

E-readers vs. Printed Books: A Financial Analysis

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31 July, 2012

Executive Summary

An e-reader allows individuals to download books via a Wi-Fi or cellular network, and read them on an electronic display without having to print them on paper. Since e-books are generally less expensive than printed books, over a period of time the purchase of an e-reader may pay for itself depending on the consumer's reading habits. To decide whether or not the purchase of an e-reader is cost-efficient, a cost analysis must be done to compare investing in an e-reading device to the alternative of buying printed books. In this analysis, the net present value (NPV) of an e-reader is compared to printed books, and an annual discount rate is determined where the initial investment of the e-reader becomes less expensive than purchasing printed books. The types of readers accounted for in this discussion are light readers, reading six books per year, average readers, reading twelve books per year, and heavy readers, reading approximately twenty-four books per year. At some point in the future, the investment of purchasing an e-reader becomes the most cost-efficient method of reading for every reader. The question on every potential buyer's mind is how long will this investment take before the benefits are realized, and is the investment worth it? The popular Kindle e-reader is chosen to analyze e-readers vs. printed books cost. The recommendation is to purchase an e-reader because e-readers are more cost-efficient than printed books at some point in the future, depending on how many books are read in one year.

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Introduction

Uncannily similar to the challenges faced by the music industry, the book publishing and bookstore industry is being transformed by technological changes, revolutionary innovations, and unforeseen paradigm shifts. The successful business model for hardcover and softcover books sold in brick-and-mortar stores generated great profits for many U.S. corporations; however, the business model is being uprooted, reinvented, and transformed. Just as the delivery of music (i.e., songs and albums) began to shift from physical, tangible compact discs to digitized mediums, so are the contents of books and literature. This digital transition has been foretold by the popularity of e-book readers, such as the Kindle and Nook.

From the perspective of tangible books, the majority of the cost is in the initial purchase price whether it is a hardcover or softcover version. Over time, books begin to accumulate, and either must be stored, given to other readers, discarded, or possibly sold. Storing a collection of books can occur in several different ways. The most traditional, and probably the most common, method is to display or stack them on existing household surfaces that subsequently result in negligible additional costs. For the more serious book collector, a dedicated shelf or bookcase may be necessary, thus resulting in the expenditure of additional funds. Alternatively, the books can be given away to friends and acquaintances, which produce no revenue but can create a non-monetary satisfaction. Another option is to donate the book to a non-profit organization, such as the library or Salvation Army. According to the Salvation Army, a tax deduction can be taken for the donation where the value of a softcover ranges from \$0.75 to \$1.50 and a hardcover book from \$1.00 to \$3.00.

Now, with technological innovations, an individual can read the same version of a printed book electronically via an e-reader. E-books for e-readers are sold at one price. However, there are a plethora of e-reader models, and they are considerably different from one another. They are available from an assortment of manufacturers, and are merchandized under brand names such as Kindle, Nook, Sony Reader, Kobo, and BeBook. New e-readers range from \$79.00 to \$379.00, depending on such variables as memory, features, and color. Books allow consumers to read, but some tablets, such as the iPad and Kindle Fire, have the functionality and abilities of a computer. Therefore, in terms of functionality, the playing field must be narrowed and the best choice is primarily controlled by cost factors. By contrast, choices are limited for printed books, where readers can sometimes choose between hardcover or softcover.

Problem Statement: Is it more economical to purchase an e-reader or to continue purchasing printed books?

The following figures show simple cash flow diagrams for one hardcover book purchased per month, including shipping, and the \$79 Kindle, including one e-book per month, from Amazon.com. The cash flow diagrams do not account for storage and electricity costs, and the reasoning behind these exclusions are explained below in the Assumptions section.

