publishers do not return to the agency model once they have switched back to the wholesale model, which means that the treatment variable does not show much variation over time. As argued by Bertrand, Duflo,

Table 4: Pre-trend Analysis

	Amazon			Barnes & Noble		
	Baseline	Pre-trend	No Simon & Schuster	Baseline	Pre-trend	No Simon & Schuster
Wholesale×Big Six	−0.199***	−0.201***	−0.213***	−0.088***	−0.087***	−0.128***
	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.008)
Publisher-specific trend						
Hachette		0.002			0.002*	
		(0.001)			(0.001)	
Simon & Schuster		−0.005***			−0.006***	
		(0.001)			(0.001)	
Macmillan		0.000			−0.001	
		(0.001)			(0.001)	
Penguin		0.001			−0.002	
		(0.001)			(0.001)	
Random House		−0.001			−0.002**	
		(0.001)			(0.001)	
R-squared	0.525	0.526	0.541	0.450	0.453	0.462
Number of observations	620,992	620,992	520,542	607,656	607,656	509,358

Notes: Dependent variable is ln(*price*). The specifications include week fixed effects and controls as the main specification in Table 3. Publisher-specific trend parameters are multiplied by 1,000 and are relative to Harper Collins. Standard errors (clustered by book) in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

and Mullainathan (2004), the resulting serial correlation problems need to be addressed to avoid underestimating the standard error of the difference-in-differences estimator.

To assess the extent to which serial correlation affects our estimates, we aggregate the data into weekly and monthly observations. This reduces the average number of periods we use for our analysis and should therefore alleviate the serial correlation problem. As shown in Table 5, the estimated coefficient on $wholesale \times bigsix$ changes only slightly when collapsing the data into fewer periods. An alternative way to address serial correlation is to ignore the time series information altogether by averaging the data before and after the switch. A complication in our application is that not all publishers switched at the same time. We therefore use the technique suggested by Bertrand, Duflo, and Mullainathan (2004) to deal with aggregation when treatment dates are staggered over time. This method consists of two stages: in the first stage we regress the log of prices on a set of covariates as well as publisher fixed effects and week dummies, i.e.,

$$\ln(price_{jt}) = \beta \cdot X_j + \lambda_p + \lambda_w + \varepsilon_{jt}.$$

We then group the residuals into residuals from before the switch and residuals from after the switch and take averages (per book). In the second stage we estimate the effect of the switch on

Table 5: Robustness Analysis

Specification	DID Estimator wholesale×Big Six		*R*-squared	Obs.
	Panel A: Amazon			
Aggregated by week	−0.194***	(0.006)	0.541	90,647
Aggregated by month	−0.181***	(0.006)	0.561	20,960
Residualized two-period panel	−0.281***	(0.012)	0.242	852
Only titles released before switch	−0.191***	(0.006)	0.542	555,498
Including other publishers	−0.233***	(0.007)	0.499	771,988
Including print-book prices	−0.198***	(0.006)	0.536	606,825
Within 90 days of release	−0.159***	(0.011)	0.733	94,604
After 90 days of release	−0.199***	(0.007)	0.523	595,270
Before paperback release	−0.203***	(0.007)	0.654	412,759
After paperback release	−0.192***	(0.010)	0.364	208,233
	Panel B: Barnes & Noble			
Aggregated by week	−0.083***	(0.007)	0.466	90,602
Aggregated by month	−0.075***	(0.007)	0.480	20,947
Residualized two-period panel	−0.118***	(0.012)	0.049	850
Only titles released before switch	−0.074***	(0.007)	0.461	543,258
Including other publishers	−0.108***	(0.008)	0.462	755,274
Including print-book prices	−0.086***	(0.007)	0.456	599,582
Within 90 days of release	−0.112***	(0.014)	0.665	93,299
After 90 days of release	−0.082***	(0.008)	0.450	583,693
Before paperbacks release	−0.105***	(0.008)	0.595	403,054
After paperbacks release	−0.057***	(0.012)	0.236	204,602

Notes: The table presents difference-in-differences coefficients estimates for different sample and control specifications. Dependent variable is ln(*price*). The specifications include week fixed effects (month fixed effects when aggregated by month) and controls as the main specification in Table 3. Standard errors (clustered by book) in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

prices by OLS using a dummy variable similar to $wholesale \times bigsix$ to indicate that the switch occurred in the second period of the aggregated two-period panel for all observations.

The results of this residualized aggregation, shown in Table 5, confirm that the standard errors were indeed understated when serial correlation was not taken into account. Compared to the main estimates in Table 3, the magnitude of the effect increases for both retailers as a result of the residualized aggregation. Part of this could be due to a difference in sample. In our main specification, we use all books that were released during the sample period, even if this was after a publisher's switch, while for the two-period panel we can only include books for which we have observations both before and after the switch. However, when we estimate the baseline specification using only titles that were released before the switch, as shown in Table 5, we get almost identical results to the baseline results, which makes it unlikely that the difference in sample is the cause of this.

In our main specification, we only include books sold by Big Six publishers. Since we have variation in the timing of the switch across the Big Six publishers, this means the control group consists of the Big Six publishers that were still using the agency model. Our dataset also contains data on books published by non–Big Six publishers. The books published by these smaller publishers can serve as an additional control group—these books were sold using the wholesale model throughout the entire sample period, so any difference in outcome between books published by the other publishers and those published by the Big Six publishers can potentially be attributed to the switch away from the original agency model. These results are reported in Table 5 and show an even larger effect than in our main results: an average price decrease of 21 percent for books sold by Amazon and 10 percent for e-books sold by Barnes & Noble.[16]

In order to control for demand factors particular to a book title that may change over time (for instance the release of a movie that is based on the book), Table 5 presents estimates for titles that are within ninety days of release and those that are older. Although the differences are minor, the effect of the switch is smaller for newer books than for older books sold by Amazon. We find the opposite effect for Barnes & Noble.

The first edition of a new title is typically released as a hardcover; once hardcover sales begin to decrease, a paperback edition is released. Books that have not yet seen a paperback release therefore tend to be newer and more popular, which may affect pricing of the e-book version as well. The final two specifications of Table 5 estimate the main specification separately for titles that have not yet seen a paperback release and for those that have. For Amazon, the results are very similar across the two specifications. For Barnes & Noble, we find the effect of the switch away from agency pricing to be smaller for the older titles.

4.3 Effects by Publishers

The main difference-in-differences specification presented above estimates the average effect of the switch in selling method across publishers. If there is no competition between publishers, one would expect the effect to be similar across publishers. However, if publishers compete with one another, the staggered nature of the switches to the modified wholesale model could make the effect of switching for each publisher depend on how many publishers have already switched. Table 6 presents difference-in-differences estimates by publisher for three different specifications. As the baseline results show, the effects are generally very similar across publishers, although the price

[16] The percentages are $(100 \cdot [\exp(0.233 - 1] = 20.7)$ and $(100 \cdot [\exp(-0.108 - 1)] = 10.2)$ using the coefficients from Table 5 for Amazon (-0.233) and Barnes & Noble (-0.108), respectively.

effect is much smaller after Simon & Schuster's switch than after the switches of the other Big Six publishers, and even insignificant at Barnes & Noble.

