Teaching Portfolio

Byung-Cheol Kim
Department of Economics, Finance, and Legal Studies

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Teaching Philosophy

Four major principles provide a fundamental structure for me as a teacher and learner. They help me shape my courses, advising and supervision, and other student-related activities.

1. I am to serve my students like Jesus, who washed the feet of his disciples.
2. I am not to provide instruction but to produce learning. Learning is interactive, cooperative, and collaborative.
3. Teaching needs to be learner-centered, not instructor-centered.
4. Feedbacks from students and timely responses are crucial to course development.

There are several practices that I have exercised these principles. For example, I try to memorize all students' names as much as possible so that I can call their first names when I interact with them. Also, I do my best to be as much as generous about my time: if necessary, I voluntarily offer review sessions, provide extended office hours, and invite struggling students to my office. For instance, after the first exam, I have it my rule to reach out to the students at the bottom of the grade distribution. Thanks to such efforts, some of my students have asked me to be their mentor.

On the other dimension, I try to help my students enjoy my courses. Students cannot effectively learn unless they find the class so interesting and useful. Fortunately, most topics in economics can be closely related to our real life with some efforts. So, I have tried to connect course materials with published or ongoing research articles.

Teaching Responsibilities and Strategies

My teaching responsibilities are focused on both undergraduate education and graduate education. In the first two-year (2008-2009) when I started to teach economics at Georgia Institute of Technology, my teaching assignments were centered on multiple large-scale sessions in *the Principle of Microeconomics*. In each session, I had almost 250 students, and I covered two sessions in a semester. Partly due to sheer size of the class, it was practically impossible to have interactive, learner-centered learning but I have tried to exercise a midterm assessment about my teaching so that I was able to find the strengths and weaknesses of my teaching, which much helped me to improve the learning environment quickly. As the department launched the Ph.D. program in 2010, my teaching responsibilities were adjusted toward graduate education. I taught in a much small size of classes (5-15 students) on the subjects of Ph.D. level Microeconomic Theory I and II and Ph.D. level Industrial Organization. Since graduate-level courses are small-size and more closely related to my research activities, I developed those courses based on mutual intellectual exchanges and modern research methods that the Ph.D. students would eventually adopt for their research.

Since I joined here the UA, I have taught the following courses:

- EC 412/512 Industrial Organization
- EC 570 Mathematical Economics (Master)
- EC 610 Microeconomic Theory I (Ph.D.)
- EC 612 Seminar in Industrial Organization (Ph.D.)

I adopt various strategies depending on the level of the course and the background of students on given topics. Below I briefly write some examples of those strategies.

EC 412 INDUSTRIAL ORGANIZATION (UG)

In the first semester, I taught this course with some focus on mathematical rigor. Soon I realized that our students in the Culverhouse College of Business have many broad interests and their mathematical background are diverse compared to my former institution Georgia Tech where most students major in engineering programs. Due to this difference, I have changed the course design dramatically by increasing our focus on many industry case studies, legal debates, policy changes, and on-going practices rather than on mathematical derivations and theoretical underpinnings.

EC 570 MATHEMATICAL ECONOMICS (M)

In the fall semester of 2019, I am teaching this Master-level course first time though I have a long experience in teaching mathematical economics at Ph.D. level courses. I found that some students are extremely confident as they aim to advance toward graduate programs while other students did not take a linear algebra course at all. Facing this challenge, I have provided a crash course on linear algebra with frequent exercises. At the same time, I share many advanced materials to challenge students who want to learn more advanced mathematical skills.

EC 610 MICROECONOMIC THEORY I (Ph.D.)

For this first-year Ph.D. level course, we have Ph.D. students from multiple disciplines: economics, finance, marketing, management, and accounting. I have found that we do not have enough time to cover the microeconomic theory and advanced math for this course. So, I decided to provide a bi-weekly Friday review session (9:00 AM – 10:20 AM) when we discuss exercise questions and supplementary materials on math. I attach one Friday Review Session Exercises in Appendix B.

EC 612 SEMINARS IN INDUSTRIAL ORGANIZATION (Ph.D.)

I taught this course in the spring semester of 2018. Because this is my primary research field and a field-course for second/third-year Ph.D. students, we discussed many research articles ranging from classics to recent working papers. I tried to motivate each student to think of his/her research agenda through this course.

There are more courses that I have taught or can teach as an effective teacher:

- Principle of Microeconomics
- Intermediate Microeconomics
- Statistics and Probability
- Introductory Econometrics
- Law and Economics
- International Trade (UG, Ph.D.)
- Microeocnomics II (Ph.D.)
- Economics of Innovation (Ph.D.)
- Research Methods (Ph.D.)

Course Syllabi

My comprehensive syllabi include course descriptions, regarding course description, learning objectives, textbook information, examinations, attendance policy, grade instruction, disability statement, and important dates. I also use the Blackboard system to announce and remind of required readings, exercises, supplementary notes, and a detailed weekly plan. I believe that a comprehensive syllabus is a fundamental teaching tool and crucial communication. I attach one example of my syllabi (See Appendix A).

Advising

I have advised many students in their thesis and dissertation. I offered two independent study courses when highly motivated students had asked for such one-to-one interaction on a specialized topic. For example, I provided "economics of open sources" to then a master student, Oleg Sargu, who later became a Ph.D. student.

I also advised five undergraduate theses as follows. These students graduated and successfully moved on their next career stages. (See one example of the undergraduate thesis under my advising in Appendix C.)

1. Chloe S. Smith "Intellectual Property Protection and Economic Growth in Countries of Varying Levels of Development" (2013),
2. Brian-Paul Gude "Financing Africa's Infrastructure." (2012)
3. Graydon Miller "The Effect of Hub Proximity on Air Fare." (2011).
4. James Yount "Theatrical Movie Release Revenue." (2010).
5. Kyung-sun Lee "Can the Great Depression Happen Again?" (2008 - 2009).

Because my former institution, Georgia Tech, started its Ph.D. program in 2010 at a small size (3-4 students per year), thus far I have one Ph.D. student who finished the degree. Dr. Mishal Ahmed got his first job at the University of Virginia, the Frank Batten School of Leadership and Public Policy as a non-tenure track assistant professor.

I have also actively participated as a committee member for several Ph.D. student's dissertations. Their placements are U.S. Food and Drug Administration (FDA) economist and a tenure-track assistant professor at Nankai University in China.

Evaluation of Teaching

Student evaluations have been vital to my efforts to improve courses. I have also adopted a self anonymous midterm assessment so that, before too late, I can listen to their feedback and improve my teaching. Though not all evaluations are consistently at the highest levels, I have been able to maintain a high level of course evaluation across time and courses.

Since I joined the UA summer 2017, a majority of my teaching evaluation comes from my former institution, Georgia Institute of Technology. Note that Georgia Tech also uses a similar metric on teaching effectiveness. Here I present my teaching evaluation at undergraduate courses and graduate courses separately. As is seen below, I had consistently maintained a very high teaching evaluation across different classes over time. The teaching evaluations at UA are bolded.