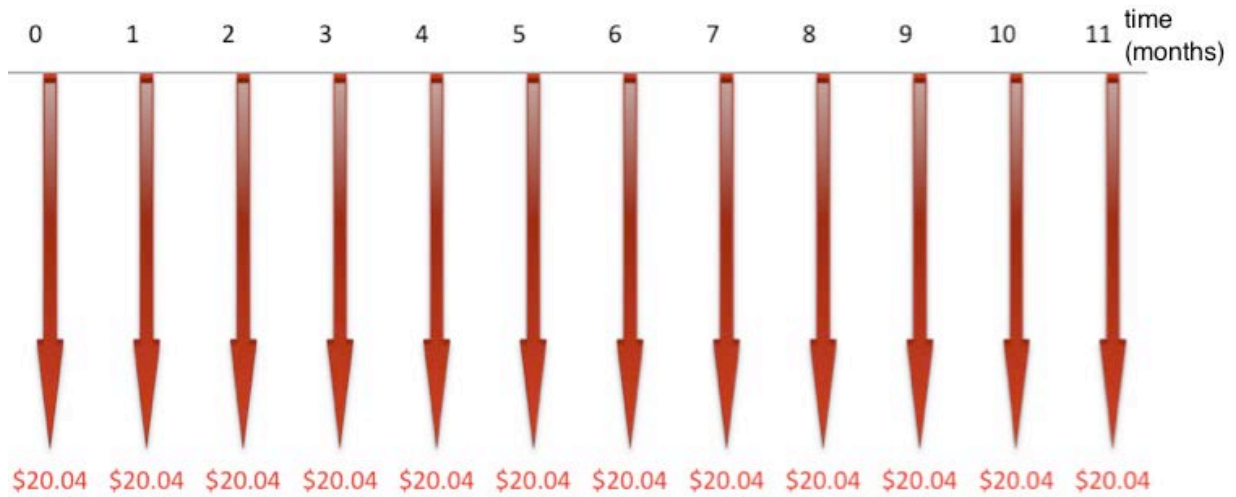


Figure 1.0 – Cash flow diagram for twelve hardcover books purchased in one year (one book per month).

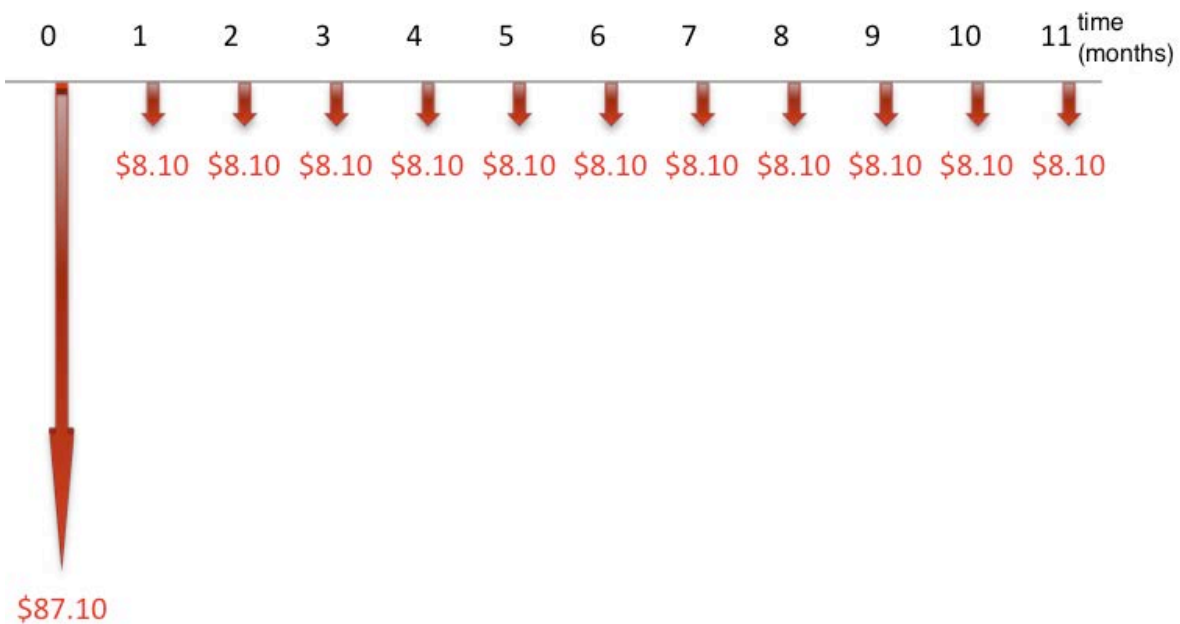


Figure 1.1 – Cash flow diagram for the \$79 Kindle and twelve e-books purchased in one year (one e-book per month).