Table 6: Effects by Publishers

	Amazon			Barnes & Noble		
	Baseline	30-day window	7-day window	Baseline	30-day window	7-day window
Wholesale×Harper Collins	−0.208***	−0.195***	−0.191***	−0.122***	−0.100***	−0.078***
	(0.018)	(0.018)	(0.011)	(0.020)	(0.020)	(0.016)
Wholesale×Hachette	−0.226***	−0.159***	−0.126***	−0.152***	−0.116***	−0.034***
	(0.013)	(0.019)	(0.013)	(0.014)	(0.023)	(0.012)
Wholesale×Simon & Schuster	−0.108***	−0.128***	−0.232***	0.013	0.017	−0.132***
	(0.013)	(0.017)	(0.019)	(0.013)	(0.017)	(0.022)
Wholesale×Macmillan	−0.191***	−0.170***	−0.092***	−0.100***	−0.132***	−0.084***
	(0.013)	(0.014)	(0.012)	(0.011)	(0.018)	(0.011)
Wholesale×Penguin	−0.221***	−0.047***	−0.059***	−0.085***	−0.003	−0.012***
	(0.010)	(0.008)	(0.006)	(0.010)	(0.008)	(0.005)
Wholesale×Random House	−0.226***	−0.189***	−0.160***	−0.111***	−0.054***	−0.031***
	(0.010)	(0.007)	(0.007)	(0.010)	(0.008)	(0.006)
R-squared	0.528			0.455		
Number of observations	620,992			607,656		

Notes: The table presents difference-in-differences coefficient estimates by publisher. The baseline specification includes switching interaction coefficients for each publisher. As publishers switched at different dates, the windowed coefficients are obtained from separate regressions using observations around the time of the switch of each publisher. All specifications include controls as in the main specification in Table 3. Dependent variable is ln(*price*). Week fixed effects included. Standard errors (clustered by book) in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

In each of the specifications so far, we have used all observations before and after a publisher's switch to obtain the difference-in-differences estimator. Since publishers made the switch from the agency to the modified wholesale model at different times, the number of observations we use before and after a switch is not the same across publishers. A potential concern is that publishers are not exposed to serial correlation in similar ways that can be detected in the data, or that any differential (publisher-specific) trend that is not picked up by the week fixed effects will bias the difference-in-differences estimator. Moreover, when using all observations before and after a publisher's switch, it is difficult to distinguish between the short-run and long-run effects of the switch. To deal with these issues, the remaining columns of Table 6 give the publisher-specific difference-in-differences estimator when using shorter windows. Specifically, we look at a window that includes price observations 30 days before and 30 days after a switch, as well as a shorter window of 7 days before and 7 days after a switch. Since the publishers' switching dates are staggered and in most cases there are more than 60 days between subsequent switching dates, we have to estimate the model for each publisher separately. The reported difference-in-differences estimators in Table 6 are thus obtained from separate regressions. For most publishers, the effects become smaller

when shortening the window, which suggests that the full price effects of the switches are spread out over time. The difference is striking, especially for Penguin: if the window is shortened, the difference-in-differences estimate changes from -0.221 to between -0.047 and -0.059 (depending on the window used).

These findings are in line with Figure 2(a), which shows how average prices for each of the Big Six publishers have evolved over time. As indicated by the light green curve, the large differences in price effects for Penguin reflect two substantial price decreases prior to the switch to the wholesale model. The first price drop coincides with the finalization of the settlement with the DOJ in May 2013 (see Table 2), several months prior to the switch to the wholesale model in August 2013. The second drop in prices coincides with the finalization of the merger with Random House on July 1st, 2013. According to the results shown in Table 6, when we attribute all three drops in prices to the switch, we find that prices decreased by approximately 20 percent, while if we only take the last drop into account (the one that happened around the time of the switch), the percentage price reduction is 5 percent. Unfortunately, our data does not allow us to take a stand on whether we should assign the first two drops to the switch or to something else. The most likely explanation for the first drop is that Penguin was adjusting its prices to reflect the fact that most other publishers had already switched, since it happened around the time of the settlement. The second drop could represent a second adjustment, but could also be related to the merger with Random House that was just announced. Interestingly, we do not observe a similar pattern for Random House. The most important factor that distinguishes Random House from the other publishers is that it was not considered a co-conspirator in the price fixing case and it was not a defendant in the DOJ lawsuit, and Random House may therefore have faced different incentives. For both publishers, the switch to the wholesale model was completed in September 2013.

Figure 2(a) also shows that all of the other Big Six publishers saw a more prominent drop in the average Amazon price when they switched. The drops are generally less noticeable for average Barnes & Noble prices over time, as shown in Figure 2(b), although Big Six publishers like Hachette and Macmillan experienced price drops at the time of the switch similar to those at Amazon.

Placebo Tests and Synthetic Control Method

The identification of the effect of the agency model on e-book prices comes from changes in publisher-specific selling method. An alternative explanation is that these changes are driven by shocks that are not captured by our controls. For instance, the switch away from the original

agency model is directly related to the settlement. Thus the drop in prices we observe may be the effect of unobserved shocks related to the lawsuit (e.g., dissolution of the alleged cartel) that are not captured by our data. To test whether our results indeed represent the effects of publishers switching to the wholesale model, we conduct several placebo tests.

In our first placebo test, we assign to each of the Big Six publishers the switch date for one of the other publishers, taking into account that this will only work if the publisher has not already switched at that date. Since Harper Collins was the first to switch, we cannot estimate a placebo difference-in-differences estimator for this publisher, but we can use its switch date as a placebo switch date for all other publishers. Hachette was the second Big Six publisher to make the switch, which means for Hachette we can only use Harper Collins' switch date as a placebo switch date, but we can use Hachette's switch date as placebo switch date for all the Big Six publishers that switched at a later time. In total we end up with 14 different combinations of publishers and placebo switch dates. We estimate each of these combinations separately, using a 14-day window before and after the placebo switch date. If our main results are picking up unobserved shocks that happened around the same time as the switches, then we would expect to find similar effects for the placebo switch dates.

The results for the first placebo test are reported in Table 7. Results for Amazon are in Panel A of the table and results for Barnes & Noble are in Panel B. The results are very similar across retailers. Only when we assign Harper Collins' switch date to Hachette do we find the placebo effect to be negative and significantly different from zero at the 5 percent level, although the effect is very small. For all other combinations, we either cannot reject that the placebo difference-in-differences estimator is equal to zero, or we obtain a significant positive effect. For instance, Random House experiences statistically significant price increases at the switching dates of all the other publishers. However, the coefficients for Random House range from 0.008 to 0.041 for Amazon, which means that these effects are relatively small in comparison to those for the main analysis. In order to address concerns that these positive effects might nevertheless lead to an overestimation of the effect of the switch, we estimate the main specification excluding Random House. This new estimation results in a switch-related price decrease at Amazon of 17 percent compared to an 18 percent decrease if Random House is included. The price decrease at Barnes and Noble is 7.5 percent when Random House is excluded and 8.4 percent without excluding it. These results suggest that the effect of the switch we find in the main specification is indeed biased downward, although only slightly. Note that the significant positive coefficients that we find could

Table 7: Placebo Tests: Switch Date Imputation

	Publisher switching to wholesale			
	Harper Collins	Hachette	Simon & Schuster	Macmillan
	Panel A: Amazon			
Wholesale×Hachette	−0.011**			
	(0.006)			
Wholesale×Simon & Schuster	0.004	0.010*		
	(0.004)	(0.006)		
Wholesale×Macmillan	−0.006	0.043**	0.002	
	(0.007)	(0.018)	(0.019)	
Wholesale×Penguin	−0.001	0.040***	0.047***	0.006
	(0.004)	(0.006)	(0.008)	(0.005)
Wholesale×Random House	0.008***	0.023***	0.041***	0.014***
	(0.002)	(0.006)	(0.007)	(0.004)
	Panel B: Barnes & Noble			
Wholesale×Hachette	−0.009*			
	(0.005)			
Wholesale×Simon & Schuster	0.004	0.012**		
	(0.004)	(0.006)		
Wholesale×Macmillan	−0.004	0.033*	−0.001	
	(0.006)	(0.020)	(0.018)	
Wholesale×Penguin	−0.002	0.031***	0.043***	−0.006*
	(0.004)	(0.006)	(0.008)	(0.004)
Wholesale×Random House	0.007***	0.016***	0.046***	0.001
	(0.002)	(0.006)	(0.008)	(0.003)

Notes: The table presents difference-in-differences estimates using the switching date of the publisher in each column imputed to the corresponding publisher on the row. Dependent variable is ln(*price*). The specification includes switching interaction coefficients for each publisher, week fixed effects and controls as the main specification in Table 3. Standard errors (clustered by book) in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

be the result of some form of price competition between publishers and retailers, in which prices set by the non-switching publishers are strategic substitutes for the prices set by the retailer for the publisher that just switched.

