The Economics of Durable Goods and the College Textbook Market

Yuvaluck Setboonsrung
Clemson University, ysetboo@g.clemson.edu

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THE ECONOMICS OF DURABLE GOODS AND THE COLLEGE TEXTBOOK MARKET

A Dissertation
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy
Economics

by
Yuvaluck Setboonsrung
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Accepted by:
Dr. Chungsang Lam, Committee Chair
Dr. Frederick Hanssen
Dr. Patrick Warren
Dr. Yichen Zhou
Abstract

This paper examined factors determine the update frequency of college economics textbook in six subjects, which are Economics, Microeconomics, Macroeconomics, Econometrics, Industrial Organization, and Game Theory. The unique data set of books published in the U.S. between 1964 and 2018 gathered from the Internet by searching the title of the book and collected all previous versions that the textbook has. The results show that each book has its update pattern, and the update frequency is different among categories and levels. On average, it takes approximately three years to update a new edition of a book. Books in introductory and intermediate level update faster than an advanced class. An updated advanced level book takes nearly eight years to revise. The core economic class has updated faster than the elective class. Econometrics book takes approximately five years to rewrite. Industrial Organization book spends about six years to upgrade.

To see how big of the update, the table of contents analysis in Microeconomics and Macroeconomics book is analyzed. According to the analysis, every book has a new cover design, but the table of contents could be the same. The mainly introductory-level book has cosmetic changes by adding new examples, exercises, and applications. It could have switched chapter and reorganized the content to fit the new format. For the advanced book that has more than one edition, it takes a longer
time to update, but once it updates, it is considered a significant change. The analysis emphasized that the amount of content changes in the introductory book is fewer compared to the advanced level book. Note that the content in the introductory text contains more timely examples and questions which is outdated faster than the advanced level, which includes the core concept and theory. The theory of durable good monopolist and planned obsolescence could be used to explain the update. Finally, the study of the competition effect found a negative effect on the probability to update a book.
Dedication

For mother, my first pillar of strength.
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Chapter 1

Introduction

Textbook industry is a very important industry. Textbook publishing revenue in the United States was 10.87 billion U.S. dollars in 2017 (Watson (2018)). It is vital to many people from authors to publishers in order to earn a living from the textbook industry. There is a concern about the high price of textbooks in the United States. In 2005 the investigation of college-textbook costs by the Government Accountability Office (GAO) found that textbook costs account 8% of the cost of tuition and fees at private universities, 26% of the cost of tuition and fees at four-year public universities, and 72% of the cost of tuition and fees at two-year public institutions (Office (2005)). Senack (2014) surveyed students from 150 different university and campuses. The average student in the U.S. bears the textbook and supply expenses approximately 1200 dollars per year.

The research question is what factors affect the update frequency and how competition affects the decision to update a book.

The first research question is about what factors affect the update frequency.
The update decision is an economic decision since the author has the freedom and choice to write and update a book. Given that the author has finished the writing, it does not mean that the author has to issue an update. It is an economic decision to make.

Textbooks have dual characteristics: fashion and durable goods. It can be considered as a durable good since we can use it multiple times. At the same time, when a new edition is available, it is obsolete as fashion goods. Publisher updates the book periodically for a constant revenue stream and to keep the book up to date. There is a group of literature on planned obsolescence discusses whether shorten revision cycle raise revenue or not. Iizuka (2007) performed empirical analysis in the college textbook market and found planned obsolescence exists. While Chevalier and Goolsbee (2009) made a contradiction to planned obsolescence because forward-looking consumers can adjust the decision to buy or wait so an attempt to shorten revision time cannot raise revenue to the book publisher.

Since the textbook has durable goods characteristics, it can use multiple times, and the used unit is an imperfect substitute to the newest version, the optimal revision time carefully considered. There is a trade-off for the publisher in the decision to update. The publisher does not want to update too frequently because it is costly to update. However, the publisher does want to update at some point in time. It is because the textbook is a durable good. The characteristics of a durable good are that it can have a second-hand market. Moreover, if the textbook is not updated, the old textbook is a relatively better substitute for the new textbook, and it will compete with the new textbook. That is a reason why the publisher updates the book and makes a new textbook a worse substitute for the old book.
There are several theoretical literatures on durability and secondary market, namely Bulow (1982), Swan (1970), Waldman (1996), Anderson and Ginsburgh (1994), Hendel and Lizzeri (1999), Sobel et al. (1991). They studied the monopolist’s durability with the different assumption on the type of consumers: homogeneous or heterogeneous in terms of willingness to pay for quality. Anderson and Ginsburgh (1994) found sorting between new and used goods, and the secondary market provides options to consumer. Hendel and Lizzeri (1999) found that a durable good monopolist prefers to change durability than closing the secondary market. Sobel et al. (1991) found that monopolist still gains average positive profit in a dynamic monopolist with the entry of new consumers.

The second research question is how competition affects the decision to update a book. The other publisher’s decision to update can affect their own decision to update a book in a particular year. For example, if the competitor updates, the book will become obsolete more compared to the situation that the competitors do not update. The other update decision is also an economic decision to make.

The unique data set of 145 books from 1964 to 2018 published in the U.S. collected from several websites on the internet. These include Amazon, Barnes and Noble, Thriftbooks, Goodreads, Vitalsource, Chegg, Biblio, eBay, publisher’s website, and the National Library of Australia. The number of update is 658 units. The set of textbook are active books used in the top 50 university suggested by QS Rank 2017. The data collection and validation process performed in 2018 so we can get the data available before 2018. We have seen the updated pattern of an active and non-active book in the market. The scope of subject is Economics, Microeco-
nomics, Macroeconomics, Econometrics, Industrial Organization, and Game Theory. The data divided into twelve sub-groups based on subject and level. For instance, Microeconomics has three levels: introductory and intermediate for an undergraduate student and a higher level for the graduate student, so there are three subgroups into Microeconomics book.

To determine how big the update would be among different versions, a table of content analysis is performed. The table of contents analysis data in Microeconomics and Macroeconomics book collected from Amazon, and Barnes and Noble.

The econometrics models are the model of Time Last Update, the model of Big Update, and the model of Update a Book. We used the Ordinary Least Squared (OLS) method to estimate the model of Time Last Update. The Maximum Likelihood method (MLE) used to estimate the model of Big Update and the model of Update a Book.

The results from the model of time last update found category determines the difference in update frequency in a college economics textbook. On average, it takes approximately three years to revise a book. By level, the introductory class book has updated faster than the advanced class. It could happen because different category and level have different outdated content and concern. The table of content analysis confirmed that the amount of content changes in the introductory book is fewer compared to the updated advance class. The regression result from the model of the big update shows the significance of advanced economics book to have a big update.

The results from the model of update a book found the competition effect has a negative effect on the probability to update a book. The results are similar in the
linear model and the nonlinear model. There is a three percentage point decrease in the probability of update a book from the competition effect, holding all else constant.

This study fills a gap of knowledge on the revision cycle of college economics textbook in the U.S. We have seen the updated pattern of each textbook, factors determine the update and how big the book update in the sample of Microeconomics and Macroeconomics book by looking inside the different editions of the book-the analysis provided in the appendix for the exciting reader. What we learned from the results is the revision is actually an economic decision rather than adopting common simple three years rule on updating project. In addition, the book updating project adds value to the updated book. There is no need to suppress the quality of the book to accelerate revenue.