Although the cash flow diagrams in Figures 1.0 and 1.1 look fairly simple, the problem statement is much more complicated than utilizing a payback analysis. Figures 1.0 and 1.1 do not account for time, and moving money through time is an important financial concept. Calculating the net present value and understanding discount rates are the foundations of moving money through time.

Assumptions

To make the comparison of e-readers to hardcover and softcover books, a few assumptions are necessary. It is assumed the individual asking the question, “Is buying books or an e-reader cheaper?” will truly accept either one as long as it is the more affordable choice. Subjective and qualitative factors, such as wanting more functionality or the joy of having a hard copy over a digital copy, will not be incorporated in this analysis.

To make an accurate comparison, it is necessary to examine the functionality for both mediums of reading. On the level of functionality, books do nothing more than display text on a page for the reader to view. The functionality of some e-readers far surpasses that of books to the extent that they are no longer comparable. Therefore, the e-readers that are examined for this report are ones with comparable functionality to that of a book. To start looking at tablets that have applications, internet browsing, and data storage would be to change the question from, “Are books or e-readers cheaper?” to, “What is the cheapest tablet I can purchase that will allow me to read e-books?” In other words, without equating the property of functionality, books would already be out of the question, given that they do not offer internet, apps, or data storage.

Equating functionality for the purpose of comparison takes the form of excluding certain devices from the analysis. The process essentially weeds out e-readers that have the multimedia experience books cannot compete with, and leaves e-readers that actually behave like books. Here are some of the excluded major e-readers or major tablets that function as e-readers: the iPad, Kindle Fire, Nook Color, and the Nook Tablet. All of the preceding devices function as much more than a book, and are therefore not comparable to books for the scope of this report. E-readers that offer close functionality as a book include: Kindle Touch, Nook Simple Touch Reader, Sony Reader Touch, BeBook, and Kobo. Out of these devices, the most affordable will be determined. The price will then be compared to the price of buying printed books, resulting in recommendations to the original problem statement. Table 1.0 summarizes a breakdown of the e-readers.

A couple other important exclusions are the storage of printed books and the cost of electricity required to charge an e-reader. Medium-sized book cases range from \$30 to \$50, and they can hold fifty to eighty printed books. Since the study focuses on a smaller range of books, six to twenty-four books, the cost to store books is negligible. E-reader batteries vary in watt-hour. For example, the Kindle uses a 6.47 watt-hour battery (Wells, 2012). The cost of electricity to charge small watt-hour batteries is also negligible and could cost as little as \$0.70 per year.

In the comparison of net present value versus discount rate, a maximum discount rate of 24% was chosen. Higher discount rates are improbable in most financial applications, therefore they were not considered in the calculations of net present value for any extension of time. For the recommendation presented, the suggested discount rate by the OMB of 7% was used

(“Guidelines and Discount Rates...”, 1992). The expenditures calculated for the e-reader assumed the e-reader would not malfunction, have any defects, or break in the lifetime of ownership, thus no extended warranties were included in the cost of the product. It was also assumed that resale, trade-ins or lack of ownership of purchased books, print or e-reader, would not occur. Thus, cash flows were based on perpetual ownership of a purchased product.

Table 1.0 – Top 10 e-readers based on customer rating

E-reader	Customer Ranking	Price	Touch Screen	Screen Size	Display	Resolution	Battery ¹	Weight ²	Memory	Expandable Memeory	Dimensions	Ads	WiFi	email	Apps
BeBook Neo	8	159	x	6"	Grey scale	600 x 800	97	10.5	512MB	x	7.7 x 4.8 x 0.40		x		
Kindle Touch	1	99	x	6"	Grey Scale	600 x 80	30	7.8	4GB		6.8 x 4.7 x 0.40	x	x		
Kindle Touch		139	x	6"	Grey Scale	600 x 80	30	7.8	4GB		6.8 x 4.7 x 0.40		x		
Kindle DX	5	379		9.7"	Grey Scale	824 x 1200	107	14.6	4GB		10.4 x 7.2 x 0.4				
Kindle Fire	4	199	x	7"	Color	1024 x 600	8	18.9	8GB		7.5 x 4.7 0.45		x	x	x
Kobo Wireless	10	100		6"	Grey Scale	600 x 800		6.5	2GB	x	4.6 x 6.5 x 0.4		x		
Nook 1st Edition	9		x	6"	Grey scale	600 x 800	5	12.1	2GB		7.7 x 4.9 x 0.5				
Nook Simple Touch	2	99	x	6"	Grey scale	800x600	30	7.5	2GB	x	6.5 x 5 x 0.47		x		
Nook Simple Touch with glow light		139	x	6"	Grey scale	800 x 600	30	7	2GB	x	6.5 x 5 x 0.47		x		
Nook Color	6	169	x	7"	Color	1040 x 600	8	15.8	8GB	x	8.1 x 5 x 0.48		x	x	x
Nook Tablet	3	199	x	7"	Color	1040 x 600	11.5	15.8	8 GB	x	8.1 x 5 x 0.48		x	x	x
Nook Tablet		249	x	7"	Color	1040 x 600	11.5	15.8	16 GB	x	8.1 x 5 x 0.48		x	x	x
Sony PRS-T1WC	7	130	x	6"	Grey scale	800 x 600	20	5.9	1.3	x	6.9 x 4.4 x 0.40		x		