UNDERGRADUATE COURSES

Semester	*Course No.*	*Course Name*	*Enrolled*	*Responded*	*Score*
2019 Spring	**EC 412/512**	**Industrial Organization**	**43**	**35**	**4.2**
2018 Fall	**EC 412/512**	**Industrial Organization**	**48**	**28**	**3.76**
2017 Fall	**EC 412/512**	**Industrial Organization**	**49**	**21**	**3.95**
2015 Spring	EC4180	Game Theory Economics	31	17	4.0
	EC8803	Game Theory Economics	4	4	4.8
2012 Summer	EC 2803	Introduction to Game Theory	19	13	4.76
2009 Fall	EC 2106A	Principles of Microeconomics	244	188	4.6
	EC 2106C	Principles of Microeconomics	248	196	4.6
2008 Spring	EC 2106	Principles of Microeconomics	202	160	4.5
2008 Fall	EC 2106	Principles of Microeconomics	196	156	4.0

GRADUATE COURSES

Semester	*Course No.*	*Course Name*	*Enrolled*	*Responded*	*Score*
2018 Spring	**EC 612**	**Seminar in IO**	**5**	**4**	**4.5**
2016 Spring	EC 7013	Microeconomic Theory II	5	5	4.9
2015 Spring	EC 7013	Microeconomic Theory II	5	4	4.8
2014 Fall	EC 7004	Mathematics for Economists	10	9	4.6
	EC 7111	Industrial Organization I	10	7	4.9
2014 Spring	EC 7013	Microeconomic Theory II	8	5	4.9
2013 Fall	EC 7004	Mathematics for Economists	11	8	4.9
	EC 7111	Industrial Organization I	10	6	4.8
2012 Fall	EC 7012	Microeconomic Theory I	18	14	4.12
	EC 7004	Mathematics for Economists	12	10	4.25
	EC 7111	Industrial Organization I	10	9	4.75
2011 Fall	EC 7012	Microeconomic Theory I	12	9	4.75
	EC 7004	Mathematics for Economists	8	8	4.83
	EC 7111	Industrial Organization I	15	10	4.79
2010 Fall	EC 7012	Microeconomic Theory I	9	6	4.5
	EC 7004	Mathematics for Economists	6	3	5.0
	EC 6106	Microeconomic Analysis	46	38	4.6
2009 Fall	EC 6106	Microeconomic Analysis	43	40	4.5
2008 Fall	EC 6106	Microeconomic Analysis	32	32	4.6

Anonymous Student Comments

Student narratives reveal significant strengths of my courses and instruction, but I admit that I need to improve some areas in my teaching. Here are some selected comments from our students.

- *Dr. Kim is a great teacher and made the course accessible to those of us without strong math or economics backgrounds. He is always available to help us. I enjoyed the class very much and will miss his enthusiasm!*
- *Excellent professor. Energetic about a topic that can be boring, and has a clear passion for this material. He had very high expectations for us (unfortunately I think we disappointed him a bit) but adjusted for our backgrounds and was fair.*
- *Professor Kim is a gift from God. Absolutely amazing—nice, funny, truly knows his material and able to explain concepts effectively. If I weren't graduating I would take any class he offers. I really can't express enough how much I respect and like him!*
- *Loved the material. I learned an absolute ton, maybe more than any other course ever. I sorely lacked the prerequisite coursework to do very well, but Dr. Kim made it work for all of us. I eventually managed to really understand the material. The big picture charts were the sole reason I was able to finally get it. Definitely keep emphasizing those. Only change I would make is more problem sets for consumer theory, as we just started doing problems too late for that section for me to learn it effectively. Dr. Kim made this change for producer theory and I was much more successful.*
- *Dr. Kim cares more about his students and learning than just about throwing information out to a classroom. He is one of the rare professors who would go on a 10 minute tangent just to make sure we really understood the material at the time, not just blow through it and assume we understood it all. Every example or case presented tied in with exactly what he was saying/trying to teach.*
- *I tend to be brutally honest in giving teacher SOIs. That being said, Byung–Cheol Kim is by far the most knowledgeable and best teacher I have encountered in the field of Economics here at The University of Alabama. He is a great at conveying what he wishes to teach and amazing at interacting with his students. It is by no understatement that I gave him the best evaluation for a professor that I have ever given.*

Conclusion

I think it a great blessing to teach and learn from great colleagues and excellent students. I am so passionate about teaching that I feel so elated to meet students through classes. One day I asked my Ph.D. advisor, Professor Jay Pil Choi, “How can you know if someone fits a professor job in a college?” He answered me that “Two things. One is how much are you excited to go to class, and the other is how much are you enjoying research at your office without feeling lonely.” Now more than fifteen years passed since his answers to my question rang my ears. Good news is that I am so excited to go to class and enjoy research in the office. I wrap up my lecture by telling the students, “Each of you is so special to me. Please feel free to drop by my office for any question or send an email at me at any time. I am here for you guys.” I have strived to improve my teaching and will do so continuously.

Appendix A.

Industrial Organization (ECON 412)

Spring 2019

MW 05:00 p.m. - 06:15 p.m. / Bidgood Hall 140

Instructor Associate Professor Byung-Cheol "BC" Kim (bkim34@ua.edu)
Culverhouse College of Commerce
Department of Economics, Finance, and Legal Studies
265 Alston Hall Tuscaloosa, AL 35487
Office Hours: Mon 3-4:30 p.m. / Fri 10-11 a.m.

TA Guanzhong (Clark) Shu (gshu1@crimson.ua.edu)

TA Office Hour: Wed 1-2PM at Bidgood 355

Course home page

All teaching materials will be posted and notified via Blackboard system.

Course Description / Learning Objectives

We study various markets/industries characterized by departures from a competitive market. We focus on how firms behave in a market with an imperfect competition where there are market power, market concentration, transaction costs, limited information, externalities, and barriers to entry. We will use basic game theoretic tools for analysis. Basic knowledge of calculus is necessary. We will discuss public policies related to economic regulation and antitrust law when necessary. (Prerequisite: EC 308 with a grade above C-)

Textbook

Industrial Organization: Markets and Strategies. Paul Belleflamme and Martin Peitz, Cambridge University Press. 2015 (2nd ed.)

Problem Sets

- Assigned problem sets will be collected at the beginning of the class on the due date. Delayed submission is counted as no submission.
- There will be six problem sets on this course. The grade on each problem set will be broadly categorized into the following categories:
    - Excellent (90% and above, 3 points)
    - Good (70% and above, 2 points)
    - Adequate (50% and above, 1 point)
    - Unsatisfactory (less than 50% or no submission, 0 point)

Attendance policy

- I will check your attendance throughout the semester.
  - You get the full credit (12 points) as long as your total absence is fewer than or equal to five times.
  - From the sixth absence, two points are taken off for each absence.

Tests

- There will be total three tests for this course.

  Midterm #1: Feb 11 (Mon) 5:00 p.m. – 6:15 p.m.

  Midterm #2: March 20 (Wed) 5:00 p.m. – 6:15 p.m.

- The final exam schedule follows the UA final exam schedule. According to the final exam schedule https://registrar.ua.edu/academiccalendar/, the final exam is scheduled on

  Final Exam: April 29 (Mon) 3:30 p.m. – 6:00 p.m.

- All exams are a closed book. The final exam is cumulative; more than 50% of questions will be from the coverage after Midterm #2.

Grades

- Your grade in this course will be based on
  1. Problem Sets
  2. Attendance
  3. Midterm #1
  4. Midterm #2
  5. Final
  6. Extra credits on class participation (up to 5%)
  7. Extra credit on course survey with more than 80% response rate (1% to all)

Method A

Problem Set (18%), Attendance (12%), Midterm1 (20%), Midterm2 (20%), Final(30%)

Method B

Problem Set (10%), Attendance (5%), Midterm1 (20%), Midterm2 (20%), Final (45%)

- You will receive <u>a better grade</u> from Method A and Method B.

- The grade is determined as the following cuts:

  A (90% or more)

  B (80% or more)

  C (70% or more)

  D (50% or more)

  F (less than 50%)
- There is no curve for any part of a grade.
- All exams are mandatory. If you miss one midterm exam for health reasons or official UA events, you must provide the doctor's note that spells out that you cannot (or could not) take the test. For UA approved official activities that you have to participate in, you will have to produce the relevant official UA documentation noting this fact. Then, all other parts will account for your final grade determination.