Table 8 gives the results for a second placebo test in which we replicate the estimation of the main specification using the print book price instead of the e-book price for each of the titles in our sample. If the changes in e-book prices we observe only reflect the change in selling method, we would not expect to find a similar effect on the related print book prices. The results in Table 8 confirm that the effect is not present for print book prices: although the estimated difference-in-differences coefficient is negative for both retailers, the effect is small and only significant at the 10 percent level in Amazon's case and at the 5 percent level in Barnes & Noble's case. Additionally, if we split out the effect by publisher, we do not find much evidence that print book prices changed as a result of the switch, providing strong support for our main findings.

Table 8: Placebo Tests: Effect of Switch on Print Book Prices

	Amazon		Barnes & Noble	
	Overall	By publisher	Overall	By publisher
Wholesale×Big Six	−0.006*		−0.010**	
	(0.003)		(0.004)	
Wholesale×Harper Collins		−0.001		−0.015
		(0.011)		(0.014)
Wholesale×Hachette		−0.011		−0.027***
		(0.009)		(0.010)
Wholesale×Simon & Schuster		0.016*		0.003
		(0.008)		(0.009)
Wholesale×Macmillan		0.012		0.020
		(0.010)		(0.014)
Wholesale×Penguin		−0.037***		−0.029***
		(0.006)		(0.005)
Wholesale×Random House		0.002		−0.007
		(0.005)		(0.006)
R-squared	0.909	0.910	0.909	0.882
Number of observations	608,670	608,670	614,687	614,687

Notes: The table presents difference-in-differences coefficient estimates by publisher and for Big Six publishers using ln(*price*) of print books as dependent variable. The specification includes switching interaction coefficients for each publisher, week fixed effects and controls as the main specification in Table 3. Standard errors (clustered by book) in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

To assuage potential concerns about the quality of the control group, we also obtain difference-in-differences estimates using the synthetic control group methodology of Abadie and Gardeazabal (2003) and Abadie, Diamond, and Hainmueller (2010). They propose a methodology that deals with the uncertainty of selecting a suitable control group from many potential control groups. Central to their methodology is the creation of a synthetic control group, which is an optimally weighted average of all possible control groups.

In our setting, the six publishers switched regimes in a staggered fashion, which limits the number of potential controls available for each switch to the publishers that have not switched at the time of the treatment. For this reason we are able to construct a synthetic group only for Harper Collins (the first publisher that made the switch) for retail prices at Amazon and Barnes & Noble.

Our estimate of the switch is the difference between the average prices under the agency model and the synthetic version after the switch. Table 9 presents estimates of the effect using a standard difference-in-differences methodology. The estimate closely matches the baseline results presented in Table 3: according to the synthetic control group method, the switch to the modified wholesale model implies a price drop of 19 percent at Amazon and 7 percent at Barnes & Noble.

Figure 3 illustrates the trend of average retail prices of Harper Collins and the synthetic control

group at each of the retailers for 14 days before and after the switch. The figure illustrates that the synthetic control group closely follows the trajectory of Harper Collins' average prices (up to a scale) in the period before the switch to the wholesale regime. This indicates that the synthetic group is a sensible approximation of what the level of Harper Collins retail prices would have been under the agency regime after the date of the switch. The figures illustrate that the effect of the switch is substantial: Amazon's prices dropped $2 immediately after the switch, while Barnes & Noble decreased prices $0.59 on average in the first week and $1.32 in the second week after the switch.[17]

Table 9: Estimates using Synthetic Control for Harper Collins

	Amazon	Barnes & Noble
Wholesale×Harper Collins	−0.207***	−0.073***
	(0.007)	(0.009)
R-squared	0.985	0.843
Number of observations	58	58

Notes: The table presents difference-in-differences coefficient estimates for Harper Collins using a synthetic control group created from the rest of Big Six publishers that had not switched by the time of Harper Collin's switch. The specifications include week fixed effects and controls as in the main specification in Table 3. Dependent variable is ln(*price*). * significant at 10%; ** significant at 5%; *** significant at 1%.

4.4 Effects for Other Retailers

Our dataset also contains prices for e-books sold at Books-A-Million and Apple. Table 10 presents the results for these retailers. As shown in the first column of this table, the overall effect for Books-A-Million is close to zero when estimating the main specification. However, as shown in the second column of Table 10, when we obtain the difference-in-differences estimator for each individual Big Six publisher, the switch did have an effect for three of the publishers.[18] However, the effect goes in opposite directions: Harper Collins saw lower prices after the switch, while Simon & Schuster and Random House both saw higher prices. Interestingly, when shortening the window to 7 days, the negative effects found for Harper Collins turn into a positive effect, which suggests the immediate

[17]Note that Barnes & Noble's second drop could be explained by Barnes & Noble strategically adjusting its prices after learning about Amazon's response. Also note that especially after the retailers were again setting their own prices, price variation increased, and some of this price variation is not picked up by our controls. Since our synthetic control group analysis uses a two-week window only, it is particularly sensitive to idiosyncratic movements in the price data within this period—Figure 2 shows that Harper Collins' prices at Barnes & Nobles were indeed going down in the second week after the switch, but went up again during the next few weeks.

[18]Note that Books-A-Million was not selling Hachette book titles in the period we use for our sample.

effect of Harper Collins' switch was for prices to go up, although they decreased in the long run. This pattern is confirmed by Figure 4(a), which plots publisher-specific average e-book prices over time for Books-A-Million.

Table 10: Estimates for Books-A-Million and Apple

	Books-A-Million			Apple
	Overall	By publisher	7-day window	Baseline
Wholesale×Big Six	0.005			
	(0.009)			
Wholesale×Harper Collins		−0.090***	0.058***	−0.136***
		(0.022)	(0.016)	(0.017)
Wholesale×Simon & Schuster		0.050***	0.016	
		(0.014)	(0.015)	
Wholesale×Macmillan		0.003	0.020	
		(0.014)	(0.015)	
Wholesale×Penguin		−0.012	−0.017***	
		(0.012)	(0.004)	
Wholesale×Random House		0.072***	−0.006*	
		(0.018)	(0.004)	
R-squared	0.462	0.465		0.550
Number of observations	413,153	413,153		139,545

Notes: The table presents difference-in-differences coefficient estimates by publisher and for Big Six publishers. For Apple, only observations for 2012 are available, hence we can estimate the effect for Harper Collins, the first publisher to switch. Dependent variable is $\ln(price)$. As publishers switched at various dates, the windowed coefficients are obtained from separate regressions using observations around the time of the switch of each publisher. The specification includes switching interaction coefficients for each publisher, week fixed effects and controls as in Table 6. Standard errors (clustered by book) in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

For Apple we only have data up to December 2012. Since Harper Collins is the only publisher that switched in this period, we can only obtain the difference-in-differences estimator for this publisher. The results for Apple are presented in the last column of Table 10. The magnitude of the price decrease at Apple for e-books published by Harper Collins is smaller than at Amazon but only slightly larger than at Barnes & Noble. The sharp drop in prices for e-books published by Harper Collins right after its switch is also clearly visible in Figure 4(b).

5 Discussion of Theoretical Mechanisms

Our results provide evidence that the switch to the modified wholesale model in the period from 2012 to 2013 led to a substantial drop in prices of e-books at Amazon and, to a lesser extent, Barnes & Noble. Since publishers could directly set the retail prices of e-books during the agency period, our findings support the notion that retail pricing strategies for e-books between big publishers

and the majority of retailers were not aligned. In this section we examine the pricing strategies of the publishers and retailers in more detail, and use this to try to distinguish between different theoretical mechanisms. Our main focus will be on the recent theoretical literature on agency versus wholesale models, which has centered on issues related to switching costs and complementary goods, as well as on the literature on vertical markets.