Table designed from “2012 Best eBook Reader Reviews and Comparisons” (http://ebook-reader-review.toptenreviews.com/ppc-index.html?cmpid=165617&s_kwid=TC).

The cost per book in the analysis for e-reader, hardcover and softcover, was calculated from an average based on prices displayed in the Amazon marketplace. The books whose prices are integrated into the average are displayed in Table 3.0. Most Amazon marketplace sellers do not offer their customers “FREE Super Saving Shipping,” unless the seller is endorsed as “FULFILLMENT BY AMAZON;” therefore, the \$3.99 shipping cost is only added to the average prices. Cash flows were calculated on a monthly basis for one year up to four years. The amount of books purchased per month was subject to an individual’s reading pace.

Number of books read per year	Number of books purchased in one year	Reader description
24	2 per month	Avid
12	1 per month	Average
6	1 every other month	Light

Table 2.0 – Range of readers

Individuals who purchase less than six books per year were not considered because the likelihood of these individuals purchasing an e-reader is impracticable. From this maximum, median, minimum approach, three scenarios were developed to calculate the net present value for varying discount rates with the associated cash flows for the e-reader, hardcover and softcover books.

Table 3.0 – List of 24 books based on popularity and genre

Title	Author	Year of publication	Kindle	Nook	Sony Reader	Kobo	BeBook	Soft cover*	Hard cover*	Genre
			E-book price (\$)	E-book price (\$)	E-book price (\$)	E-book price (\$)	E-book price (\$)	Print price (\$)	Print price (\$)	
Fifty Shades of Grey	E.L. James	2011	9.99	9.99	9.99	9.99	X	9.57	18.55	Fiction
The Chaperone	Laura Moriarty	2012	12.99	12.99	12.99	12.99	X	X	17.79	
A Discovery of Witches	Deborah Harkness	2011	9.99	9.99	9.99	9.99	X	9.6	17.91	
Live and Let Die	Ian Fleming	1954	9.69	X	X	X	X	10.2	X	
Steve Jobs	Walter Isaacson	2011	14.99	14.99	14.99	14.99	X	X	16.84	Nonfiction
The Immortal Life of Henrietta Lacks	Rebecca Skloot	2010	9.99	9.99	9.99	9.99	X	9.6	15.54	
In the Garden of Beasts	Erik Larson	2011	11.99	11.99	11.99	11.99	X	9.6	15.47	
In Cold Blood	Truman Capote	1966	9.99	9.99	9.99	9.99	X	10.2	15.64	
Pride and Prejudice	Jane Austen	1813	0.99	0.99	0.95	0.99	0	3.00	7.95	Romance
The Notebook	Nicholas Sparks	1996	7.99	7.99	7.99	7.99	X	9.33	10.75	
The Flame and the Flower	Kathleen E. Woodiwiss	1972	7.99	7.99	7.99	7.99	X	7.99	X	
Matters of the Heart	Danielle Steel	2009	7.99	7.99	7.99	7.99	X	7.99	X	
The Memoirs of Sherlock Holmes	Sir Arthur Conan Doyle	1986	0.99	0.99	0.95	2.99	0	3.5	26	Mystery
Complete Stories and Poems of Edgar Allan Poe	Edgar Allan Poe	1984	0.99	0.99	12.99	0.99	0	X	16.3	
The Silence of the Lambs	Thomas Harris	1988	7.99	7.99	7.99	7.99	X	10.19	20	
The Godfather	Mario Puzo	1969	9.99	9.99	9.99	X	X	10.88	14.04	
The Hunger Games	Suzanne Collins	2010	4.63	8.99	8.99	9.39	X	4.87	9.98	Young adult
Breaking Dawn (The Twilight Saga)	Stephanie Meyer	2008	8.99	8.99	8.99	8.99	X	9.54	12.63	
Harry Potter and the Deathly Hallows	J.K. Rowling	2009	9.99	9.99	9.99	9.99	X	10.19	19.22	
Holes	Louis Sachar	2000	6.99	6.99	6.99	6.99	X	6.99	12.24	
A Game of Thrones	George R.R. Martin	1996	8.99	8.99	8.99	8.99	X	9.99	20.16	Fantasy
The Fellowship of the Ring	J.R.R. Tolkien	1988	8.32	8.32	10.99	9.39	X	8.76	16.57	
Gardens of the Moon	Steven Erikson	2009	2.99	2.99	2.99	2.99	X	10.17	16.99	
The Name of the Wind	Patrick Rothfuss	2007	8.99	8.99	8.99	8.99	X	11.56	16.63	
Average:			8.10125	8.22173913	8.856086957	8.299090909	0	8.0552381	16.0571429	