The rest of the paper organized as follows: Chapter 2 provides the literature review. Chapter 3 discusses the methodology and data. Chapter 4 consists of the theoretical model of Planned Obsolescence, and Durable Good Monopolist. Chapter 5 presents the empirical model of Time Last Update, a model of Big Update, and the model of Update a Book. Chapter 6 finds factors determine the Update. Chapter 7 analyzes how big of the update. Chapter 8 examines the competition effect. Chapter 9 concludes the paper.
Chapter 2

Literature Review

Anderson and Ginsburgh (1994) constructed a model of the second-hand market where market segmentation is endogenously determined and a monopolist in the primary market faced perfect competition in the used market. I think this set up of the model can be used to describe textbook market because each new textbook has characteristics that are unique. The publisher has the market power to set its price on every new textbook edition, but it faces competition in the used market since the used textbook is an imperfect substitute to the book. This paper concludes that 1) the monopolist will not have the incentive to kill off the second-hand market because the monopolist can use the second-hand market to achieve indirect price discrimination via segmentation of the market into different types of consumers. The consumer with high willingness to pay for the high-quality product will buy the new textbook and the one who has lower willingness to pay will buy used textbook through second-hand market. When there is more and more second-hand user, it enhances the demand for the consumer who loves buying new because they have the market to sell textbook once they finish using and do not want the book anymore. 2) There is a situation that monopolist wants to kill off the second-hand market by setting a low price while
allowing some used good consumer receiving a free good or even a very low price, this facilitates the first-hand consumer to buy new. 3) The monopolist may wish to set up the high price for a new user who has high replacement cost, and this will kill off the second-hand market because the new keep the durable good and no incentive to sell the used one to the second-hand market. Once there is no supply of used book the second-hand market cannot run.

Clerides and Hadjiyiannis (2008) constructed a theoretical model to study the impact of quality standards for used durable goods on trade flows, profits, and consumer welfare. High-quality standards for used durable goods increase the cost of holding on to them and induce consumers to upgrade their holding more frequently than they would have. The trade flows from high-quality standard to low-quality standard country because of costly quality standards. The strict quality standards favor producers in exporting country but hurt the consumer in that country. This is explained by an indirect subsidy from consumers to producers. This paper can be explained the US textbook market which is considered high-quality standards on the textbook. The textbook that is sold in the US is more expensive than the international edition. The price of US textbook is needed to cover development and production costs. Once development costs have been incurred for the US market, the incremental cost of producing additional copies for the international market is low. This allows publishers to sell textbooks in other countries at prices that are closer to printing and distribution costs (GAO, 2005). This phenomenon could be explained an indirect subsidy from consumers to producers in the US market.

Hammond et al. (2015) examined the revision cycle of 69 accounting textbooks. They found that accounting textbooks have been revised at an increasing rate
over the past 28 years. Furthermore, they did a survey of faculty and found that faculty who teach sub-disciplines prefer longer revision cycle than do faculty who teach in rapidly changing fields. Another interesting point is more experienced faculty, female faculty and faculty who are not authors are more likely to consider the price of a textbook that student pay as an important factor in the textbook selection decision. This finding contradicts the general belief that professor does not realize the price of the textbook because the professor has no responsibility for the price student pay for it.

Zinser and Brunswick (2010) studied the revision cycle of 26 introductory business textbooks. They found that the revision cycle getting shorter by comparing the mean in years before and after year 2000.

Williamson et al. (2016) studied the professors’ perspective on the rising cost of the textbook. They used a 5-point rating scale in 17 questions on a voluntary internet survey from 228 management professors in the United States. They found that instructors with years of experience concern about the high price of a textbook to students. They are willing to have legislation enacted to the publisher, but they do not want university policy to restrict the freedom to choose text to teach in class.

Koch (2006) studied the economic market of textbook price and markets in the United States. First, the textbook market has an agency problem because the professor has a choice to choose a text but does not need to pay for it; the student does. Second, the textbook market in the U.S. is not regulated by any government agency, so it is difficult for a policymaker to interfere with the price. Third, the barriers do exist in textbook markets in terms of significant capital requirements, product
differentiation, reputation, and contractual relationships among wholesalers, bookstores, and authors. Forth, the elasticity of demand of textbook is equal to -0.2, a ten percent increase in textbook price will result in two percent decline in the number of books bought by students, which is relatively inelastic.

Iizuka (2007) did an empirical analysis of planned obsolescence in the textbook market. He found that the publisher introduces new edition to kill off a used unit by revising more frequently when competition from the used market increases.

Chevalier and Goolsbee (2009) made a contradiction argument of planned obsolescence. If consumers are forward-looking updating textbook more frequently fails to increase revenue to the producers.

Ding et al. (2018) empirical studied video game market which new product is competing with its product. The results found that quality improvements in the new product decrease used good price but increased the new good price. It is interesting finding since in college textbook market publisher also introduce the new product (a newer edition of a textbook) which has high price while the used book is cheaper and still available to purchase in the marketplace.

Hendel and Lizzeri (1999) studied car market by using dynamic model of adverse selection to examine the interaction between used car and new car. He found that the used car market never shuts down, the volume of trade is large, and distortions is not high as previously thought. If the producer want to exercise monopoly power on the durable good, adjusting durability is preferred to close the secondary market.
Siegfried and Latta (1998) studied retail prices of 16 textbooks on campus college and university bookstores and found that they are not related to the number of sellers, entry, or any market conditions. The university bookstores does not exercise monopoly power to increase price of the book. This finding makes sense to me since there are lots of option to buy the textbook from the marketplace and internet.

Chevalier and Goolsbee (2003) studied price competition online and estimated the elasticity of demand and found that elasticity of demand at Barnes and Noble.com is more price elastic than the demand at Amazon.com.
Chapter 3

Methodology and Data

Since we do not know International Standard Book Number (ISBN) of the book at the beginning, we search the book by Title and Name of the author and collect all the previous edition of each book from various sources. The set of textbook in this study are economics and econometrics book used in the top 50 university suggested by QS Rank 2017. The university websites and syllabus search from the Course Hero also help identify which textbook and edition used in class. For the well-known book can be published or reprinted over time by many publishers, also in various kinds of format. To ensure data quality, we cross-checking the book data such as the year of publication, the number of pages, controlling for the format of the book from several websites to make sure that the data is correct and comparable within the book.

There is so much variation in prices and qualities of a textbook in the marketplace; if one wants to find the exact version of the book, the precise ISBN is essential to know. Note that different format and publisher uniquely defines ISBN. For instance, a hardcover or a paperback, and an e-book version of the same title could have a different ISBN. To avoid repetition, one observation of book-year collected for
the analysis. The total number of the unique update is 658 observations.

It is interesting to know that when the textbook has been revised, the old version is no longer available from the publisher website, but it can be found from the marketplace. The book data and characteristics are collected from various source, including the marketplace, publisher’s website, and the National Library of Australia. Amazon website is good for the recent textbook, the past three editions from the newest edition is easily found from Amazon but it is hard to collect the previous data up to the first edition. To solve the completeness of data, the alternative website provided by Barnes and Nobel is considered. The Barnes and Noble website helped lessen the incomplete of data and helped validate the data which is previously found from the Amazon. The collection and validation process performed at the same time. Furthermore, other websites namely, Thriftbooks, Goodreads, Vitalsource, Chegg, Biblio, and eBay are checked to get the clean and reliable data to use in the analysis.