5.1 Agency versus Wholesale Models

Several recent papers that theoretically analyze the relationship between agency and wholesale models argue that the relatively low e-book prices set by Amazon before the adoption of the agency model in 2010 were mainly temporary and the result of a consumer lock-in strategy (Johnson, 2013) or related to the existence of a complementary good (Gaudin and White, 2014). Low e-book prices subsidized consumers' adoption of the Kindle platform, which in turn increased Amazon's ability to raise prices in the future. In Johnson's (2013) model, publishers may raise prices initially when switching to the agency model, but since publishers sell to multiple retailer platforms and are thus not affected by lock in, future agency prices are likely to be lower than under the wholesale model. Gaudin and White (2014) argue that the switch to the agency model in 2010 coincided with the release of Kindle apps for competing devices, such as the iPad. This meant that Amazon's Kindle was no longer essential for reading e-books, and as a result, Amazon's incentive to keep e-book prices low diminished. Gaudin and White thus argue that Amazon will raise e-book prices when given the ability to set retail prices. However, we find that Amazon's retail prices decreased after it regained the ability to set retail prices, and have remained consistently low despite the availability of Kindle apps for mobile, tablet, and computer platforms.[19] Nevertheless, Johnson's (2013) model may help explaining our finding that we find bigger effects at Amazon than at the other retailers. Specifically, an explanation for the different trends in post-agency prices between Amazon and Barnes & Noble is that, while Barnes & Noble sold part of its Nook business in early 2013, Amazon's Kindle remains an essential part of its business.[20] Our finding that there is a negligible effect on e-book prices sold by Books-A-Million is consistent with this explanation: Books-A-Million was never in the business of selling e-readers, so, as in Johnson's framework, it had less incentive to set low prices in order to lock in consumers.

[19] In fact, Amazon's Kindle app for the PC and for iPhone was available a year before the release of the iPad and the concurrent switch to the agency model. Kindle app versions for Mac and iPad were released in 2010 and subsequently for Android and Blackberry devices.

[20] Barnes & Noble announced on June 25, 2014 the decision to sell the rest of the Nook e-reader business to focus on its stores.

Foros, Kind, and Shaffer (2014), on the other hand, argue that the agency model may lead to higher prices. More specifically, they find that retail prices are higher under the agency model when competitive pressure is higher among retailers than upstream firms. Their model explains why the publishers and Apple preferred the agency model: if the goal is to increase prices, then price control should be given to those firms in the distribution chain that face the least competitive pressure. To analyze this mechanism in more detail, Table 11 shows the effects of the switch by genre for both Amazon and Barnes & Noble. One would expect there to be more competition at the retailer level, especially for book titles that are more substitutable (e.g. fiction in general, and novels in fantasy, science fiction, and romance genres in particular). As a result, one would expect the switch to be larger for book titles in these genres than for more differentiated titles (e.g. literary books and nonfiction). To see if the effect of the switch in selling method is related to the level of differentiation of a book title, we interact the difference-in-differences estimator with a fiction dummy, as well as more specific genre dummies for genres that fall under the fiction category. The results, shown in Table 11, indicate that the switch indeed had a larger effect on fiction books than non-fiction books; for Amazon, the difference is 6.2 percentage points, and 8.9 percentage points for Barnes & Noble. Moreover, within the fiction genre, the difference with non-fiction titles is the smallest for literary books and the largest for more substitutable genres such as action, adventure, fantasy, science fiction, and romance. This shows that the retailers' and publishers' pricing strategies in particular diverged for books that tend to be less differentiated, while pricing strategies for more differentiated books (non-fiction and literary novels) are more similar. This is consistent with the theory that there is more competitive pressure among retailers than publishers/upstream firms.

5.2 Resale Price Maintenance and Vertical Relations

An essential component of the agency model is that the publishers directly set retail prices for e-books—a practice known as resale price maintenance. The e-book industry provides an illustration of a vertical market in which upstream firms prefer retail prices to be higher than those set by the downstream retailers. This is contrary to the textbook example of the efficiency enhancing role of resale price maintenance, in which vertical restraints are used to eliminate double marginalization. Our analysis shows that the Big Six publishers would set retail prices at *higher* levels than what retailers, particularly Amazon, would set. The theoretical literature on resale price maintenance gives several explanations why upstream firms prefer resale price maintenance with higher prices than those set by retailers. For instance, resale price maintenance can be used by upstream firms to

Table 11: Effect of the Switch by Genre

	Amazon		Barnes & Noble	
	Fiction overall	Fiction sub-genres	Fiction overall	Fiction sub-genres
Wholesale×Big Six	−0.149***	−0.147***	−0.028***	−0.026***
	(0.010)	(0.010)	(0.010)	(0.010)
Wholesale×Big Six×Genre				
Fiction	−0.075***		−0.096***	
	(0.011)		(0.011)	
Action and adventure		−0.138***		−0.134***
		(0.032)		(0.031)
Fantasy and science fiction		−0.137***		−0.167***
		(0.025)		(0.028)
Literary		−0.052***		−0.079***
		(0.017)		(0.018)
Mysteries and thrillers		−0.079***		−0.083***
		(0.017)		(0.016)
Romance		−0.150***		−0.127**
		(0.050)		(0.061)
Other fiction		−0.066***		−0.099***
		(0.014)		(0.015)
R-squared	0.550	0.556	0.497	0.504
Number of observations	571,050	571,050	558,879	558,879

Notes: Dependent variable is ln(*price*). All specifications include genre and week fixed effects and other controls as the main specification in Table 3. Standard errors (clustered by book) in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

give retailers sufficient incentive to provide a high level of service—if retailers can no longer compete in prices, they have to compete in service to attract consumers (see Telser, 1960; Mathewson and Winter, 1984).

Alternatively, resale price maintenance may be used as a way to facilitate collusion between the upstream firms. Jullien and Rey (2007) show that in situations where retail prices are not only driven by wholesale prices set by the upstream firms but also respond to local demand and cost shocks, resale price maintenance will make it easier to detect wholesale price deviations from a collusive agreement. Indeed, according to the DOJ's complaint, the adoption of identical pricing tiers that were part of the agency model would not have happened without the publishers conspiring. An important question is therefore whether the large price drops we observe after the settlements are simply because the lawsuit put an end to "the conspiracy to fix prices," or whether these are due to the differences in selling method.[21] Put differently, what retail prices would the publishers have

[21] According to the original DOJ complaint (paragraph 5 of U.S v. Apple, Inc., et al., April 11, 2012): "As a result [of the adoption of the agency model,] the publishers could end price competition among retailers and raise the price consumers pay for e-books through the adoption of identical pricing tiers. This change in business model would not have occurred without the conspiracy among the Defendants."

set under the agency model if there was no coordination with other publishers? Two features of our data may help in answering this question. First of all, even though the lawsuit was announced in April 2012, prices remained high for most Big Six publishers until close to the actual switch date, even for the three publishers that settled immediately. Secondly, we find price effects for Random House that are of similar magnitude as the other Big Six publishers, even though Random House was not part of the publishers' collusive coordination.

Table 12: Agency Price Changes After Settlement Announcement

	Average prices 3 months	
	Before	After
Publishers that settled		
Harper Collins	10.91	11.11
Hachette	8.83	10.36
Simon and Schuster	11.83	11.38
Other defendants publishers		
Macmillan	11.65	11.79
Penguin	10.73	11.74
Non-defendant publishers		
Random House	12.24	11.68

Notes: Average prices at Amazon 3 months before and 3 months after the annoucement.