Disability Statement

- If you are registered with the Office of Disability Services, please make an appointment with me as soon as possible to discuss any course accommodations that may be necessary. If you want to take the test at the ODS, you must sign up for booking the test room as early as possible. There is no special accommodation elsewhere.

Course Topics

1. Introduction to Industrial Organization [Chapter 1]
    a. What is I.O.?
    b. Structure-Conduct-Performance Paradigm
    c. Chicago School's Critique
    d. Innovation-led monopolies
2. Markets [Chapter 2]
    a. How to define a market?
    b. SSNIP and the Cellophane Fallacy
    c. Staple-Office Depot case
    d. CR and HHI
    e. Lerner Index

3. Decision-makers [Chapter 2]
    a. Rational consumers
    b. Several examples from behavioral economics [Thaler, *Misbehaving*]
        i. Sunk costs
        ii. Mental accounting
        iii. Present bias
4. Theory of the Firm [http://people.stern.nyu.edu/hmueller/papers/IC.pdf]
    a. Neoclassical approach
    b. Transaction costs approach
    c. Principal-Agent approach
    d. Property rights approach
        i. Hold-up problem
        ii. Grossman-Hart-Moore theory
5. Principal-Agent Problem: Moral Hazard (Hidden Action)
    a. Basic set-up and key insight
    b. First-best analysis
    c. Second-best analysis
    d. More general set up and discussion

Midterm #1: Feb 11 (Mon)

6. Monopoly and Price Discriminations
    a. General introduction to PDs
    b. Third-degree PD
    c. Second-degree PD
    d. Other issues on PD
7. Static Oligopoly Models and Static Games [Chapter 3]
    a. Cournot model
    b. Bertrand model
    c. Hotelling model
    d. Salop model
    e. Strategic substitutes and complements

8. Dynamic Oligopoly Models and Dynamic Games [Chapter 4]
    a. Subgame perfect Nash equilibrium
    b. Stackelberg model
    c. Paradox of commitment

Midterm #2: March 20 (Wed)

9. Cartels, Collusion and Repeated Games [Chapter 14]
    a. Repeated game and folk theorem
    b. Multi-market contacts
    c. Detecting and fighting collusion
    d. Collusion facilitating strategies
10. Horizontal Mergers [Chapter 15]
    a. Cournot mergers and merger paradox
    b. How to escape the merger paradox
    c. Mergers and entry
11. Vertically-related Markets [Chapter 17]
    a. Vertical merger and Double marginalization problem
    b. Exclusive contracts

Final Exam: April 29 (Monday) 3:30 p.m. – 6:00 p.m.

- Notable dates for this course

  1/9 First day of the class for this course

  1/21 Martin Luther King, Jr. Day (Class dismissed)

  3/8-15 Spring Holidays (Classes dismissed)

  3/27 Last day to drop a course with a grade of "W."

  4/24 Last day of class

Appendix B.

EC610. Practice Problems #1 in Review Session
(09/13/2019, Friday, 9:00AM - 10:20AM, Bidgood 369)

1. Suppose that Chipper's preferences are represented by the following utility function.

$$u(x, y) = x + xy$$

The prices and income are denoted by p_x, p_y, and w.

(a) For the given utility function, determine the following three nature: (i) whether it is concave, convex or neither; (ii) whether it is a quasi-concave, quasi-convex or neither; (iii) whether it is a homogeneous function. Be sure to explain your answer.

(b) Set up the Lagrangian function for the utility maximization problem and state the first-order conditions and the second order condition for the optimal choices. (You need not describe Kuhn-Tucker conditions.)

(c) Derive Chipper's Marshaillian demand functions and indirect utility function. Confirm that Roy's identity holds.

(d) Derive Chipper's expenditure function and Hickisan demand functions.

(e) Confirm that the Slutsky equation holds for changes in p_x.

(f) Suppose that $p_x = 2$, $p_y = 2$ and $w = 18$ initially. Then, the price of good x decreases to $p'_x = 1$. Calculate the substitution effect and the income effect for good x.

Answers:

(a) (i) The given function is NOT concave because the Hessian of $u(x, y)$ is NOT negative definite.
$H = \begin{pmatrix} u_{xx} & u_{xy} \\ u_{yx} & u_{yy} \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$
$|H_1| = 0$ and $|H_2| = -1$ does not ensure the negative definiteness of H.
(ii) However, the utility function is quasi-concave because the Bordered Hessian is negative definite.
$B = \begin{pmatrix} 0 & u_x & u_y \\ u_x & u_{xx} & u_{xy} \\ u_y & u_{yx} & u_{yy} \end{pmatrix} = \begin{pmatrix} 0 & 1+y & x \\ 1+y & 0 & 1 \\ x & 1 & 0 \end{pmatrix}$
$|B_1| = -(1+y)^2 < 0$ and $|B_2| = 2x(1+y) > 0$ for any positive x, y.
(iii) The function is NOT homogeneous function because $u(tx, ty) \neq t^k u(x, y)$ for any k and $t > 0$.

(b)

$$\max_{x,y,\lambda} \mathcal{L}(x,y,\lambda) = x + xy - \lambda[p_x x + p_y y - w]$$

The first-order conditions are given by $\mathcal{L}_x = 1+y-p_x = 0$, $\mathcal{L}_y = x-p_y = 0$ and $\mathcal{L}_\lambda = w - p_x x - p_y y = 0$.
The second-order condition requires that the following Hessian applied to the new objective function, the Lagrangian, is negative definite.

$$H_{\mathcal{L}} = \begin{pmatrix} \mathcal{L}_{\lambda\lambda} & \mathcal{L}_{\lambda x} & \mathcal{L}_{\lambda y} \\ \mathcal{L}_{x\lambda} & \mathcal{L}_{xx} & \mathcal{L}_{xy} \\ \mathcal{L}_{y\lambda} & \mathcal{L}_{yx} & \mathcal{L}_{yy} \end{pmatrix} = \begin{pmatrix} 0 & -p_x & -p_y \\ -p_x & 0 & 1 \\ -p_y & 1 & 0 \end{pmatrix}$$

$|H_1| = -p_x^2 < 0$ and $|H_2| = 2p_x p_y > 0$ for any positive p_x and p_y. Thus, the second order condition is satisfied.

(c) Using $MRS_{x,y} = \frac{p_x}{p_y}$ and $w = p_x x + p_y y$, we can derive that

$$x^* = \frac{w + p_y}{2p_x}$$
$$y^* = \frac{w - p_y}{2p_y}$$

From $v(p_x, p_y, w) = u(x^*, y^*)$, we can derive the indirect utility function as $v(p_x, p_y, w) = \frac{w+p_y}{2p_x}(1 + \frac{w-p_y}{2p_y}) = \frac{(w+p_x)^2}{4p_x p_y}$
To confirm the Roy's Identity, let us derive followings

$$\frac{\partial v}{\partial p_x} = -\frac{(w+p_x)^2}{4p_x^2 p_y}; \quad \frac{\partial v}{\partial p_y} = \frac{p_y^2 - w^2}{4p_x p_y^2}; \quad \frac{\partial v}{\partial w} = \frac{(w+p_x)}{2p_x p_y}$$

With some algebra, we can confirm the Roy's Identity holds for both goods.