3.1 Data

The data collection and validation performed in 2018. The collected characteristics are the title name of the book, the number of pages, the publication date, year, the edition, format, the author name, and the publisher name. The book data is unbalanced panel data with the cross-section of book id and the time series of the year. It is 145 unique books published in the U.S. between 1964 and 2018. The total number of the update is 658 units. The sample included textbooks in six subjects, which are Economics, Microeconomics, Macroeconomics, Econometrics, Industrial Organization, and Game Theory. The book categorized in twelve sub-groups by subject and level. For example, Macroeconomics has three levels: introductory and intermediate
level for an undergraduate student and an advanced level for the graduate student in Economics, so there are three subgroups in the subject of Macroeconomics. Table 5 shows the total number of books and updates in each group.

From the collected data, the total number of the update is 658 observations, but the number of valid updates using in regression of Time Last Update is 521 observations which excluded no update of the book that has only one edition. On average, the book has approximately six editions. The minimum is two editions. The maximum is twenty-one edition. The average pages of the book are 675 pages. The minimum is 238 pages. The maximum is 1480 pages.

The data capturing the popularity of the book is the book cited score from Google Scholar (https://scholar.google.com), which voluntarily provided reviews from the reader. One interesting point is that the author needs to voluntary register and upload their profile and publication to the website. The available data is about one-third of the entire data. The range of book cited score is large. The minimum score is 24 point, and the maximum is 69628 point. The average book cited score is 6705 point.

Every new book is a new product. There is no organization or authority to identify the update. A well-known book can be published or reprinted over time by many publishers, also in various kinds of format.

To determine how big the update would be among different versions, a table of contents analysis in Microeconomics and Macroeconomics book performed in chapter 7.

Table 5 shows the number of books, updates, and big updates using in table of contents analysis in Microeconomics and Macroeconomics books.
Chapter 4

Theoretical Model

The related theoretical model is Planned Obsolescence and Durable Good Monopolist.

4.1 Planned Obsolescence

Planned obsolescence is a policy of planning or designing product to break after a certain period. Once the product obsolete, the producer can issue a new version of the market and continuing to generate a stream of revenue. Tearing out the page of exercise at the end of the book and bundling with electronic services that expire after one-time use are forms of technology that the publisher used to make the book obsolete or expire. When the competition of used unit increase the publishers revise the book more frequently, the introduction of new edition help generate revenue to the producer. Iizuka (2007) claimed that planned obsolescence exists in the textbook market. While Chevalier and Goolsbee (2009) made contradiction argument to planned obsolescence since forward-looking consumers can adjust the decision to buy a textbook so shorten revision time cannot increase revenue to the book publisher.
4.2 Durable Good Monopolist

Each book is different among the other. Once a book is chosen to use in class, another book is less substitute so the author can keep issuing a new version of the book and keep high price but not suppress quality. An example of a Macroeconomics book by Mankiw, the price of the book is always high. The listed price range is 232.95 dollars to 351.95 dollars.

A professor could lead the demand for a textbook. Bookstore and professor work together and decide which book to use in class (I knew this by checking University Syllabus, which has a link directly to campus bookstore). The bookstore only carries the current edition using in class. Table 13 shows examples of Economic class and textbook used at Clemson University (Spring 2019). In the same university, the same class number could use different book ordered by professors. For example, ECON 2110 Principle of Microeconomics for an undergraduate student at Clemson University, there are at least four textbooks in Microeconomics. It means that the professor exclusively has the freedom to choose a textbook to teach in class, and his choice could lead to the demand for the book. The average price of a new textbook is above 200 dollars, and there is variation in prices and qualities of the book in the marketplace which gives options to the student to self select the quality based on the ability to pay.

Professor has a right to choose a textbook for his class. We investigated class syllabus and textbook used by the top university ranked by QS World University Ranking in 2017. There are many choices of textbook choosing based on the instructor’s preference. In the introductory level, the newest version, study’s aid, and
exercise are needed to keep students in the same pace of up-to-date knowledge. In the advanced class, more than one textbook is recommended to read. For Econometric, there are also choices of a book to choose differently among professors. Table 14 shows examples of textbook selection in a selected top university in the U.S. Unfortunately, the number of students enrolled in each class is challenging to find because of the limited access from the university website.

Evidence of high price, the relevant of a textbook used in class, the poor substitute support the theory of Durable Good Monopolist to superior explain textbook updating behavior. There is no need to suppress the quality of the book to accelerate revenue. The update decision is an economic decision since the author has the freedom and choice to write and update a book.
Chapter 5

Empirical Model

In this section, we investigated the factors determining the update. The first equation is the model of Time Last Update. We used the Ordinary Least Squared (OLS) method to estimate the first equation. The Maximum Likelihood method (MLE) used to estimate the second and third model, especially in the logit and probit model. The second equation is the model of Big Update. The third equation is the model of Update a Book.

5.1 Model of Time Last Update

\[
\text{TimeLastUpdate}_{ipt} = \beta_0 + \beta_1 \text{Category}_i + \beta_2 \text{X}_{it} + T_t + \delta_p + \epsilon_{ipt} \tag{5.1}
\]

where \( i \) indexes book id, \( p \) indexes publisher, and \( t \) indexes year.

The variable \( \text{Category}_i \) is an indicator variable equal to 1 if the book is in category \( i \) and 0 otherwise. The category is introductory, intermediate, advance, econo, io, and game. The baseline category is intermediate. The vector \( \text{X}_{it} \) contains the book characteristics, including format, the different numbers of pages, the maximum edition of the book, the book cited, and whether the book is new or not. Table
4 presents the description of variables and construction. The terms $T_t$ represents year fixed effect. The term $\delta_p$ represents the publisher’s fixed effects. The publishers are cengage, mcgrawhill, pearson,norton, wiley, worth, and upress. Note that upress stands for university press which includes the MIT press, Oxford university press, Harvard university press, Princeton university press, and Cambridge university press. Since the publisher change over time and one publisher has several imprints, the historical research performed. The $\epsilon_{ipt}$ represents the error term.

The dependent variable, $TimeLastUpdate$, is the number of time last update, defined by year. It is the difference of a year in the next edition of the book. For example, if a book has four editions: the fourth edition of the book published in 2017, the third edition of the book published in 2014, the second edition of the book published in 2010, and the first edition of the book published in 2007 so the time last update of this book is equal to 3, 4, 3, respectively. For the book that has only one edition, we cannot study the time last update, so we dropped them. The final data-set of valid update using in regression of $TimeLastUpdate$ is 521 observations.

We used the Ordinary Least Squared (OLS) method to estimate the regression model of Time Last Update. Several specifications performed in Table 3.

5.2 Model of Big Update

$$BigUpdate_{i,t} = \alpha_0 + \alpha_1 Category_i + \alpha_2 X_{it} + T_t + \epsilon_{it} \quad (5.2)$$

where i indexes book id, and t indexes year.

The variable $Category_i$ is an indicator variable equal to 1 if the book is in category i and 0 otherwise. The category is the introductory, intermediate, advance.
The baseline category is still intermediate. The vector $\mathbf{X}_{it}$ is a control variable of the number of past update and number of current update in each group. The terms $T_t$ represents year fixed effect. The $\epsilon_{it}$ represents the error term. The number of observations is 658 updates.