Both findings are in line with results for the various placebo tests in Section 4.3, which indicate that the price effects we find cannot be attributed to any other shocks happening around the times of the switches. Although this suggests that the price decreases we find are due to the actual switch in selling method, what complicates matters is that existing contractual obligations may have prevented publishers from changing agency prices of existing books before the actual switch date. However, for titles that came out after the announcement of the settlement but were still sold under the original agency agreements, the publishers did have some flexibility to change an e-book price by changing the hardcover list price of the printed version of the e-book, even under existing agency contracts. A test of whether the announcement of the lawsuit had any effect on agency prices should therefore focus on newly released titles only. Table 12 gives the average retail price at Amazon in the three months before and after the announcement of the lawsuit in April 2012 for each of the Big Six publishers. For most publishers the effect is small, if any. However, for Penguin and Hachette we find that average retail prices of newly released titles actually increased considerably after the announcement, for Hachette as much as $1.50. Since Hachette was one of

the three publishers that settled right away, these prices may have been set in anticipation of future negotiation with Amazon. Nevertheless, our finding that agency prices did not change much for the other publishers in the period after the announcement of the lawsuit but before any of the Big Six publishers had switched is consistent with the DOJ's view that the alleged collusion only affected prices through its effect on facilitating the adoption of the agency model.

5.3 Loss-leader Pricing and Other Potential Explanations

There are several alternative explanations for why retailers—in particular Amazon—set lower prices than those set by the publishers during the agency period, including loss-leader pricing and behavioral explanations. According to Amazon's own calculations, demand for e-books is relatively price elastic; Amazon claims that at a price of $14.99, a 33 percent price reduction increases sales for the average e-book by 74 percent.[22] These numbers correspond to an own-price elasticity of approximately -2.24, which implies that revenues and, assuming near-zero marginal costs, short-run profits from a particular e-book will increase when lowering the price from $14.99 to $9.99. However, a number of empirical studies reach the opposite conclusion and find that Amazon faces relatively inelastic demand for books. In a recent study, Reimers and Waldfogel (2014) use price and sales rank data from Amazon for two months in the period from 2012 to 2013 and obtain own-price elasticities estimates for e-books between -0.39 and -0.53, from which they conclude that e-book prices are set below static profit maximizing levels. This is consistent with findings from earlier studies for print books. For instance, Chevalier and Goolsbee (2003) study the effect of price changes on sales ranks of print books using data from 2001 and find an own-price elasticity of -0.45 for books sold by Amazon. De los Santos, Hortaçsu, and Wildenbeest (2012) obtain an own-price elasticity estimate of similar magnitude using online search and purchasing data for 2002 and 2004.

To better illustrate Amazon's and other retailers' pricing strategies, especially in the post-agency period, Table 13 presents average book prices as a proportion of the list price set by the Big Six publishers for June 18, 2014.[23] On this day, Amazon's average e-book prices for books from the Big Six publishers were sold at 82 percent of the digital list price set by the publishers. This means that—assuming the thirty percent commission rule typically used in the agency model—the

[22] See http://www.readersunited.com.

[23] We use the digital list price to estimate the proportion for e-book prices. The digital list price was unavailable for the time period of the collection of the main sample. Fortunately, we collected this information in June 2014 from Books-A-Million, which prominently lists this price on the webpage of a specific e-book title as the retail price. For most titles, Amazon only lists the print list price, while Barnes & Noble only gives its own price.

average book was not sold at a loss. The average discount is roughly the same across publishers, although the discount is less for books published by Hachette.[24] However, Amazon does discount popular books more than less popular titles. For instance, as shown in Table 13, the top 1 percent of the most popular books in terms of Kindle sales rank are sold at 70 percent of the digital list price, whereas this number is 85 percent for e-books that are in the lower half of the sales rank distribution.

Table 13: Retailers' E-book Pricing Strategies under the Wholesale Model

	E-books			Print books		
	Amazon	B & N	BAM	Amazon	B & N	BAM
	Panel A: Average price/list price					
Big Six	0.821	0.978	0.958	0.734	0.747	0.747
By publisher						
Harper Collins	0.821	0.979	0.998	0.737	0.760	0.753
Hachette	0.894	0.996	0.798	0.852	0.666	0.784
Simon and Schuster	0.818	0.980	0.983	0.724	0.744	0.739
Macmillan	0.819	0.988	1.000	0.721	0.744	0.742
Penguin	0.798	0.967	0.971	0.756	0.769	0.769
Random House	0.807	0.974	0.975	0.704	0.728	0.722
By sales-rank percentiles						
Most popular 1%	0.697	0.859	0.853	0.620	0.620	0.650
1-5%	0.752	0.864	0.863	0.644	0.637	0.659
5-15%	0.734	0.887	0.885	0.647	0.650	0.661
15-30%	0.785	0.980	0.955	0.686	0.683	0.694
30-50%	0.827	0.997	0.975	0.737	0.757	0.755
More than 50%	0.854	0.999	0.977	0.778	0.798	0.793
	Panel B: Price/list price distribution (%)					
Less than 0.5	4.0	1.0	0.0	0.2		
0.5 to 0.7	10.8	1.3	2.2	36.3	32.7	32.2
0.7 to 0.9	60.9	5.8	17.3	52.7	45.2	54.4
More than 0.9	24.3	91.9	80.5	10.8	22.1	13.5

Notes: Panel A presents average prices as a proportion of their list price for different retailers and by percentiles of the sales-rank distribution. For e-books we use the digital list price, for print books we use the list price for the calculation; similarly we use the Kindle sales rank for e-books and the print book sales rank for the print edition. In Panel B, the table presents the distribution of observations for different ranges of the proportion of prices to their digital list prices. The number of observations is 1,413. Data is for June 18, 2014.

In Panel B of Table 13, we show that roughly 15 percent of e-books sold at Amazon are sold at less than 70 percent of the digital list price, which most likely means these titles are sold at a loss. Note that these numbers are consistent with the proportion of books that Amazon sold at a loss

[24]The lower discounts for e-books published by Hachette is a direct result of a dispute between Amazon and Hachette that was going on at the time of data collection. As a result of the dispute, which is widely believed to be about the renewal of the existing e-book contract between the two, Amazon was selling a substantial number of Hachette e-book titles at list price.

before the agency model was implemented.[25] The books that are sold below wholesale cost include a disproportionate share of bestselling books, which suggests that these books are used as part of a loss-leader strategy. Although Amazon sells a large number of best sellers, this does not necessarily mean that Amazon's e-book division is unprofitable. Our data over-samples popular books, so we do not observe margins of the large number of older or "backlisted" titles with higher margins which are the "vast majority of [e-book] sales through Amazon."[26] The other two retailers in Table 13 sell their books at much higher prices, although they seem to be using a similar loss-leader strategy as Amazon by giving larger discounts for the more popular titles.

For comparison, the table also presents the proportion of print-book prices over their list prices for the same sample of books. An interesting feature of print books is that their pricing is very similar across retailers: print books are sold at 73 to 74 percent of their list price. This is in contrast to e-book pricing, where Amazon's price is on average 82 percent of the digital list price compared to 98 percent at Barnes & Noble and 96 percent at Books-A-Million. Although we cannot directly compare the differences in magnitudes of the discount of e-books and print books over their list prices, as they can be attributed to the difference in wholesale prices of the two formats (wholesale prices of print books are roughly 50 percent of the list price) and shipping and handling costs, all retailers show a similar pattern of discounting more popular print books.

In order to further explore the use of a loss-leader strategy by Amazon and Barnes & Noble, we estimate specifications that include an interaction of the switching dummy with measures of a book's popularity. Specifically, we use the number of book reviews as a cumulative measure of a book's popularity and the sales rank of the book as a relative measure of the current popularity level of a book. Panel A of Table 14 presents estimates of the switch using the two different measures of a book's popularity. Using the interaction of the switching dummy and the number of reviews results in significant negative interaction coefficients, which indicate that popular books are more heavily discounted at Amazon and Barnes & Noble. We obtain similar findings when using sales rank—as a higher sales rank indicates a less popular book, we find positive interaction coefficients when interacting the switching dummy with sales rank, although the interaction is only significantly different from zero for Barnes & Noble. Both sets of results indicate a larger switch-related reduction in prices for more popular books, which is in line with a loss-leader strategy.

[25]The percentage of books below wholesale cost is obtained from Figure 12 of the direct testimony by Orley Ashenfelter, which is available at http://www.justice.gov/atr/cases/apple/exhibits/px-1097.pdf.