(d) Expenditure function is derived from the indirect utility function using the inverse relationship: $e(p_x, p_y, u) = 2\sqrt{p_x p_y u} - p_y$
Using the Shephard's lemma, we can obtain the Hickian demands:
$h_x(p_x, p_y, u) = \sqrt{\frac{up_y}{p_x}}$; $\quad h_y(p_x, p_y, u) = \sqrt{\frac{up_x}{p_y}} - 1$

(e) The Slutsky equation for p_x is given by
$\frac{\partial h_x(p_x,p_y,u)}{\partial p_x} = \frac{\partial x^*(p_x,p_y,w)}{\partial p_x} + \frac{\partial x^*(p_x,p_y,w)}{\partial w} x^*$
With some algebra, we can confirm the Slutsky equation holds.

(f) For $p_x = 2$, $p_y = 2$ and $w = 18$, we derive $x^* = 5$ and $y^* = 4$ at which the consumer earns the utility of 25. Under the new price of $p_x' = 1$, the consumer choose $x' = 10$ and $y' = 4$ and obtain the utility of 50. Using the Hickian demand for good x at the new prices, we can get $h_x = 5\sqrt{2} \approx 7.07$. Thus, SE=$5\sqrt{2} - 5$ and IE=$10 - 5\sqrt{2}$.

2. Given the following price, quantity and income information, find the possible values for q that the weak axiom of revealed preference is not violated. For all other values of q, provide a complete ranking of this consumer's over bundles over the three periods.

	p_x	p_y	x	y	w
Period 1	1	1	4	4	8
Period 2	1	2	3	q	3+2q
Period 3	1	3	8	2	14

Answers:

	Bundle Choices		
Spending	(4,4)	(3,q)	(8,2)
Prices in Period 1 (1,1)	8	3+q	10
Prices in Period 2 (1,2)	12	3+2q	12
Prices in Period 3 (1,3)	16	3+3q	14

If you made the above table,

- Consider the case that $q \leq 5$. Then, Bundle 1 was revealed preferred to Bundle 2. Now, WA is violated if Bundle 1 was affordable in Period 2, that is, $3 + 2q \geq 12$. That is, the WA is violated if $4.5 \leq q \leq 5$.
- Next, consider the other case that $q > 5$. Then, the observation in Period 1 does not give any information about the preference ranking. So, let us move on the observation in Period 2. If $q > 5$, then the consumer spent more than \$13 for Bundle 2 in Period 2. This implies that this consumer revealed preferred Bundle 2 over Bundle 1 and Bundle 3. In Period 3, Bundle 2 turned out too expensive at the budget \$14. So, there is no more violation to the WA. The ranking is Bundle 2 $\succsim^*$ Bundle 1 or Bundle 3.
- Finally, consider any case $q < 4.5$. Then, from Period 1 we know that Bundle 1 $\succsim^*$ Bundle 2. Period 2 does not gives any new information. In Period 3, if $3 + 3q < 14$ (i.e., $q < 11/3$), then we can additionally say Bundle 3 $\succsim^*$ Bundle 2.

3. Prove the following claims *rigorously*.

(a) Suppose that the Walrasian demand function $x(\mathbf{p}, w)$ is homogeneous of degree zero, $x(\alpha\mathbf{p}, \alpha w) = x(\mathbf{p}, w)$ and that it satisfies Walras' law, $\mathbf{p} \cdot x(\mathbf{p}, w) = w$. If $x(\mathbf{p}, w)$ satisfies the weak axiom and the wealth is adjusted with Slutsky wealth compensation ($w' = \mathbf{p}' \cdot x(\mathbf{p}, w)$), then we have

$$(\mathbf{p}' - \mathbf{p}) \cdot [x(\mathbf{p}', w') - x(\mathbf{p}, w)] \leq 0,$$

with strict inequality whenever $x(\mathbf{p}, w) \neq x(\mathbf{p}', w')$.

Answers:

If $\mathbf{x}(\mathbf{p}, w) = \mathbf{x}(\mathbf{p}', w')$, then the result is immediate. Suppose that $\mathbf{x}(\mathbf{p}, w) \neq \mathbf{x}(\mathbf{p}', w')$. Then,

$$\begin{aligned}
& (\mathbf{p}' - \mathbf{p}) \cdot [\mathbf{x}(\mathbf{p}', w') - \mathbf{x}(\mathbf{p}, w)] \\
= \;& \mathbf{p}' \cdot [\mathbf{x}(\mathbf{p}', w') - \mathbf{x}(\mathbf{p}, w)] - \mathbf{p} \cdot [\mathbf{x}(\mathbf{p}', w') - \mathbf{x}(\mathbf{p}, w)] \\
= \;& -\mathbf{p} \cdot [\mathbf{x}(\mathbf{p}', w') - \mathbf{x}(\mathbf{p}, w)] < 0 \\
\because \;& \mathbf{p}' \cdot \mathbf{x}(\mathbf{p}', w') = w' \text{ (Walras' law); } \mathbf{p}' \cdot \mathbf{x}(\mathbf{p}, w) = w' \text{(Slutsky compensation)}
\end{aligned}$$

Now the remaining task is to show $\mathbf{p} \cdot [\mathbf{x}(\mathbf{p}', w') - \mathbf{x}(\mathbf{p}, w)] > 0$. Recall that $\mathbf{p} \cdot \mathbf{x}(\mathbf{p}, w) = w$ by Walras' law. Let us check $\mathbf{p} \cdot \mathbf{x}(\mathbf{p}', w') > w$. Because the compensated price change makes $\mathbf{p}' \cdot \mathbf{x}(\mathbf{p}, w) = w'$, we can say that $\mathbf{x}(\mathbf{p}, w)$ was affordable under $(\mathbf{p}', w')$. But, the consumer chose $\mathbf{x}(\mathbf{p}', w')$ which implies that $\mathbf{x}(\mathbf{p}', w')$ must not be affordable at $(\mathbf{p}, w)$, i.e., $\mathbf{p} \cdot \mathbf{x}(\mathbf{p}', w') > w$ by the weak axiom.

(b) Suppose that $u(\mathbf{x})$ is differentiable and strictly quasiconcave and that the Walrasian demand function $x(\mathbf{p}, w)$ is differentiable. Assume that $u(\mathbf{x})$ is homogenous of degree one, i.e., $u(\alpha\mathbf{x}) = \alpha u(\mathbf{x})$ for $\alpha \geq 0$. Show that $\mathbf{x}(\mathbf{p}, w)$ and $v(\mathbf{p}, w)$ are homogeneous of degree one in w, i.e., $\mathbf{x}(\mathbf{p}, \alpha w) = \alpha\mathbf{x}(\mathbf{p}, w)$ and $v(\mathbf{p}, \alpha w) = \alpha v(\mathbf{p}, w)$. What does this suggest for the expenditure function's form?

Answers:

Walras' law makes the following equations hold.

$$\mathbf{p} \cdot x(\mathbf{p}, w) = w \quad (1)$$

$$\mathbf{p} \cdot x(\mathbf{p}, \alpha w) = \alpha w \quad (2)$$

From Eq (1) and (2), we can derive that

$$\mathbf{p} \cdot x(\mathbf{p}, \alpha w) = \alpha w = \alpha [\mathbf{p} \cdot x(\mathbf{p}, w)] = \mathbf{p} \cdot \alpha x(\mathbf{p}, w)$$

Hence, (2)-(1)$\times\alpha = 0$. So, we must have

$$\begin{aligned}
& \mathbf{p} \cdot x(\mathbf{p}, \alpha w) - \alpha\mathbf{p} \cdot x(\mathbf{p}, w) \\
= \;& \mathbf{p} \cdot [x(\mathbf{p}, \alpha w) - \alpha x(\mathbf{p}, w)] = 0
\end{aligned}$$

For any $\mathbf{p} \geq 0$, we get $x(\mathbf{p}, \alpha w) = \alpha x(\mathbf{p}, w)$, which shows that $x(\mathbf{p}, w)$ is homogeneous of degree one in w. Therefore, we have

$$v(\mathbf{p}, \alpha w) = u(x(\mathbf{p}, \alpha w)) = u(\alpha x(\mathbf{p}, w)) = \alpha u(x(\mathbf{p}, w)) = \alpha v(\mathbf{p}, w)$$

which shows that $v(\mathbf{p}, w)$ is homogeneous of degree one in w.
This means that the expenditure function will satisfy $e(\mathbf{p}, \alpha u) = \alpha e(\mathbf{p}, u)$, and $e(\mathbf{p}, u) = ue(\mathbf{p}, 1)$: it is linearly proportional to the target utility.