The dependent variable, $BigUpdate$, is a dummy variable equal to 1 when a big update happens in a particular year. It is interesting to note that this regression is further of analysis in Microeconomics and Macroeconomics Book. It used the restricted sample from a study of the Table of Contents. The total number of updates is ninety-seven. The big updates in Macroeconomics and Microeconomics Book is thirty-four updates. The summary statistics on Big Update model provide in Table 7. We used the Linear Probability Model to investigate what factor determining the big update. Table 8 presented the probability of a big update.

### 5.3 Model of Update a Book

\[
Update_{i,t} = \alpha_0 + \alpha_1 PastUpdate_{i,t-1} + T_t + \delta_i + \epsilon_{it} \quad (5.3)
\]

where $i$ indexes book id, and $t$ indexes year.

The variable $PastUpdate_{i,t-1}$ is the number of competitors update the book in the previous year ($t-1$). The coefficient of interest is $\alpha_1$, which represents the competitor effect in the category from the previous year. The terms $T_t$ and $\delta_i$ represent year and book fixed effects, respectively. The $\epsilon_{it}$ is the error term. The dependent variable, $Update_{i,t}$ is a dummy variable equal to 1 if the book update in year $t$ and 0 otherwise.
Note that the construction of $PastUpdate_{i,t-1}$ is based on the group, so it is a real competitor. Different book id has a different set of the number of competitors. The total number of observations is 3,338 units, which includes 145 unique books published in the U.S. between 1964 and 2018.

We used the Linear Probability model and later compared the result with the Logit and Probit model. Table 17 showed The average marginal effects comparison among those model.
Chapter 6

Update Frequency in Economics Book

6.1 Introduction

The theory of planned obsolescence and durable good monopolist paved the way to do empirical analysis. In this chapter seeks to find the factor determines the update. The model of update frequency used to explain the revision cycle in Economic book.

6.2 Model and Estimation

In this section, we estimated the regression model of Time Last Update by Ordinary Least Square method (OLS).

\[
\text{TimeLastUpdate}_{ipt} = \beta_0 + \beta_1 \text{Category}_i + \beta_2 \text{X}_{it} + T_t + \delta_p + \epsilon_{ipt}
\]  

(6.1)

where i indexes book id, p indexes publisher, and t indexes year.
The variable $Category_i$ is an indicator variable equal to 1 if the book is in category $i$ and 0 otherwise. The category is introductory, intermediate, advance, econo, io, and game. The baseline category is intermediate. The vector $X_{it}$ contains the book characteristics, including format, the different numbers of pages, the maximum edition of the book, the book cited, and whether the book is new or not. Table 4 presents the description of variables and construction. The terms $T_t$ represents year fixed effect. The term $\delta_p$ represents the publisher’s fixed effects. The publishers are cengage, mcgrawhill, pearson,norton, wiley, worth, and upress. Note that upress stands for university press which includes the MIT press, Oxford university press, Harvard university press, Princeton university press, and Cambridge university press. Since the publisher change over time and one publisher has several imprints, the historical research performed. The $\epsilon_{ipt}$ represents the error term.

The dependent variable, $TimeLastUpdate$, is the number of time last update, defined by year. It is the difference of a year in the next edition of the book. For example, if a book has four editions: the fourth edition of the book published in 2017, the third edition of the book published in 2014, the second edition of the book published in 2010, and the first edition of the book published in 2007 so the time last update of this book is equal to 3, 4, 3, respectively. For the book that has only one edition, we cannot study the time last update, so we dropped them. The final data-set of valid update using in regression of $TimeLastUpdate$ is 521 observations.
6.3 Results


Update frequency also differs among publisher. On average commercial publisher update faster than university press publisher. The difference because they publish different types of book. The university press publishes most of one edition book and advanced level while the commercial publishers publish the popular book and more on the introductory level book. Table 2 shows the revision time among category and publisher.

Table 3 shows the regression of Time Last Update model. The regression results controlling for year and publisher fixed effect (column 4) show that the book in different category update at a different speed. A baseline category is an intermediate group. An introductory book updates 0.738 years faster than the intermediate book, which is statistically significant at 5% level. An advanced book updates 4.088 years slower than the intermediate book. An Econometrics book updates 1.832 years slower than the intermediate. An Industrial Organization book updates 1.975 years slower
than the intermediate. The industrial organization book takes two more years to revise relatively to the average time. The econometric book takes between one to two more years to rewrite compared to the average. The coefficient of maxed is -0.099 and statistically significant at the 0.01 level.

The more editions the book has decreased the updating time. It means the revision cycle is shorter in the book that has many versions or revise more regularly. Book characteristics such as format either the book are a hardcover or not and the different numbers of pages between editions controlled for the format cannot determine update frequency. As well as popularity, measured by the book cited from google scholar does not have enough power to explain the update frequency. It could blame the small number of observations that have a quoted score, or a favorite book is not mean to revise very often.

Another interesting point is the new book update approximately a year faster compared to the old book. This finding makes sense since the author like to update their text to keep it current, and the book is on demand that kept printing by a publisher. The results are in line with the literature that studies on the revision cycle by basically compared year before and after a specific time and later a particular year. Zinser and Brunswick (2010) studied 26 introductory business textbook and found that the revision cycle was shortening after the introduction of e-commerce in 2000. Hammond et al. (2015) examined revision cycle of 69 accounting book and found that the revision cycle is shorter in the past 28 years.

Figure 2 shows a histogram of time last update and number of updates in the data. The most popular updating time is within three years which is mainly driven
by the introductory book level.

### 6.4 Summary

This first research study factor determines update frequency of college economics textbook in six subjects. The unique data set of books from 1964 to 2018 published in the U.S. collected from the various source from the Internet. The regression results show that the update frequency is different among categories and levels. The introductory class book has updated faster than the advanced class. The table of contents analysis emphasized that the amount of content changes in the introductory book is fewer compared to the advanced level book. The author in an introductory book like to update a book. The usual contents changes are updating examples and questions, combining real-world applications and research. Each book has its updating pattern; if the book is printing the average time of revision is approximately three years. For the book that is no update pattern or only has one edition, the content is unique. The competitor updating behavior does not affect the decision of the big update. Most of the advanced level book has unique content, and it is only one edition since introduction. Besides, the model of big update shows the significance of advanced economics book to have a significant big update effect.
Chapter 7

Contents Analysis

7.1 Introduction

Publishers earn revenue from sales of the book. Author update his book according to the comments and suggestions. There is always room for improvement (from Krugman Wells, Microeconomics (2nd edition)) and keeping the book up to date is a challenging and never-ending task (from Romer, Advanced Macroeconomics(4th edition)). So, the typical behavior of the author is to update the book to timely topics and current contents.

The book is an outgrowth of courses that the author taught in college or university. For instance, Professor David Romer taught at Princeton University, the MIT, Stanford, and especially the University of California Berkeley. He mentioned in the preface and thanked many students in his courses about feedback, patience, and encouragement.

In addition, the book updating project involves many tasks not only the sole
author can get the work done, it needs a team of talented economics instructors and staffs including editorial staff working on proofreading, editing and production staff working on solutions manual, test bank, table and figures and supplement materials like data sets and power-point slides. The college textbook in the United States is using a traditional publisher who is experienced and known about the market.

The following section explains the economic reason about the time of update.