[26]Direct testimony by Amazon's Vice President of Kindle Content (http://www.justice.gov/atr/cases/apple/exhibits/px-0837.pdf). Backlisted [print] books also account for at least half of the sales of many independent bookstores ("Publisher's Backbone: Older Books", the *New York Times*, 3/26/1990).

Table 14: Effect of the Switch by Book Popularity

	Book popularity measure			
	Reviews		Sales Rank	
	Amazon	Barnes & Noble	Amazon	Barnes & Noble
	Panel A. Difference-in-differences estimator and popularity			
Wholesale×Big Six×Popularity	-0.042***	-0.044***	0.089	0.117**
	(0.007)	(0.006)	(0.059)	(0.060)
	Panel B. By quartiles of the popularity measure			
Wholesale×Big Six×Popularity Quartile				
Second quartile	0.000	-0.009	0.037***	0.050***
	(0.015)	(0.016)	(0.010)	(0.011)
Third quartile	-0.030**	-0.043***	0.003	0.019
	(0.013)	(0.014)	(0.012)	(0.013)
Fourth quartile	-0.096***	-0.102***	-0.018	-0.002
	(0.015)	(0.016)	(0.013)	(0.014)
	Panel C. Effects of popularity by publisher			
Wholesale×Big Six×Popularity×Publisher				
Harper Collins	-0.118	-0.083	-0.101	-0.164
	(0.021)***	(0.039)**	(0.161)	(0.177)
Hachette	-0.066	-0.057	0.296***	0.249**
	(0.013)***	(0.010)***	(0.097)	(0.099)
Simon & Schuster	-0.061	-0.072	0.291**	0.266***
	(0.010)***	(0.017)***	(0.117)	(0.103)
Macmillan	-0.009	-0.015	-0.002	0.155
	(0.014)	(0.011)	(0.109)	(0.103)
Penguin	-0.012	-0.021	0.038	0.122*
	(0.016)	(0.016)	(0.075)	(0.071)
Random House	-0.022	-0.027	-0.153	0.065
	(0.010)**	(0.008)***	(0.099)	(0.081)

Notes: Dependent variable is ln(*price*). The table presents estimates of the differential effect of book popularity by interacting the differences-in-differences switching variable with two measures of book popularity: sales rank (in millions) and the number of reviews (in thousands). Each column presents regressions on each retailer prices and one measure of popularity. Panel A presents only the coefficients for the interaction; the main difference-in-difference coefficients and other controls are omitted from the table. Panel B presents interaction coefficients of the switching indicator with the quartiles of the distribution of the popularity measure. Panel C presents coefficients for each publisher by interacting the switching variable with popularity and with publisher indicators. All specifications include publisher and week fixed effects as well as other controls, as in the main specification. Standard errors (clustered by book) in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

The lack of significance of the Amazon coefficient when using sales rank might indicate a targeted decrease in prices. Hence, in Panel B we obtain quartiles of the distribution of each popularity measure, which we interact with the switching indicator. Using the number of reviews, we find that Amazon reduced prices of books in the top quartile of reviews by 23 percent compared to a 15 percent price reduction for books in the bottom quartile. Barnes & Noble decreased prices in the top quartile by 14 percent, compared to 4.6 percent for books on the bottom quartile of the review distribution. Using sales rank as a measure of popularity, we find that books in the second quartile of sales rank distribution experience a smaller drop in prices (3.7 percent for Amazon and 5 percent for Barnes & Noble) compared to the first quartile of sales rank. In Panel C we further interact the

switching dummy with popularity measure and publisher indicators. We find significant positive interaction coefficients when interacting the switching dummy with sales rank for Hachette and Simon & Schuster at both retailers.

Amazon's strategy of pricing popular e-books below wholesale cost could fit into a more comprehensive strategy of customer acquisition and retention within Amazon's ecosystem (such as Amazon Prime), and is not necessarily intended to subsidize consumers' adoption of the Kindle platform or sale of older (or backlisted) e-books with higher margins (see, e.g., Abhishek, Jerath, and Zhang, 2015). Amazon has arguably the largest breadth and depth of product variety and as such, Amazon could benefit from selling other—perhaps more profitable—products to its e-book customers. Both Barnes & Noble and Books-A-Million are primarily in the business of selling books, and therefore do not face similar incentives.

Amazon's pricing strategy may also partly reflect its ambition to become a vertically integrated player in the book industry. Amazon launched Amazon Publishing in 2009, which currently consists of several imprints, including 47North (fantasy, science fiction, and horror), Little A (literary fiction), and AmazonCrossing (translated books). Amazon's low prices may ultimately be used to put pressure on the publishers to decrease wholesale prices, potentially resulting in worse deals for their authors, making them more inclined to switch to alternative publishers such as Amazon.

A final set of competing potential mechanisms can be classified as more behavioral in nature. For instance, even though the resale price maintenance component that is inherent to the agency model may have facilitated the publishers' goal to achieve higher e-book retail prices, it does not necessarily imply higher short-run e-book profits for the publishers. In fact, according to court documents, the higher retail prices during the agency period did not lead to higher e-book profit margins for the publishers—on average, e-book profit margins decreased in comparison to the pre-agency period due to the relatively higher commission for the retailers.[27] This suggests the implementation of the agency model was not meant to increase short-run profits from the publishers' e-book business, but had other reasons, such as fear of cannibalization of sales of newly released hardcover titles, the rising dominance of Amazon, and a decreased perceived value of books by consumers.

Finally, Amazon's self-declared objective is to deliver value to consumers by being consumer-

[27]The five publishers under the DOJ complaint received on average less per e-book sold: "the average decrease in the average per unit net revenue was 15.1%". Publishers knew that on average they would receive less per e-book sold under the agency model, explicitly recognized by Hachette: "[the agency model] 'would be to swap a significant amount of current margin to change the public perception of price...'." Source: Direct testimony of Richard J. Gilbert (http://www.justice.gov/atr/cases/apple/exhibits/px-1105.pdf).

centric, which includes selling products at low prices.[28] By increasing consumer satisfaction, retention, and repeated business, this strategy is focused on revenue growth and cash flow instead of margins. Whether this is a viable strategy in the long run is an open question.

6 Conclusions

In this paper, we have provided evidence that after the publishers lost their ability to directly set retail prices, prices for e-books decreased substantially at Amazon and Barnes & Noble, the two largest sellers of e-books in the United States. Even though we only observe e-book prices for 2012 for Apple, and can therefore only investigate how Harper Collins' switch affected e-book prices, we find a substantial drop in Apple's e-book prices for this publisher's book titles. Books-A-Million is the only retailer in our data for which we fail to find an effect on e-book prices that can be attributed to the switch.

In the second half of the paper, we distinguish between theoretical mechanisms that help explain our empirical findings documented in the first half of the paper. Although the complexity of the book industry does not allow us to completely isolate all the different theoretical elements at play, our empirical findings do not provide much support for claims in several recent theoretical papers that e-book prices are likely to be lower under the agency model than under the wholesale model. One reason that prices are conjectured to be higher under the wholesale model is that retailers face incentives to raise prices once a sufficiently large number of consumers are locked into their platforms. Publishers do not face these incentives under the agency model. Although our findings do not provide evidence for such behavior at this point, it may be too soon to tell, since these arguments mostly apply to the long run.

Our analysis has identified several competing theoretical mechanisms for why average retail prices decreased after the retailers were back in control of prices. For instance, we have shown that all retailers provide discounts for the most popular titles, with Amazon often using them as loss leaders. Other reasons why retailers prefer low prices are consumer lock in, inter-temporal price discrimination, and a consumer-centric price setting approach. Since Amazon is by far the largest retailer in this industry, independent of what is driving its relatively low prices, it is likely that its pricing strategy puts pressure on the other retailers to keep prices low as well.