* Prices taken from Amazon.com, \$3.99 shipping

** The only available e-book version at the Sony Reader Store is the 2012 one, not the 2010 version for \$0.99

*** The e-book is available at the Pottermore Shop

Nonfiction books taken from “Time Magazine's All-time 100 Best Non-fiction Books” and the New York Times "Best Sellers Combined Print and E-book Nonfiction: July 29, 2012." Mystery books taken from “The 100 Best Mystery Novels of All Time.” Fantasy books taken from “Top 25 Best Fantasy Books.” Popular titles and authors determined the other books.

Methods

There are a number of different e-readers available in today's market. The e-readers that were analyzed for this report are: Kindle, Nook, Sony Reader, Kobo and BeBook. These e-readers have differing specifications, abilities, and access to e-books. The prices of these e-readers range from \$79 to \$160, with the basic Kindle being the cheapest and the BeBook being the most expensive as shown above in Table 2.0.

A representative list of twenty-four books was compiled using four books from six different genres as shown in Table 3.0. The prices of these books were used to determine an average price for three different categories: hardcover, softcover, and e-book. The e-book category had several prices for each individual e-reader model. The prices for the hardcover, softcover and Kindle e-books are based on the list prices from Amazon.com. Prices for the other e-reader models' e-books came from their own representative marketplaces. In addition, the additional shipping cost of \$3.99 was added to the average price of printed books.

In order to compare the cost of the Kindle to print books, it was determined the analysis would use ranges of twenty-four, twelve, and six books read per year as these reflect avid, average, and light readers. A net present value analysis was conducted using a wide range of annual discount rates (0.5-24%) to compare the value of an e-reader to hardcover and softcover books, as show in Figures 2.0, 3.0 and 4.0.

Here is an example of how the annual discount rate was converted to a monthly effective rate:

Given annual discount rate, $annual_{rate} = 0.5\%$ and number of compounding periods per year, $n = 12$

$$Effective_{rate} = (1 + annual_{rate})^{(1/n)} - 1$$

$$Effective_{rate} = (1 + 0.005)^{(1/12)} - 1 = 4.157(10)^{-4}$$

After computing the effective rate, Microsoft Excel's Net Present Value function, NPV(rate, value, value...), was used to compute the Net Present Value for e-readers and printed books.

Here is an example of calculating the net present value by hand for a \$79 Kindle after one year:

$$NPV = \frac{Sum\ of\ yearly\ cost\ *\ time\ (in\ years)}{(1 + discount\ rate)^{time\ (in\ years)}} + Initial\ investment$$

$$NPV = \frac{(-79 + 12\ books * \frac{-8.1}{book}) * 1}{(1 + 0.005)^1} + (-79)$$