### 7.2 Economic Times of Update

Book publishers revise textbook business as usual and update data to the current event. When time past and the old version is outdated, it allows earning profit again from the introduction of the newer version. The economic decision takes place at the optimal time of the update.
The figure above explains the time of update and amount of outdated content, measured the distance between the new edition to the previous version. The vertical axis represents outdated content. The horizontal axis represents time in year term. The economic time of update ($T_t$) occurs when marginal benefit reaches the marginal cost of updating ($t=1, 2, 3, \ldots$). The publisher earns revenue from the new edition of the book. The author gets pay from book advance and book royalties. In general, the royalty rate is between ten to fifteen percent based on the net price of the book. The publisher and author are dependent in terms of revenue generation. For simplicity, assume a constant marginal cost of update ($C_i$) where $i = H, L$. The marginal cost line is dot line. The slope dash line captures the distance between a new edition to the previous version. Let consider equilibrium point $E_1$ with high cost ($C_H$), the economic time of update is $T_1$. If all else constant and the book is in print, the possible next updating time is $T_2$ and $T_3$, respectively. The book has its update pattern. Assume the same outdated rate (the same slope of the dashed line), if the cost of the update is lower ($C_L$ less than $C_H$, the time of revision ($T_1$) is shorter, and the equilibrium point moves from $E_1$ to $F_1$).

From the graphical analysis, we could expect a small update occur in the introductory book than in the advanced book.

The overview of the introductory book has many editions, but each update is small. They usually update examples and questions to the current event but no main content change. These kinds of change considered low cost, so we have seen the frequent update in an introductory economics book. For the advanced book that has more than one edition, it takes a longer time to update, but once it updates, it is a significant update. For example, the third edition of Economic Analysis by
Hal Varian, it takes fifteen years from the first introduction in 1978 until now it is considered as a current edition (3rd edition 1992) published by Norton. The author claimed in the preface that it is a significant revision. For core content, it may never revise and never become obsolete.

### 7.3 Table of Contents Analysis

The table of contents analysis in thirty-six books in the subject of Microeconomics and Macroeconomics performed. All Advanced Microeconomics and Macroeconomics book that has more than one edition are analyzed. More than half of Intermediate Microeconomics and Macroeconomics and approximately half of Introductory Microeconomics and Macroeconomics are analyzed. The selection of book analysis based on the available data on the Internet. We collected all editions of the table of contents and preface from several websites from the Internet and looked inside all possible versions to find how the book updates. Table 8 and 9 summarizes the edition analysis in Microeconomics and Macroeconomics book. Table 10 and 11 provides useful information about the content changes in Microeconomics and Macroeconomics, respectively. Those tables show the inside of the changes in the book and fill the gap of knowledge to the scholars. The number of books, the number of updates, and the number of significant updates show in Table 5.

There are fifty-one updates in Macroeconomics, nineteen of them are the big update. There are forty-six updates in Microeconomics, fifteen of them are the big update. The definition of the big update is adding a new chapter which considers a significant change.
According to the analysis, every book has a new cover design, but the table of contents could be the same. A mainly introductory level book has cosmetic changes by adding further examples, exercises, and applications. It could have switched chapter and reorganized the content to fit the new format. For instance, Microeconomics: Theory and Application with Calculus by Perloff has nineteen chapters and the same table of contents from edition one to four. The author always changes and adds new applications and examples to the current event. There is no many updated advanced economics book, but once it updates, it is a big update. For Advanced level book: Advanced Microeconomics Theory by Jehle and Reny, it has a significant update in 2000 (2nd edition) by adding a new chapter of Auction and Mechanism Design. Another well-known advanced level book is Economic Analysis by Varian, there is a significant change in 1992 (3rd edition) but never update again since then.

Another interesting point is an author like to write a book in a similar topic based on their expertise. Especially in these three categories: introductory microeconomics, introductory macroeconomics, and economics have the same update frequency and the time lap between a revision of book is very close, only differ in the month of a year. For example, the work from Krugman and Wells by Worth Publisher, they published Microeconomics on 11/10/2017, Macroeconomics on 11/17/2017 and Economics on 12/12/2017. Furthermore, if the book is printing, the author uses the same publisher to reproduce their work. Note that the number of students enrolled in an introductory class is more significant than that of an advanced level. We could infer that the potential demand for the introductory book is higher than the advanced. If the publisher likes to capture this, he could ask the author to extend their expertise in writing three categories since they shared the mutual benefit of the new textbook sales. We have seen these updating pattern relationship in the data.
7.4 Big Update

In order to study the factor determines the big update, we keep only the observation that update occurs. The number of observations of the update is 658 units.

7.5 Model and Estimation

\[ \text{BigUpdate}_{i,t} = \alpha_0 + \alpha_1 \text{Category}_i + \alpha_2 X_{it} + T_t + \epsilon_{it} \]  

(7.1)

where i indexes book id, and t indexes year.

The variable \( \text{Category}_i \) is an indicator variable equal to 1 if the book is in category i and 0 otherwise. The category is the introductory, intermediate, advance. The baseline category is still intermediate. The vector \( X_{it} \) is a control variable of the number of past update and number of current update in each group. The terms \( T_t \) represents year fixed effect. The \( \epsilon_{it} \) represents the error term. The number of observations is 658 updates.

The dependent variable, \( \text{BigUpdate} \), is a dummy variable equal to 1 when a big update happens in a particular year. It is interesting to note that this regression is further of analysis in Microeconomics and Macroeconomics Book. It used the restricted sample from a study of the Table of Contents. The total number of updates is ninety-seven. The big updates in Macroeconomics and Microeconomics Book is thirty-four updates. Table 7 provides the summary statistics on Big Update model.
7.6 Results

Table 8 represents several specifications of the probability of a big update. Column (1) is the regression between big update and book category: introductory and advance, controlling for year fixed effect. The coefficient of introductory is equal to -0.038 and statistically significant at 5% level which means that if the book is an introductory economics book, the probability of big update decreases approximately 0.04. The coefficient of advance is equal to 0.227 and statistically significant at 1% level. It means that if the book is an advanced economic book, the probability of big update increases approximately 0.23. Adding control variables of the number of past updates and current update in column (2) and (3), the coefficient of advance get slightly smaller from 0.227 to 0.0221 and statistically significant at 1% level, but the sign is still positive. On the other hand, the coefficient of introductory loses significant, which is not surprised because the introductory book usually does not have a big update.

The regression results confirmed that when it is an advanced economics book, it is more likely to get big update. Holding all else constant, the probability of big update increases 23 percentage point on average.
Chapter 8

Competition Effect

8.1 Introduction

We have seen the updated pattern in 145 books (Figure 1) and want to see how competition affect the probability to update a book in a particular year. Competition effect in this study defined by the number of competitors update the book in the previous year (t-1). The data is unbalanced panel data with the cross-section of book id and time series of the year. Each book has a different starting point in the market. Furthermore, each textbook has a different number of competitors. We calculated each pair of book id and number of past update and combined them to one data set. The total number of observations is 3338. The data covered the year 1964 to 2018. The minimum number of competitors is one book. The maximum number of competitors is eight books. The summary statistics on update model shows in Table 15.
8.2 Model and Estimation Method

In this section, we performed a linear probability model to estimate the probability of update a book, and later, we compared the results to a nonlinear model.

$$Update_{i,t} = \alpha_0 + \alpha_1 PastUpdate_{i,t-1} + T_t + \delta_i + \epsilon_{it}$$  \hspace{1cm} (8.1)

where i indexes book id, and t indexes year.