4. $V(p_x, p_y, w) = (w/p_x) + (p_x/4p_y)$ is an indirect utility function.

   (a) Find the Marshallian demand for good x.

   (b) Find the expenditure function.

   (c) Find the utility function $u(x, y)$ that leads to this indirect utility function.

   Answers:
   $V(p_x, p_y, w) = \frac{w}{p_x} + \frac{p_x}{4p_y}$

(a) To derive the Marshallian demand for good x, let us use the Roy's identity: $x^* = -\frac{\frac{\partial V}{\partial p_x}}{\frac{\partial V}{\partial w}}$.

$$\begin{aligned} \frac{\partial V}{\partial p_x} &= -\frac{w}{p_x^2} + \frac{1}{4p_y}; \frac{\partial V}{\partial w} = \frac{1}{p_x} \\ x^* &= -\frac{\frac{\partial V}{\partial p_x}}{\frac{\partial V}{\partial w}} = \frac{\frac{w}{p_x^2} - \frac{1}{4p_y}}{\frac{1}{p_x}} = \frac{w}{p_x} - \frac{p_x}{4p_y} \end{aligned}$$

(b) Using the inverse relationship between V and E,
$\overline{u} = \frac{E}{p_x} + \frac{p_x}{4p_y}$
$\rightarrow E(p_x, p_y, \overline{u}) = p_x \left(\overline{u} - \frac{p_x}{4p_y}\right)$

(c) In order to find her utility function, let us derive the Hickian demands from the given expenditure function by using Shepherd lemma.
$x^c = \frac{\partial E}{\partial p_x} = \left(\overline{u} - \frac{p_x}{4p_y}\right) + p_x \left(-\frac{1}{4p_y}\right) = \overline{u} - \frac{p_x}{2p_y}$
$y^c = \frac{\partial E}{\partial p_y} = \frac{p_x^2}{4p_y^2} = \left(\frac{p_x}{2p_y}\right)^2$
$x^c = \overline{u} - \sqrt{y^c}$
Thus, $u(x, y) = x + \sqrt{y}$.

Appendix C.

Senior Economics Thesis: Theatrical Movie Release Revenue Analysis: Competitive Effects on Total Gross And Pricing Effects on Blockbuster Market Share.

Faculty Advisor:
Dr. Byung-Cheol Kim

Researcher:
James Yount

Georgia Institute of Technology

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Contents

I. Introduction

Today, quite possibly the most easily recognizable US product is movies. For the year 2009 the theatrical releases of movies brought in approximately $10.6 billion in revenues. However, competition has never been fiercer in the market place as the quality and availability of home theater options has increased significantly in recent years. In the past nothing could come close to competing with the experience of viewing a movie in a theater. The massive screens, audio quality, and quality of the video could not be matched by simple home televisions. Also, for a significant time there were no home video devices for watching movies which limited consumers to watching network programming. There simply was no readily available way to view movies in the home. This is not the case anymore.

The combination of the ever increasing quality of home televisions and projectors as well as the near ubiquitous nature of the home video player presents challenges to the theatrical releases of movies. Movies are now faced with competition with significant advantages. While the cost of purchasing a high quality home theater system is still significant, it presents an opportunity for long term savings to customers. With current average ticket prices at $7.50 per ticket, it would cost a family of 4 $30.00 to view a movie in a theater one time. This does not include the costs associated with driving to the theater or the price of any concessions they may wish to purchase which for combined can add an extra $20 in cost. Along with these costs, there is also the risk of other movie goers negatively affecting the movie watching experience. Alternatively for a family of four with a home theater system, purchasing a movie that will be available for unlimited viewing at home can cost as low as $15 for a new release DVD. The cost of food at home is also significantly less (estimated at $5). Finally there is no need to travel to a theater and almost no risk of an outside factor ruining the experience. On cost alone not including general convenience the home theater can save a family $30 each movie going experience. There is now also an option in Blu-ray players that prevents an even better movie watching experience, but does increase the cost of purchasing movies as the range of prices is more commonly $25-$35 for a new release movie.

3D movies have become the most recent attempt to elevate the movie theater experience significantly above the experience of the home theater, and as of now there is competitive 3D home theater option. The issue this presents however, is the increased cost passed on to moviegoers. Viewing a movie in 3D at a movie theater adds a significant extra charge to the price of the ticket. This added cost can be as high as a 50% increase over normal ticket cost pushing the price of some tickets into the $15 range (a price at which DVD's and even some Blu-ray movies can be purchased for unlimited viewing). This jump in price could have significant effects on movie revenues. While recent 3D movies have broken revenue records, there is still a question of how this affects the revenues of other movies.

Another form of competition has now begun to arise in the form of videogames and computers. Until very recently computers were used almost solely for work and videogames could not compete with creating the kind of imagined environment that movies are able to. However, technology has now advanced to the point where major video games can rival the production values of major motion pictures while also presenting the user with a much longer experience. Computers also now have the ability to view media streamed over the internet, and most importantly to the movie industry, have made available free illegal copies of movies to users.

Research in the arena of the motion picture industry tends to focus most heavily on this piracy aspect. Focus is given to analyzing the relationship and competition between legally acquired movies and the free copies available online. This however is not the topic of focus for this paper.

This paper will seek to generate three main focuses. The first will be an analysis of the impact of home theaters, home electronics, and video games on the theatrical release revenues of movies. The second will be a brief analysis of the price elasticity for movie ticket sales. Finally, an analysis will be made on the effect ticket prices have on the distribution of theatrical revenues to see if higher prices lead to fewer movies generating larger portions of the overall revenue.

The statistical results and conclusions will show that competition from home theaters do have a significant impact on the revenues of films while video games show a surprising positive effect. Also, the concentration of revenues into fewer movies will also be shown to be true as ticket prices increase.

This paper will give a brief walk through of other research that has been performed on the motion picture industry and then the model will be developed and the data discussed. Finally statistical results and full conclusions will be presented based on the results obtained from the model.

II. Related Research

The bulk of research in this field is focused on the effects of piracy on the revenues of both theatrical releases of movies and also the revenues of the home video (DVD, Blu-ray, On-demand, etc.) releases. While some of this research looks at how films can or cannot compete with the free alternative of pirated movies, there is a lack of research on the competition between legal home video and theatrical releases. This competition may seem less critical but the theatrical release revenues of films play a large role in the decisions of movie studios and also serve as the measuring stick for how successful a film is. From 2002-2005 box office revenues in the US decreased by 5.6%. However, based on research in several French universities, piracy had no effect on the box office revenues of films. This leaves the question remaining, what is the cause of the decrease in box office revenues?