$$NPV = \$254.32$$

Discussion and Analysis

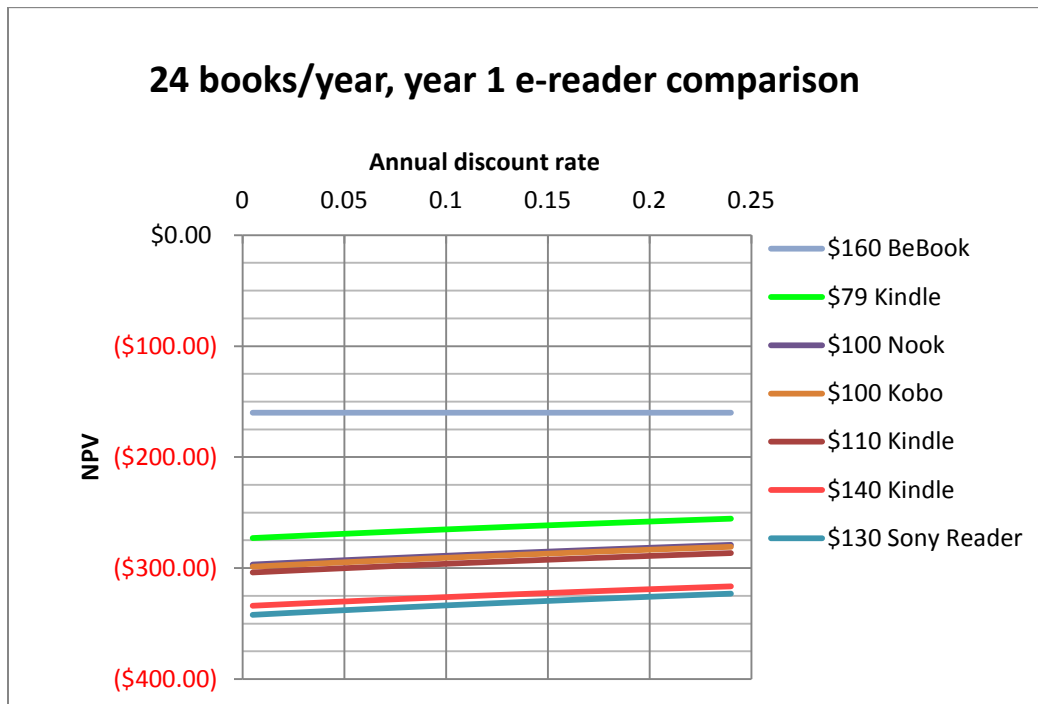


Figure 2.0: Comparison of e-readers

Figure 2.0 compares seven different e-readers when purchasing twenty-four e-books per year during their first year of ownership. An annual discount rate range of 0 to 24% was used. The price includes the purchase of the e-reader and twenty-four books over the course of the year, two per month. Figure 2.0 also shows the BeBook is the cheapest option. The BeBook offers free access to thousands of classic works that are part of the public domain. However, the BeBook does not offer a digital store in which the reader may purchase recent texts and therefore is deemed inadequate for this analysis.

From Figure 2.0, it was determined the \$79 Kindle is the cheapest and best option. This is based on the price of the e-reader itself and the average cost of books for the respective e-reader. Additionally, the Kindle has access to the widest range of titles and best represents a “digital book.” The following figures show the Net Present Value comparison between the \$79 Kindle and printed books.