Our results are important for several reasons. First of all, our findings may also be relevant for other markets in which the agency model is used, such as the market for apps and various

[28] Interview with Amazon's CEO Jeff Bezos, "The Institutional YES", *Harvard Business Review*, October, 2007.

online marketplaces (Amazon, eBay). Secondly, the settlements with the DOJ only prohibited the publishers from directly setting retail prices for a period of two years. Amazon has recently reached new book contracts with several of the publishers, which again allow those publishers to set retail prices of e-books, although Amazon will be able to offer discounts in certain situations.[29]

A limitation of our approach is that we are mainly attributing the price effect of the switch from the agency to the modified wholesale model to the transfer of pricing rights. However, other contractual arrangements between the publishers and the retailers could play a role as well, and may be responsible for part of the estimated price effects. For instance, the commission may be different across retailers and publishers, and as such may affect optimal pricing. Unfortunately, most of these contractual details are unobservable to us, and hence it is difficult to make precise statements about some of the implications of the changes in the industry, such as whether retailers are better off under the modified wholesale model or the original wholesale model.

The long-run impact of the switch on consumer welfare remains an open question. Consumer welfare not only depends on the price effects but also on other factors such as the number, variety, and quality of titles written and published. How these factors will evolve over time will depend on how the publishers' profits are affected by the switch. Assuming wholesale prices have not changed significantly, short-run publishers' profits from e-book sales should have gone up after the switch, since lower e-book prices are likely to boost e-book sales. However, even if profits for e-books increase, total profits might decrease for a title as this also includes profits from sales of hardcover and paperback books. Although we have shown in the placebo regressions that the switch does not have an effect on printed book prices, lower e-book prices could lead to increased cannibalization of printed books, which may lead to lower total profits, assuming printed books have higher margins than e-books. Lower overall profits for the publishers may put pressure on authors' royalties, and as such may lead to a reduction in quality and product variety, negatively affecting consumer welfare.

[29] See http://www.wsj.com/articles/amazon-simon-schuster-reach-book-contract-1413833713.

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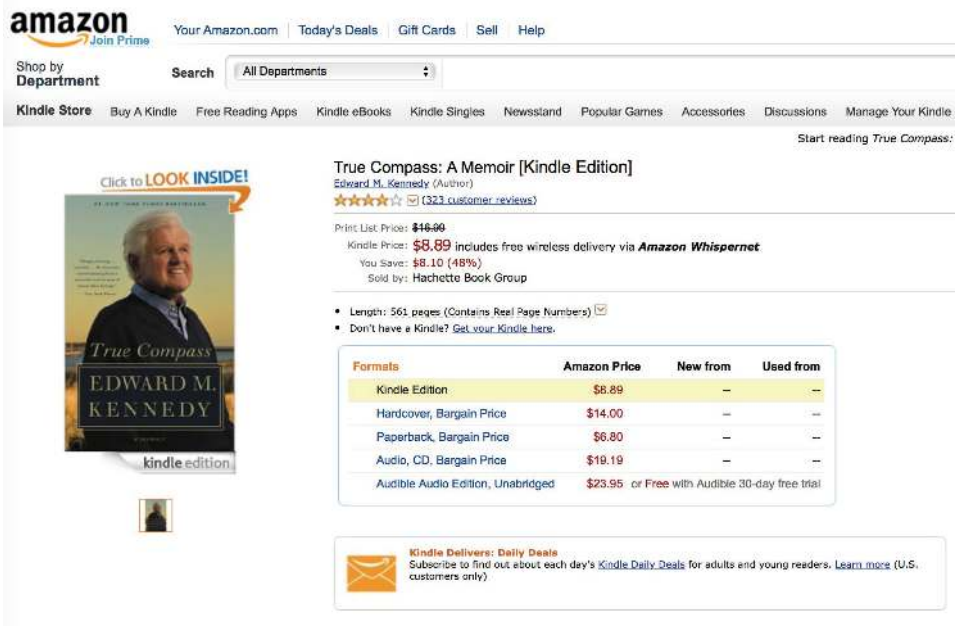
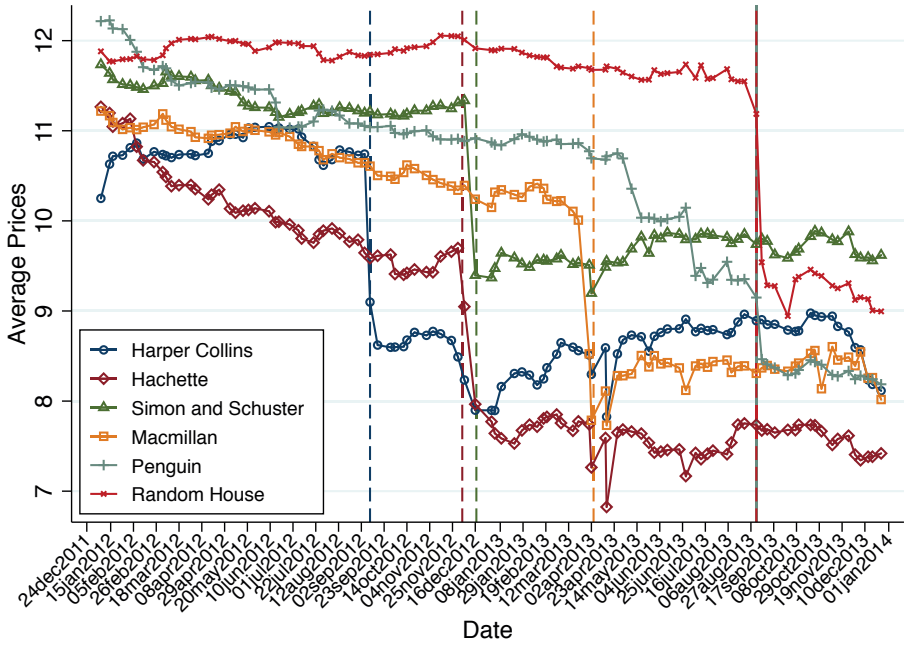
Figure 1: Screenshot of *True Compass: A Memoir* (Amazon.com)