The variable $PastUpdate_{i,t-1}$ is the number of competitors update the book in the previous year(t-1). The coefficient of interest is $\alpha_1$, which represents the competitor effect in the category from the previous year. The terms $T_t$ and $\delta_i$ represent year and book fixed effects, respectively. The $\epsilon_{it}$ is the error term. The dependent variable, $Update_{i,t}$ is a dummy variable equal to 1 if the book update in year t and 0 otherwise.

Note that the construction of $PastUpdate_{i,t-1}$ is based on the group, so it is a real competitor. Different book id has a different set of the number of competitors. The total number of observations is 3,338 units, which includes 145 unique books published in the U.S. between 1964 and 2018.

8.2.1 Linear Probability Model

Dependent variable takes value 1 or 0.

$$Pr(y = 1|x) = G(x\beta),$$

For logit and probit model The key is the different distribution in the error term.

$G$ is the cdf for either the standard normal or the logistic distribution.
8.2.2 Logit Model

The cumulative distribution function of the logit model

\[ E(Y) = P = \frac{\exp(\beta_0 + \beta_1 X)}{1 + \exp(\beta_0 + \beta_1 X)} \]

The log of odd ratio

\[ \ln \left( \frac{P}{1 - P} \right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k \]

P is the probability of outcome.

8.2.3 Probit Model

The cumulative distribution function of the probit model

\[ Pr(Y = 1|X) = \Phi(\beta_0 + \beta_1 X) \]

\( \Phi \) is the cumulative normal distribution function.

\[ z = \beta_0 + \beta_1 X \]

z-value or z-index of the probit.

8.3 Results

Table 16 represents several specifications of the linear probability model of update. Column (1) is the simple regression between update and number of competi-
tors update the book in the previous year. Without any other control variables, the relationship is positive. The coefficient of $PastUpdate$ is equal to 0.018, which means the probability of update the book in the current year increases approximately 0.018 when there is one more competitor’s update in the previous year. This regression could have a problem of missing control variables, which makes the coefficient biased and inconsistent. Then, We added one more control of how many books update in the current year, so column (2) is the multiple regression between update and the number of update in the previous year and the current year. The coefficient of $PastUpdate$ is equal to -0.021, which switch from positive to negative. It means if there is one more competitor’s update in the previous year, the probability of update the book in the current year decreases approximately 0.021. The coefficient of $CurrentUpdate$ is equal to 0.077, which means if there is one more update in the current year, the probability of update the book that year increases approximately 0.077.

After controlling both year and book fixed effect, the coefficient of $PastUpdate$ get slightly smaller from -0.0211 to -0.0206 but the sign is still negative. On the other hand, the coefficient of $CurrentUpdate$ get slightly bigger from 0.0775 to 0.0778, but the sign is still positive.

Table 16 in column (3) represents the regression results controlling for year and book fixed effect show that the coefficient of $PastUpdate$ is equal to -0.021 which means if there are one more competitors update in year $t-1$, the probability of update the book in year $t$ decreases approximately 0.021. The coefficient of $CurrentUpdate$ is equal to 0.078, which means if there is one more update in year $t$, the probability of update the book in year $t$ increases approximately 0.078. In column (4) without the current update variable, the coefficient of $PastUpdate$ get bigger from -0.021 to -0.029
but the negative sign still present. The coefficient of $PastUpdate$ is equal to -0.029, which means if there are one more competitors update in year t-1, the probability of update the book in year t decreases approximately 0.029.

In column (4) is the linear probability model of update controlling for year and book fixed effect. The coefficient of $PastUpdate$ is equal to -0.029, which means if there are one more competitors update in year t-1, the probability of update the book in year t decreases approximately 0.03. The adjusted r-squared is equal to 0.1221, which means 12.21 percent of the variation in update explained by the covariates.

Since the coefficients obtained from the command of logit and probit in the STATA program is not the probability of update, so further estimation of average marginal effect is useful to study the probability of update a book. We presented the comparison in the following section.

8.3.1 Average Marginal Effect

Table 16 represents the probability of update a book. The average marginal effect in Linear Probability model in column 1 is equal to -0.0293382 which is slightly larger compared to the Logit model in column 2 (-0.0178915), and the Probit model in column 3 (-0.0187758).

Both logit and probit model can interpret as if there is one more competitor update in year t-1, the probability of update the book in year t decrease approximately 0.02. It is slightly smaller, compared to the Linear Probability Model.
Note that: the average marginal effects in LPM model is -0.0293382. If there is one more competitor update in year t-1, the probability of update the book in year t decrease approximately 0.03.

What we learned from this model and estimation is competition decreases the probability of update.
Chapter 9

Conclusions

This research examined factor determines the update frequency of college economics textbook in six subjects, which are Economics, Microeconomics, Macroeconomics, Econometrics, Game Theory, and Industrial Organization. The unique data set of books from 1964 to 2018 published in the U.S. gathered from the various source from the Internet by searching the title of the book and collected all previous version that textbook has. Also, we looked at many syllabi from the university website to make sure that the book is using in class in the U.S. university. Besides, we performed table of contents analysis to see how big the update is. Finally, we examined the competition effect among subcategory to estimate the probability of update a book.

The research questions are what are factors determining the update frequency, and how competition affects the decision to update a book.

There are two theoretical models involved; planned obsolescence and durable good monopolist. The empirical model in this study and the evidence from the college
textbook market in the U.S. support the theory of durable good monopolist to be better explain the updated pattern. The update decision is an economic decision since the author has the freedom and choice to write and update a book.


According to the table of contents analysis in Microeconomics and Macroeconomics book, every book has a new cover design, but the table of contents could be the same. The mainly introductory level book has cosmetic changes by adding new examples, exercises, applications, and switching chapter but no main content change. For the advanced book that has more than one edition, it takes a longer time to update, but once it updates, it is a significant update. The regression results show that the probability of big update increases approximately 0.23 if the book is the advanced economics book. The table of content analysis emphasized that the amount of content changes in the introductory book is fewer compared to the advanced level book. Note that the content in the introductory text contains more timely examples and questions which is outdated faster than an advanced level, which mainly the core concept and theory.
To examine the competition effect defined by the number of competitors published the book in the previous year, we performed several estimations to study the probability of update a book. We are then comparing the results of the linear model to the nonlinear model. The average marginal effect in Linear Probability model is equal to -0.0293382, which is slightly larger compared to the Logit model (-0.0178915), and the Probit model (-0.0187758). What we learned is that competition decreases the probability of update. It is approximately three percentage point decrease in the probability of update from the competition.