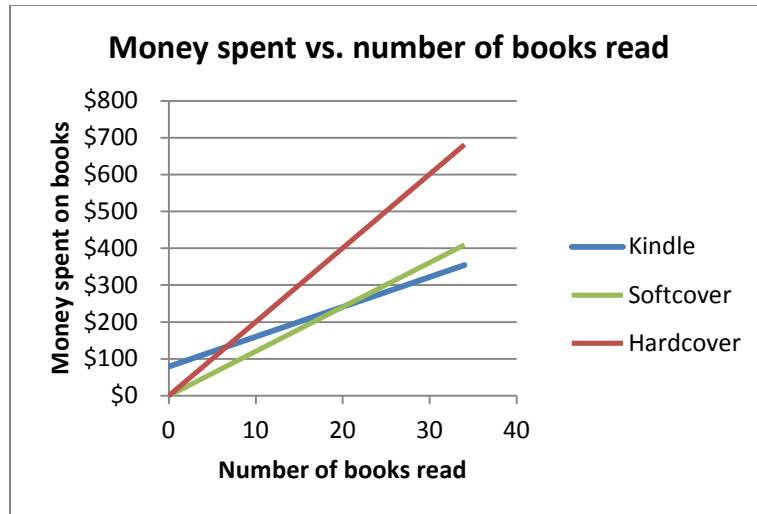


Figure 3.0: Money spent vs. the number of books read in one year

Due to the price disparity between e-books and printed books shown in Table 3.0, it should be obvious that the Kindle will eventually pay for itself after a certain number of books. Figure 3.0 was produced using a simple financial analysis that is not time dependent. From Figure 3.0, the \$79 Kindle is more cost-efficient than hardcover books after an individual reads seven books and is more cost-efficient than softcover books after an individual reads twenty-one books. Due to the time value of money, it is important to consider when, relative to the initial purchase of the \$79 Kindle, the reader will read that twenty-first book.

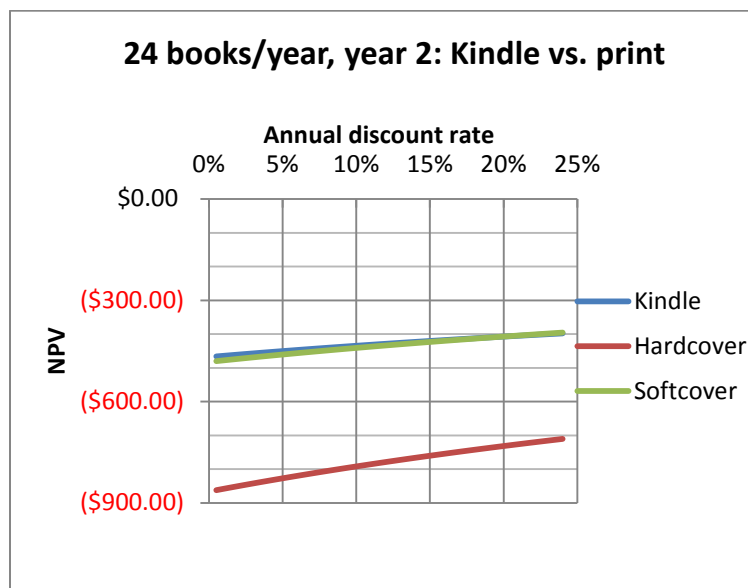


Figure 4.0: Kindle vs. print hardcover and softcover after two years of ownership

Figure 4.0 compares the \$79 Kindle vs. printed books when purchasing 24 e-books and printed per year during their second year of ownership. From Figure 4.0, the \$79 Kindle line

intersects with softcover line at an annual discount rate of approximately 19.5%. At annual discount rates lower than 19.5%, e-books are cheaper than softcover books. E-books and softcover books will always be cheaper than hardcover books.

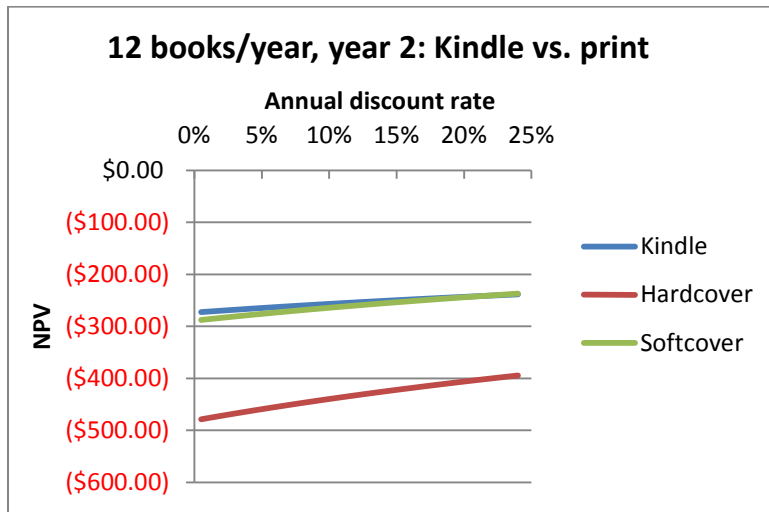


Figure 5.0: Kindle vs. print hardcover and softcover after two years of ownership

Figure 5.0 compares the \$79 Kindle to printed books when purchasing 12 e-books and printed books per year during their second year of ownership. From Figure 5.0, the \$79 Kindle line intersects with softcover line at an annual discount rate of approximately 21.0%. At annual discount rates lower than 21.0%, e-books are cheaper than softcover books. Similar to Figure 4.0, the \$79 Kindle is more cost-efficient after the second year of e-reader ownership.