Other research can also be found focusing on the effects of uniform pricing at box offices when movies are released to theaters. Uniform pricing can be looked at in two ways. First, it can be viewed as uniform pricing throughout days of the week where a movie Thursday at 7:00pm will cost the same as a movie Friday at 7:00pm. It can also be viewed in the context of low budget independent films versus major Hollywood tent-pole releases. This uniform pricing is due to many factors including the potential to shift profits between exhibitors and distributors, perceived fairness, and general uncertainty with the release of a film. However, uniform prices for each individual movie, which in the eyes of consumers are differentiated goods, may be detrimental to many movies. Smaller independent films may lack the advertising budget to generate the same interest and perceived value in the mind of consumers for their film leading to more lackluster box office revenue. Anecdotal evidence can be found for the advantages of non-uniform pricing. Several theaters that slashed weekday prices saw a significant increase in box office revenues as well as increased revenues from sales of refreshments inside the theater. While this presents an argument for more non-uniform pricing, it also presents an argument for a decrease in the price of movie theater admission in general.

Generally absent from research though is the competition between home theaters and retail theaters. This topic may be less focused on as legally acquired movies for home theater use do generate profits for the producers of the films. However, declines in box office revenue may eventually offset these revenues, especially as cheaper home video alternatives become more widely available. It also presents a challenged to the motion picture exhibitors who survive solely on the theatrical release of movies. These alternatives are not limited to piracy, but also streaming online content, Netflix, and on-demand services. Also, as the adoption of home theaters progresses further, more and more consumers may opt for the cheaper experience of viewing a film in their own home rather than travel to a theater.

III. Theory and Model

The theoretical backing for the majority of the analysis to be performed is very well established. Analyzing the impact of alternatives to a movie theater experiment is simply an analysis of the effect of a substitute good. A substitute good is one that may take the place of another good, and in this case our substitute goods will be home theaters, home electronics (computers, media players), and video games. Each will be represented in a regression model in order to determine to what degree each substitute good has on the revenues of motion pictures in theatrical releases. The basic model will appear as follows:

In addition to the above regression, a second regression will be run replacing *Revenue* with *Tickets Sold Per Person*. This is to provide analysis of this same question on an individual consumer basis.

Analysis of price elasticity of movie tickets will be in order to develop an idea of the sensitivity consumers have to the change in ticket prices. One of the basic laws of demand is that as prices increase, demand decreases. However, this paper seeks to determine how much demand will change as the prices change. The price elasticity of demand is found using the following equation:

The above equation is applicable when the demand curve is known. In this case, as the demand curve is unknown, a log-log regression model will be used to determine the price elasticity. The beta values in a log-log regression represent the percent change in ***y*** for every percent change in ***x***. By running a model of price on quantity, this beta result β_1 will represent the percent change in quantity, based on the percent change in price, which is the same measure of price elasticity presented in the previous equation. A log-log model is developed by taking the log of each data set prior to running the regression to get the desired results. Therefore the regression model will appear as follows:

$$\ln(Tickets) = \beta_0 + \beta_1 \ln(Price)$$

The final analysis to be performed will be an analysis of pricing effects on the concentration of profits into fewer films. This analysis focuses specifically on consumer behavior and will give some insight into how increasing ticket prices may affect the market. While motion pictures are somewhat differentiated products based on their type (comedy, action, etc), director, or featured actors, they are still in direct competition with each other during their theatrical release. As with any good that must be purchased, consumers will generally seek to maximize their utility for the price they pay. However, with movies it is difficult to know beforehand exactly how much utility an individual consumer will gain from a film. To determine this, each consumer must rely on advertising and reviews to make a decision. Even so, at a low cost, consumers will and do take risks on films that may not be as well reviewed or be advertised as heavily. However, the theory presented in this paper is that as prices increase, the appetite for risk of consumers will decrease. As this appetite for risk decreases, consumers will spend more of their money on 'blockbuster' releases, movies that are perceived to provide guaranteed enjoyment.

The model used to determine the concentration of revenues more heavily into blockbuster releases will again be a regression model with the focus on ticket prices and the revenues of the top 5 grossing films in a given year. The revenue of the top 5 films will be viewed as a percentage of the overall market in that year as the goal is to determine the market share of these films. Included in the model will also be the home theater, home electronic, and video game variables used in the first analysis. This is simply to control for these factors which may also have effects on outcome of this analysis. The complete regression model will appear as follows:

$$TopFive = \beta_0 + \beta_1 Price + \beta_2 HT + \beta_3 HE + \beta_4 VG$$

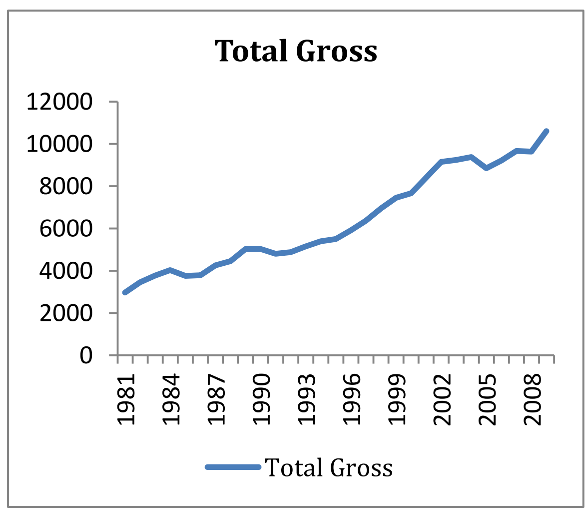
IV. Data and Final Models

Acquisition of data for the analysis to be performed in this paper served to be the most difficult aspect given the constraints of this research paper. The box office information including revenues, ticket sales, and ticket prices was the most easily obtained data and was purchased from the movie website Box Office Mojo. However, data for the substitute goods was much more difficult to acquire. Without a significant monetary investment into a data set from an industry organization, the data had to be obtained from the Census Department of the US. The US Census Department generates statistical abstracts of the United States which contain brief glimpses of not only population trends, but also of industry performance. It is these industry portions that provided the necessary information on substitute goods. However, the data was segmented as each abstract only show a select few years. In order to have usable data over the entire data set, data had to be combined from numerous abstracts. While this data did appear to remain consistent by comparing overlapping years, there still is presented an opportunity for error as portions of the data may have been acquired differently in different years, but this cannot be determined.

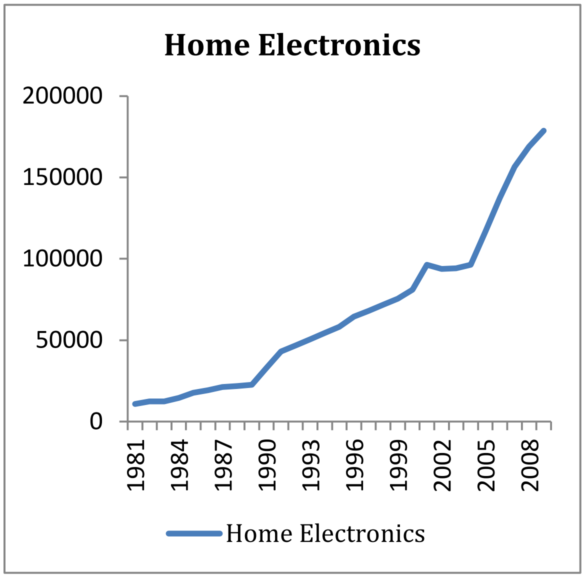
With the combined data from the Census Department and Box Office Mojo, all the data necessary for the before discussed models was available. However, in some cases the variables were altered slightly to fit the available data. In the place of the variable home theater, the variables LCDTV and Plasma are to be used. These two variables represent the sales of LCD and Plasma TVs in the United States in a given year. Other aspects of a home theater such as the speakers and audio equipment are now included in home electronics. The home electronics variable also includes expenditures on electronic accessories (remotes, cables, etc), computers, computer peripherals, and mobile electronic devices. The video game variable includes expenditures on both video game hardware and video game software. Tickets sold per person are determined by simply dividing the gross total ticket sales in a given year by the US population in that year. Ticket sales and ticket prices are provided directly by Box Office Mojo.