(a) June 2012

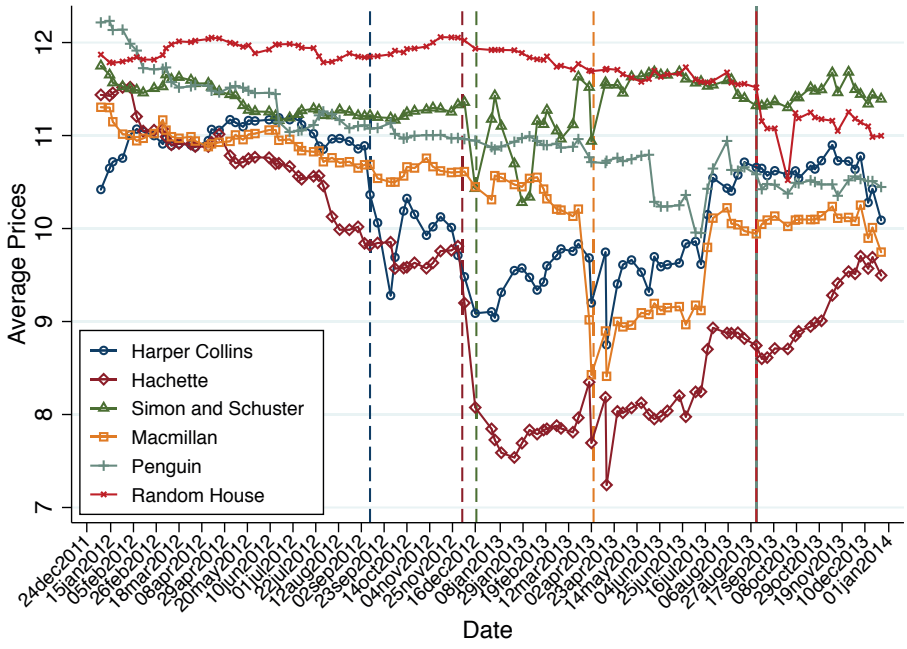


(b) July 2013

Figure 2: Average Weekly Prices of E-Books for Big Six Publishers

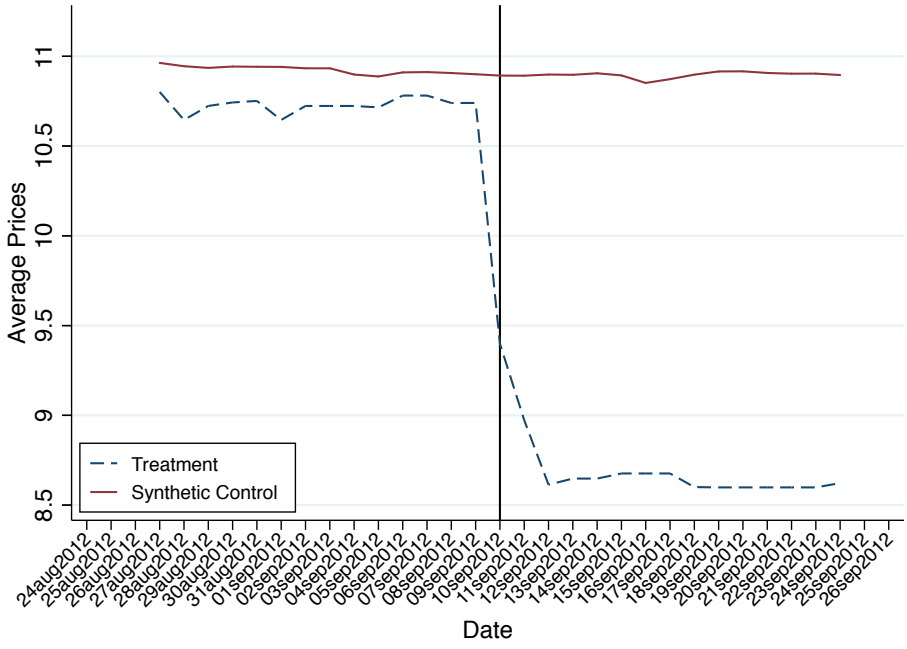


(a) Amazon

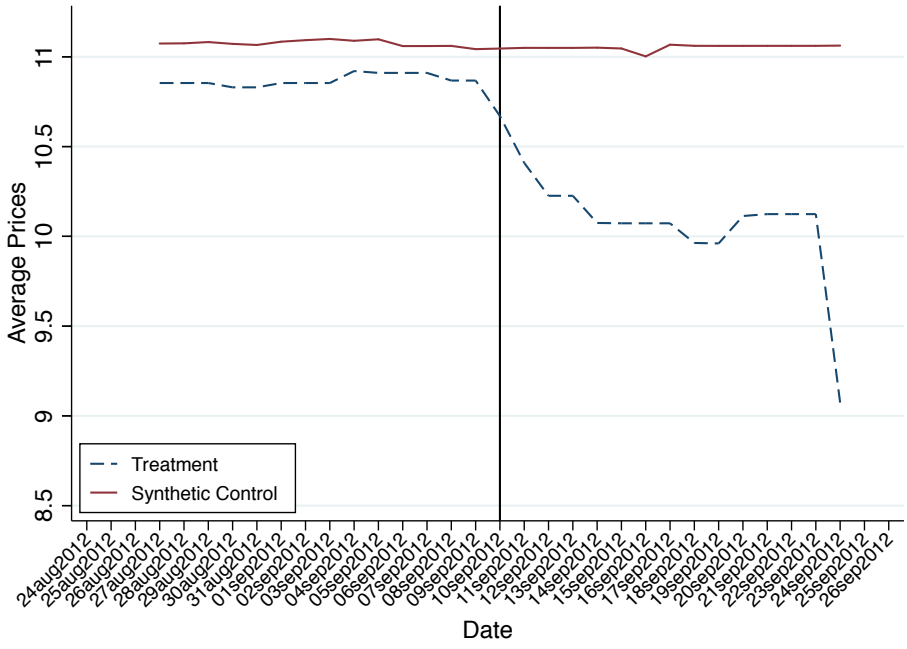


(b) Barnes & Noble

Figure 3: Average Prices for Harper Collins vs. Synthetic Control

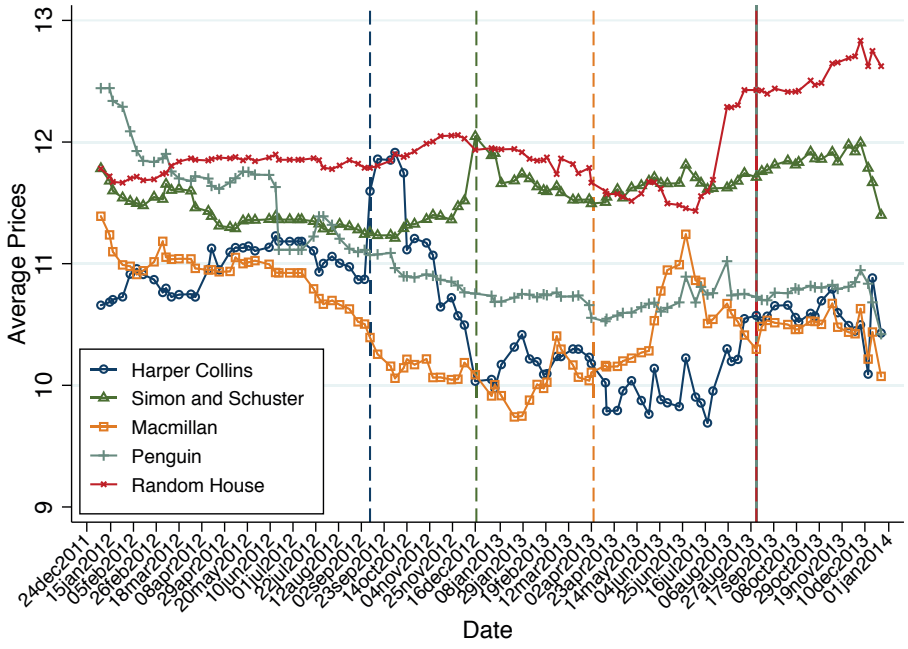


(a) Amazon

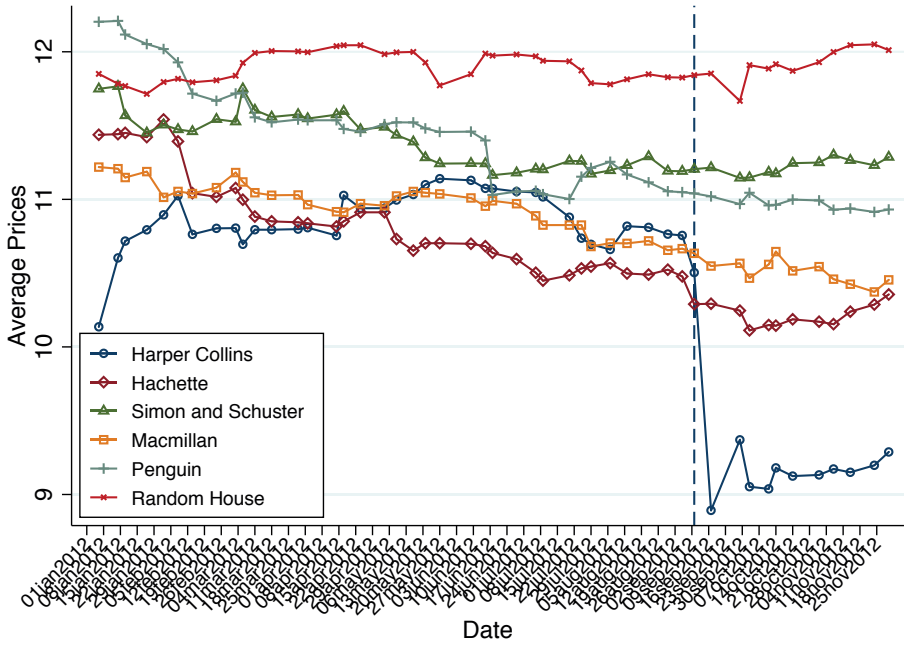


(b) Barnes & Noble

Figure 4: Average Weekly Prices of E-Books for Big Six Publishers



(a) Books-A-Million



(b) Apple