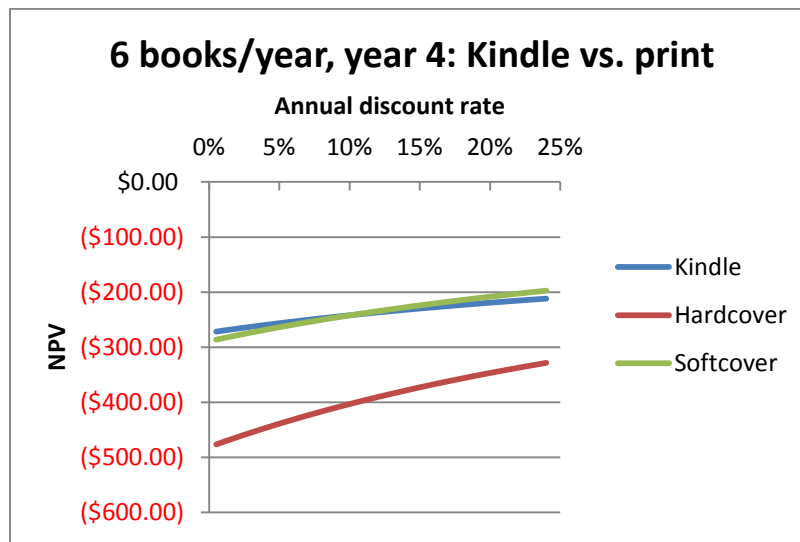


Figure 6.0: Kindle vs. print hardcover and softcover after 4 years of ownership

Figure 6.0 compares the \$79 Kindle vs. printed books when purchasing 6 e-books and printed books per year during their fourth year of ownership. From Figure 6.0, the \$79 Kindle line intersects with softcover line at 10.5%. At discount rates lower than 10.5%, e-books are

cheaper than softcover books. Unlike Figures 4.0 and 5.0, it takes the \$79 Kindle four years after the initial purchase before the e-reader is more cost-efficient than printed books because only six books are read throughout one year.

From Figures 4.0 and 5.0, the \$79 Kindle is cheaper than printed books after the second year of ownership. Prior to year two, the initial cost of purchasing an e-reader and e-books exceeds the cost of purchasing the printed books; therefore, purchasing a softcover book is the most cost-efficient method of purchasing books. If an individual reads at least six books per year, then the e-reader is more affordable after four years. If an individual reads at least twelve books per year, then the e-reader is more affordable after two years.

Table 4.0 – Cost Summary of Kindle, Hardcover and Softcover at one Book per Month

1 Book per Month Kindle, Hardcover and Softcover															
Month	0	1	2	3	4	5	6	7	8	9	10	11	12	21	24
# of Books	0	1	2	3	4	5	6	7	8	9	10	11	12	21	24
Kindle	79.00*	8.10	8.10	8.10	8.10	8.10	8.10	8.10	8.10	8.10	8.10	8.10	8.10	8.10	8.10
		87.10	95.20	103.30	111.40	119.50	127.60	135.70	143.80	151.90	160.00	168.10	176.20	249.10	273.40
Hardcover		20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04
			40.08	60.12	80.16	100.20	120.24	140.28	160.32	180.36	200.40	220.44	240.48	420.84	480.96
Softcover		12.04	12.04	12.04	12.04	12.04	12.04	12.04	12.04	12.04	12.04	12.04	12.04	12.04	12.04
			24.08	36.12	48.16	60.20	72.24	84.28	96.32	108.36	120.40	132.44	144.48	252.84	288.96

Monthly price includes one shipping charge per order of printed books \$3.99

* Initial Purchase of Kindle

Recommendation

The e-reader eventually becomes the cheaper option. Assuming perpetual ownership of e-readers and printed books, the e-reader should be purchased if a minimum of six books are read per year. The e-reader becomes more cost-efficient than printed books quickly if more books are read per year.

If an avid reader with a high interest rate credit card (~21%) does not have the funds to buy an e-reader, then the individual can feel confident in buying an e-reader with the credit card based on the graphs and data presented in the analysis. The e-reader will eventually pay for itself, and the individual will save money when purchasing the e-reader instead of printed books.

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