The top 5 film revenue percentage variable had to be altered slightly after looking at the data set. The original idea was to analyze the revenue share of the top 5 grossing films in a given year. However, this did not take into account the wide range of number of films released in a year. The top 5 films in a year could represent anywhere from .79% of the films released in a year to 1.2%. Changes in this percentage could easily skew the outcome as the analysis is seeking to determine the percentage of revenue the top films make. Instead of using the top 5 films, analysis will be done using the top 5% of films.

The revenues of the top *x* films will then be summed and their percentage of the market taken. Now that the raw data for each variable has been obtained, a more detailed look at the variables will be taken.



The above graph demonstrates the growth of Total Gross in movie theater revenues over the period of 2001-2009. A trend is clearly present and can be seen to be strongly linear. The following graph displays the data for home electronic sales in the US over the same time period.

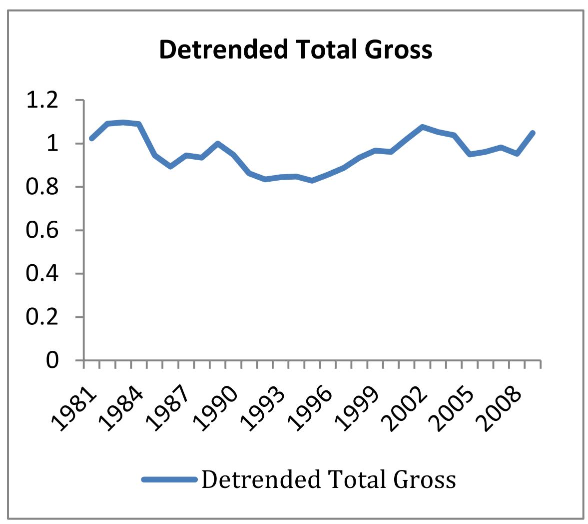


Looking at these two graphs it is easy to see where some problems may come into play with the data sets to be used in this analysis. As both of these data sets demonstrate a strong positive trend, regressing the two will generate a spurious regression. The results would not demonstrate if there truly was a causal effect as it could simply just be that they happen to both have positive trends over the same time period. Graphs of Plasma, LCDTV, and video games also demonstrate an upward trend in the data set. In order to generate useful results, this data must be detrended before analysis is performed. Detrending each set of data will be performed using the same basic process. First, the following regression model will be run:

In each case the variable will be represented by Y. If both β_1 and β_2 are shown to be significant, than there is a quadratic trend present. If only β_1 is significant than the trend is linear, and the regression will be run again with t^2 dropped and the equation used will then be:

Once the appropriate trend equation has been acquired, values will be generated for each time period. Once these values are generated, a detrended time series will be obtained by performing the following calculation (dtY_t represents the detrended value of Y) for each time period t:

The above will be performed to detrend each of the variables with a trend present. The result when applied to Total Gross can be seen in the graph below:



Clearly there is now no trend present in the total gross data, and the result is the same when applied to the other data sets. Along with the normal detrended values of the variables, the square of these detrended values will also be taken. This is to analyze whether the effect of the variables is simply linear or if there is a quadratic effect on the dependent variable. With all of the necessary calculations on the data performed, the analysis can now be performed. The final models to be run are as follows (full variable definitions as well as units are presented in Appendix I):

[Effect of Substitute Goods]
Dependent Variable(s):
dtTG (model 1)
TPPLg (model 2)

Independent Variables:
dtLCDTV, dtLCDTVSq, dtPlasma, dtPlasmaSq, dtVG, dtVGSq, dtHE, dtHESq (in model 2 the variables are not detrended as TPP has no trend)

[Price Elasticity]
Dependent Variable:
LNdtTS

Independent Variables:
LNdtATP

[Top 5% Revenue Share]
Dependent Variable:
dtFPGPer

Independent Variables:
dtATP, dtATPSq, dtLCDTV, dtLCDTVSq, dtPlasma, dtPlasmaSq, dtVG, dtVGSq, dtHE, dtHESq

For the analysis of the effect of substitute goods, the value of each independent variable is of interest to the final results. The price elasticity results are focused on the β value of LNdtATP. Finally, the top 5% revenue share analysis focuses strictly on dtATp and dtATPSq. Other variables are, as stated before, included simply as a control as the analysis seeks to find the effect caused specifically by the changes in prices.

V. Statistical Results

Effects of Substitute Goods

The initial analysis for this portion was performed on the detrended Total Gross values with the following results:

dtTG	**β**	**t-statistic**	**p-value**
Constant	0.1660493	0.23	0.853
dtLCDTV	-3.537718	-1.12	0.278
dtLCDTVSq	0.1171596	1.22	**0.238**
dtPlasma	0.0273728	0.3	0.764
dtPlasmaSq	0.1051497	0.8	**0.433**
dtVG	-0.2471495	-2.93	0.008
dtVGSq	0.1388463	3.71	0.001
dtHE	2.35924	1.63	0.118
dtHESq	-1.463752	0.053	0.053
	Rsq	0.7219	

Results are analyzed at the 10% significance level in this and all following analysis. The initial results shows a large portion of the variables to be insignificant. The variables dtPlasmaSq and dtLCDTVSq will be removed as they show that neither of those variables shows a quadratic relation to the Total Gross. Once removed the model improves:

dtTG	β	t-statistic	p-value
Constant	0.3582227	0.55	0.585
dtLCDTV	0.0357267	2.78	0.011
dtLCDTVSq	---	---	---
dtPlasma	-0.0017213	-0.08	0.939
dtPlasmaSq	---	---	---
dtVG	-0.2491576	-3.06	0.006
dtVGSq	0.1424468	3.94	0.001
dtHE	1.989335	1.55	0.135
dtHESq	-1.294022	-2.02	0.056
	Rsq	0.7119	

The variable dtPlasma can now be seen to be truly insignificant in this model, and therefore is eliminated. The model is run a final time generating the final result below:

dtTG	β	t-statistic	p-value
Constant	0.3472094	0.55	0.585
dtLCDTV	0.0349332	3.74	0.001
dtLCDTVSq	---	---	---
dtPlasma	---	---	---
dtPlasmaSq	---	---	---
dtVG	-2.508482	-3.09	0.005
dtVGSq	0.1434935	4.02	0.001
dtHE	2.011905	1.61	0.121
dtHESq	-1.305079	-2.09	0.048
	Rsq	0.7119	

The final model above shows all variables other than dtHE to be significant at the 10% significance level and a relatively high R-squared value. However, since dtHESq is shown to be significant at the 10% level, dtHE is left in the final model. Each β in the final model represents the change in millions of dollars a $1 million dollar change in the independent variable will generate. The results are somewhat surprising on first appearance. Analysis shows LCDTV's to have a positive relationship with Total Gross. Also, while video games will have an initial downward effect on Total Gross, the quadratic nature shows that eventually increased video game sales lead to an increase in Total Gross. Home electronic sales show the opposite pattern. Initially increases in expenditures leads to increases in Total Gross, but expenditure levels eventually lead to decreases in Total Gross.