In short, this study finds category is a factor determining the update frequency. Update frequency is different among categories and levels. The update frequency in introductory economics book has updated faster than the advanced class. The table of contents analysis confirmed the contents change in introductory book is fewer than the updated advance book. Besides, the model of big update shows the significant of advance book to have a big update. Finally, the competition effect decreases the probability of update but no effect on the big update.
Bibliography


Appendices
Appendix

Table 1: Summary Statistics on Time Last Update Model

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Table 2: Revision Time Among Category and Publisher

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Table 3: Regression of Time Last Update

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*p < 0.05, **p < 0.01, ***p < 0.00
Table 4: The Description of Variables

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<td>Including introductory microeconomics, introductory macroeconomics, and economic.</td>
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<td>advance</td>
<td>Advance Economics Level Book</td>
<td>Including advanced microeconomics, and advanced macroeconomics.</td>
</tr>
<tr>
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<td>Econometrics Book</td>
<td>Including introductory, and advanced econometrics.</td>
</tr>
<tr>
<td>io</td>
<td>Industrial Organization Book</td>
<td>Including introductory, and advanced industrial organization.</td>
</tr>
<tr>
<td>game</td>
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<td>Including introductory, and advanced game theory.</td>
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<td>Format</td>
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Table 6: The Analysis in Microeconomics and Macroeconomics Book

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<th>Number of Big Updates</th>
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Notes: big update means new chapter
Table 7: Summary Statistics on Big Update Model

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* $p < 0.05$, ** $p < 0.01$, *** $p < 0.00$
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<td>12th/2016</td>
<td>Pearson/10,11,12</td>
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Table 10: Content Changes in Microeconomics

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<td>Pearson/10,11,12</td>
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<td>Norton/1,2</td>
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<td>Worth/3,4</td>
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Notes: An underline text is a big update.
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<td>Pearson/1,2</td>
<td>3</td>
</tr>
<tr>
<td>Romer</td>
<td>1995</td>
<td>Advanced Macroeconomics</td>
<td>5th/2018</td>
<td>McGraw-Hill/1,2,3,4,5</td>
<td>5.8</td>
</tr>
<tr>
<td>Ljungvist &amp; Sargent</td>
<td>2000</td>
<td>Recursive Macroeconomic Theory</td>
<td>4th/2018</td>
<td>MIT/1,2,3,4</td>
<td>6</td>
</tr>
<tr>
<td>Wickens</td>
<td>2008</td>
<td>Macroeconomic Theory: A Dynamic General Equilibrium Approach</td>
<td>2nd/2012</td>
<td>Princeton/1,2</td>
<td>4</td>
</tr>
</tbody>
</table>
Table 12: Content Changes in Macroeconomics

<table>
<thead>
<tr>
<th>Author Short Name</th>
<th>Title</th>
<th>Publisher/ Edition Analysis</th>
<th>Content Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mankiw</td>
<td>Principles of Macroeconomics</td>
<td>Cengage/1.2.3.4.5.6.7.8, Worth/7,8</td>
<td>Within the same publisher, the contents are the same. Between publisher, the contents are orderly different, but the main topics are similar.</td>
</tr>
<tr>
<td>Parkin</td>
<td>Macroeconomics</td>
<td>Pearson/10.11.12.13</td>
<td>Small</td>
</tr>
<tr>
<td>Hubbard &amp; O’Brien</td>
<td>Macroeconomics</td>
<td>Pearson/1.2.3.4.5.6.7.8</td>
<td>Edition 1=2=3 has 18 chapters. Edition 4=5=6=7 has 19 chapters. New chapter of The Economics of Health Care.</td>
</tr>
<tr>
<td>Krugman &amp; Wells</td>
<td>Macroeconomics</td>
<td>Worth/1.2.3.4.5</td>
<td>Small</td>
</tr>
<tr>
<td>Coppock &amp; Mateer</td>
<td>Principles of Macroeconomics</td>
<td>Norton/1,2</td>
<td>Small</td>
</tr>
<tr>
<td>Acemoglu, Laitson &amp; List</td>
<td>Macroeconomics</td>
<td>Pearson/1,2</td>
<td>Small</td>
</tr>
<tr>
<td>Williamson</td>
<td>Macroeconomics</td>
<td>Pearson/1.2.3.4.5.6</td>
<td>New material on the Solow Growth Model and Endogenous Growth. New Chapter on Credit Market Imperfections. “Search and Unemployment” is entirely new.</td>
</tr>
<tr>
<td>Jones</td>
<td>Macroeconomics</td>
<td>Norton/2.3.4.5</td>
<td>New chapter on DSGE Model.</td>
</tr>
<tr>
<td>Blanchard</td>
<td>Macroeconomics</td>
<td>Pearson/5.6.7</td>
<td>New chapter on Economic Crisis and chapter on Fiscal Policy focus on current debt problems of the US.</td>
</tr>
<tr>
<td>Mishkin</td>
<td>Macroeconomics: Policy and Practice</td>
<td>Pearson/1,2</td>
<td>Small</td>
</tr>
<tr>
<td>Romer</td>
<td>Advanced Macroeconomics</td>
<td>McGraw-Hill/1.2.3.4.5</td>
<td>New chapter on Financial Markets and Financial Crisis.</td>
</tr>
<tr>
<td>Ljungvist &amp; Sargent</td>
<td>Recursive Macroeconomic Theory</td>
<td>MIT/1.2.3.4</td>
<td>Adding more chapters. Seven more chapters in edition 2. Three more chapters in edition 3. Two more chapters in edition 4.</td>
</tr>
<tr>
<td>Wickens</td>
<td>Macroeconomic Theory: A Dynamic General Equilibrium Approach</td>
<td>Princeton/1.2</td>
<td>New chapter on Unemployment Banks, Financial Intermediation and Unconventional Monetary Policy.</td>
</tr>
<tr>
<td>Barro &amp; Xavier</td>
<td>Economic Growth</td>
<td>MIT/2, McGraw-Hill/1</td>
<td>Rename title, switching chapters and 133 more pages added.</td>
</tr>
</tbody>
</table>

Notes: An underline text is a big update.
Table 13: Examples of Class and Textbook Used at Clemson University (Spring 2019)

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Required</th>
<th>Textbook Used</th>
<th>Author</th>
<th>Ed.</th>
<th>Price ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ECON 2000 Economic Concepts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shubhashrita Basu</td>
<td>0</td>
<td>Principles of Economics</td>
<td>Coppock &amp; Mateer</td>
<td>2</td>
<td>204</td>
</tr>
<tr>
<td><strong>ECON 2110 Principle of Microeconomics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frederick Andrew Hanssen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sarah Louise Wilson</td>
<td>1</td>
<td>Modern Principles: Microeconomics</td>
<td>Cowen &amp; Tabarrok * Loose leaf version + access code</td>
<td>3</td>
<td>*122+ 104.05</td>
</tr>
<tr>
<td>Roksana Ghanbariamin</td>
<td>0</td>
<td>Modern Principles: Microeconomics</td>
<td>Cowen &amp; Tabarrok</td>
<td>3</td>
<td>269.35</td>
</tr>
<tr>
<td>Chen Wang</td>
<td>1</td>
<td>Modern Principles: Microeconomics</td>
<td>Cowen &amp; Tabarrok</td>
<td>3</td>
<td>269.35</td>
</tr>
<tr>
<td>Molly Espey</td>
<td>1</td>
<td>Microeconomics Private and Public Policy</td>
<td>Gwartney, Stroup, Sobel, Macpherson</td>
<td>16</td>
<td>250</td>
</tr>
<tr>
<td>Liuna Issagholian</td>
<td>0</td>
<td>Modern Principles: Microeconomics</td>
<td>Cowen &amp; Tabarrok</td>
<td>4</td>
<td>285.5</td>
</tr>
<tr>
<td>Jonathan Orry Ernest</td>
<td>1</td>
<td>Principles of Microeconomics</td>
<td>Coppock &amp; Mateer</td>
<td>2</td>
<td>200</td>
</tr>
<tr>
<td>Jacob Walloga</td>
<td>1</td>
<td>Principles of Microeconomics</td>
<td>Frank, Bernanke, Antonovics, Heffetz</td>
<td>6</td>
<td>185.5</td>
</tr>
<tr>
<td><strong>ECON 2120 Principle of Macroeconomics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scott L. Baier</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tyler Francis</td>
<td>1</td>
<td>Modern Principles: Macroeconomics</td>
<td>Cowen &amp; Tabarrok</td>
<td>3</td>
<td>274.5</td>
</tr>
<tr>
<td>Benjamin Timothy Harbolt</td>
<td>1</td>
<td>Modern Principles: Macroeconomics</td>
<td>Cowen &amp; Tabarrok</td>
<td>3</td>
<td>274.5</td>
</tr>
<tr>
<td>Elijah R Neilson</td>
<td>0</td>
<td>Modern Principles: Macroeconomics</td>
<td>Cowen &amp; Tabarrok * Loose leaf version</td>
<td>4</td>
<td>*122</td>
</tr>
<tr>
<td><strong>ECON 3140 Intermediate Microeconomics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yichen Christy Zhou</td>
<td>1</td>
<td>Intermediate Microeconomics and Its Application</td>
<td>Nicholson &amp; Snyder</td>
<td>12</td>
<td>325</td>
</tr>
<tr>
<td>Robert Kenneth Fleck</td>
<td>1</td>
<td>Intermediate Microeconomics</td>
<td>Varian</td>
<td>9</td>
<td>162.15</td>
</tr>
<tr>
<td><strong>ECON 3150 Intermediate Macroeconomics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Michal Maria Jerzmanowski</td>
<td>1</td>
<td>Macroeconomics</td>
<td>Jones</td>
<td>4</td>
<td>189.35</td>
</tr>
<tr>
<td>Jeremy W Choquette</td>
<td>1</td>
<td>Macroeconomics</td>
<td>Jones</td>
<td>4</td>
<td>189.35</td>
</tr>
</tbody>
</table>
Table 14: Examples of Textbook Selection in a Selected Top University in the U.S.

<table>
<thead>
<tr>
<th>QS Rank(2017)</th>
<th>University</th>
<th>Examples of Book Used in Class</th>
</tr>
</thead>
</table>
| 1             | Massachusetts Institute of Technology (MIT) | Introductory Micro = Pindyck & Rubinfeld (Fall 2007), Perloff (Fall 2011)  
               |            | Introductory Macro = Blanchard (Fall 2004)  
               |            | A set of lecture notes written by Prof. Giavazzi (Spring 2014)  
               |            | Intermediate Macro = Romer (Spring 2003)  
               |            | Intermediate Micro = Varian (Fall 2006)  
               |            | Advanced Micro = Kreps, Mas-Colell, Whinston & Greene (Fall 2005), Varian (Spring 2017) |
| 6             | Princeton University | Introductory Micro = Mankiw 8th edition (Spring 2017-2018)  
               |            | Intermediate Micro = Nicholson (Spring 2017-2018)  
               |            | Introductory Macro = Baumol & Blinder (Spring 2017-2018)  
               |            | Intermediate Macro = Williamson, Jones (Spring 2017-2018)  
               |            | Advanced Micro = Kreps (Spring 2017-2018)  
               |            | Advanced Macro = Ljungvist & Sargent (Spring 2017-2018)  
               |            | Econometrics = Stock & Watson (Spring 2017-2018) |
| 10            | Columbia University | Intermediate Micro = Varian (Fall 2009, Spring 2016)  
               |            | Intermediate Macro = Mankiw (Spring 2014)  
               |            | Intro Econometrics = Stock & Watson, Wooldridge (Fall 2010)  
               |            | Advanced Econometrics = Greene (Fall 2015) |
| 12            | University of California, Los Angeles (UCLA) | Introductory Macro  
               |            | = Mankiw 8th edition with MindTap (Winter 2018)  
               |            | Advanced Micro = Nicholson (Summer 2017)  
               |            | Intro Econometrics = Hill 4th edition (Winter 2018)  
               |            | Advanced Econometrics = Hayashi (Winter 2018) |
| 13            | University of Pennsylvania | Introductory Micro = Parkin 12th edition with MyEconLab  
               |            | Introductory Macro = Mankiw with MindTap (Spring 2018)  
               |            | Advanced Micro = Mas-Colell, Whinston & Greene (Fall 2016)  
               |            | Econometrics = Gujarati, Wooldridge, Stock & Watson (Spring 2018) |
| 14            | New York University (NYU) | Introductory Micro = Lieberman  
               |            | Intermediate Micro = Varian, Schotter (Fall 2010)  
               |            | Macro = develop own book  
               |            | Econometrics = Wooldridge (Fall 2014) |
| 22            | Cornell University | Introductory Micro = Case & Fair 12th edition, MyEconLab (Spring 2018)  
               |            | Intermediate Micro = Varian (Spring 2011)  
               |            | Introductory Micro = Mankiw 7th edition with MindTap (Fall 2016) |
| 47            | University of Minnesota | Introductory Micro = Mankiw (Fall 2009)  
               |            | Introductory Macro = Mankiw (Summer 2009)  
               |            | Advanced Micro = Nicholson (Spring 2014) |
Table 15: Summary Statistics on Update Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>year</td>
<td>3338</td>
<td>2003.92</td>
<td>10.72</td>
<td>1964</td>
<td>2018</td>
</tr>
<tr>
<td>group</td>
<td>3338</td>
<td>6.15</td>
<td>3.60</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>update</td>
<td>3338</td>
<td>0.20</td>
<td>0.40</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>number of current update</td>
<td>3338</td>
<td>2.06</td>
<td>2.05</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>number of past update</td>
<td>3338</td>
<td>2.08</td>
<td>2.07</td>
<td>0</td>
<td>8</td>
</tr>
</tbody>
</table>
Table 16: Linear Probability Model of Update

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PastUpdate</td>
<td>0.018***</td>
<td>-0.021***</td>
<td>-0.021***</td>
<td>-0.029***</td>
</tr>
<tr>
<td></td>
<td>(5.33)</td>
<td>(-5.85)</td>
<td>(-3.79)</td>
<td>(-5.26)</td>
</tr>
<tr>
<td>CurrentUpdate</td>
<td></td>
<td>0.077***</td>
<td>0.078***</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(21.24)</td>
<td>(14.25)</td>
<td></td>
</tr>
<tr>
<td>year fixed effect</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>book fixed effect</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Adj R-squared</td>
<td>0.0082</td>
<td>0.1261</td>
<td>0.1752</td>
<td>0.1221</td>
</tr>
<tr>
<td>N</td>
<td>3337</td>
<td>3337</td>
<td>3337</td>
<td>3337</td>
</tr>
</tbody>
</table>

t statistics in parentheses

*p < 0.05, **p < 0.01, ***p < 0.00
Table 17: The Probability of Update a Book

<table>
<thead>
<tr>
<th></th>
<th>Linear Probability Model</th>
<th>Logit Model</th>
<th>Probit Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Marginal Effects</td>
<td>-0.0293382</td>
<td>-0.0178915</td>
<td>-0.0187758</td>
</tr>
<tr>
<td>Delta-Method Std. Err.</td>
<td>-0.0055737</td>
<td>0.0054351</td>
<td>0.0053782</td>
</tr>
</tbody>
</table>
Figure 1: Update Frequency in 145 Books
Figure 2: Histogram of Time Last Update
Figure 3: Economic Time of Update