TPPLg	β	t-statistic	p-value
Constant	5066.742	17.21	0
LCDTV	-4.689128	-1.15	0.262
LCDTVSq	0.0000199	0.74	0.47
Plasma	-2.908385	-0.88	0.392
PlasmaSQ	0.0000663	5.32	0
VG	0.2502328	0.99	0.333
VGSq	-0.00001	-0.65	0.526
HE	-0.0298462	-1.3	0.208
HESq	0.0000002	1.7	0.104
	Rsq	0.5525	

When running the model on TPPLg instead of the detrended Total Gross, once again a large portion of the independent variables appear insignificant. First to be removed will be the squared terms of LCDTV and VG as they are the most insignificant of the squared terms. Once these are removed the significance of variables increases drastically.

TPPLg	β*	t-statistic	p-value
Constant	4910109	23.5	0
LCDTV	-145.1016	-3.79	0.001
LCDTVSq	---	---	---
Plasma	-509.2609	-4.97	0
PlasmaSQ	0.0644	5.3	0
VG	99.2972	3.02	0.006
VGSq	---	---	---
HE	-14.9373	-1.92	0.068
HESq	0.000118	1.79	0.087
	Rsq	0.5422	
	**Upward adjusted to TPPLg representing 1/100000 of a ticket.*		

Interpreting the β values in this case, each represents he unit change that will occur when an independent variable is changed by $1 million. The units for TPPLg in this case, it is important to remember, represent 1/100000th of a movie ticket. The results of this second model seem more fitting to the original hypothesis. LCDTV has a constant negative relationship to the number of tickets sold per person. HE and Plasma both also share initial negative effects on tickets sold per person, Plasma especially. However, they both demonstrate a positive quadratic relationship in that eventually expenditures lead to an increase in ticket sales per person. Video games demonstrate the most interesting result as they show a significant positive relationship with ticket sales.

Price Elasticity

Determining the price elasticity of demand for movie theater tickets involves the running of a very straightforward model.

LNdtTS	β	t-statistic	p-value
Constant	-0.0118146	-0.99	0.027
LNdtATP	-0.436747	-2.34	0.332

As discussed in section III of this paper, the price elasticity of demand for tickets in this case is simply β of LNdtATP which is -0.436747.

Top 5% Revenue Share

The final portion of statistical analysis is performed on the revenue share of the top 5% of movies. The model is run similarly to the initial model on the effects of substitute goods but includes Average Ticket Price as well.

dtFPGPer	β	t-statistic	p-value
Constant	3.587809	0.45	0.66
dtATP	-6.874775	-0.49	0.63
dtATPSq	3.843219	0.55	0.592
dtLCDTV	-1.253084	-1.35	0.194
dtLCDTVSq	0.3708216	1.32	0.202
dtPlasma	-0.3036198	-1.5	0.15
dtPlasmaSq	0.5549911	1.81	0.087
dtVG	-2.451118	-0.56	0.584
dtVGSq	0.0886071	0.43	0.672
dtHE	0.6097562	0.12	0.906
dtHESq	-0.1973354	0.08	0.938
	Rsq	0.5484	

The initial run shows all of the square terms but the PlasmaSq term to be insignificant. Each of the other squared terms is eliminated from the model, eventually giving the following results:

dtFPGPer	β	t-statistic	p-value
Constant	-0.4588434	-0.93	0.36
dtATP	1.0643	3.61	0.002
dtATPSq	---	---	---
dtLCDTV	-0.0273036	-1.07	0.298
dtLCDTVSq	---	---	---
dtPlasma	-0.3352007	-1.87	0.075
dtPlasmaSq	0.1554881	1.35	0.191
dtVG	-0.1003326	-0.88	0.39
dtVGSq	---	---	---
dtHE	0.3233385	0.97	0.343
dtHESq	---	---	---
	Rsq	0.4948	

After the elimination of all but one of the squared terms, the model is much improved, but there are still insignificant terms remaining. Again, these terms are eliminated leading to the final model.

dtFPGPer	β	t-statistic	p-value
Constant	-0.0753834	-0.28	0.779
dtATP	0.9092091	3.31	0.003
dtATPSq	---	---	---
dtLCDTV	---	---	---
dtLCDTVSq	---	---	---
dtPlasma	-0.495196	-4.77	0
dtPlasmaSq	0.2612406	3.95	0.001
dtVG	---	---	---
dtVGSq	---	---	---
dtHE	---	---	---
dtHESq	---	---	---
	Rsq	0.4509	

The final model has eliminated all variables other than dtATP, dtPlasma, and dtPlasmaSq. β for dtATP represents the perentage increase in the percentage of revenue the top 5% of movies earn for each one dollar increase in the cost of movies. This result is in line with the original hypothesis as it demonstrates a nearly 1% increase in the revenue share in the top 5% of films for each dollar increase.

VI. Conclusions

Numerous conclusions can be drawn from all of the above analysis performed. Analysis on the effects of substitutes on movie grosses is somewhat inconclusive. Results appear to differentiate themselves when looking at total gross and when looking at tickets sold per person. In this analysis, looking at tickets sold per person may be more useful. Total gross can of course be heavily affected by population, and the population of the US has and continues to grow. By looking at the tickets sold per person we can get a better look at consumer behavior and how the substitute goods affect an individual's demand for movie tickets.

Looking strictly at the results for the tickets sold per person, the negative relationship between LCDTV's, Plasma TV's, and home electronics is as expected. The unexpected result comes from the beta value for video games. The results show a strong positive relationship between expenditures on video games and movie ticket purchases. This would suggest that video games and movie tickets act as complimentary goods. Further research would be necessary to determine exactly how this interaction works, but some hypothesis can be generated from basic knowledge of the industry. Video games and movies often have tie ins with each other. Sometimes it is in the form of a video game based on a movie, but also now quite often as a movie based on a video game. This may generate increased interest in movies from video game players. Also, while video games have come a long way in graphics and storytelling, they still cannot match the material presented in movies in these aspects. Video games could simply increase the appetite of the player for more of a visual spectacle and a deeper story that can be easily obtained through viewing a movie at a theater.

Conclusions to be drawn from the estimation of the price elasticity of demand for movie tickets are minimal. However, it is interesting to see just how sensitive consumers are to the pricing aspect of movie theater tickets to get a better sense of the demand characteristics within the industry. The price elasticity of -0.43 demonstrates that consumers are not overly sensitive or insensitive to the price of movie tickets. However, as demand is not inelastic prices must be kept in check in the long term.

The final results for the revenue share of the top 5% of movies followed closest to the initial hypothesis that increases in prices would lead to fewer movies making more of the profits. This was shown to be true as each $1 increase in the average price of movie tickets leads to an approximately 1% increase in the revenue share of the top 5% of movies. Determining the exact consumer reasoning that determines this would again require further research but some educated guesses can be made as to the reasons behind this. It is normal consumer behavior to be more cautious when spending money on an expensive item such as a car versus a ticket to a sporting event. The more expensive an item or type of item, the more thought that goes into the selection of that item. This logically is true with movie tickets as well. As prices increase the consumer will seek to make the best use of their money, and the consumer may be less likely to spend that money on a movie they are unsure about.

Advertising and word of mouth are powerful tools in driving traffic to a specific movie, and generally both are strongest for a few major films a year. Increasing prices mean an average consumer is less likely to seek out and spend their limited resources on a movie few have heard of. This could have serious consequences for smaller movies in the long run. If profits concentrate to heavily in just a few movies a year, it will become more and more difficult for smaller movies to find success in the market. It would also be more difficult for smaller movies to receive attention and funding from major movie studios.

The results of all of the above analysis point to some very interesting consumer behavior that could have significant impact on the movie industry in the future. However, to fully explore this behavior requires significant additional research and data. Determining more accurately a consumers decision making process in regards to movie ticket purchases could serve as a major benefit to the movie industry especially as competition increases and the industry attempts to keep pace with technology.

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Data provided by BoxOfficeMojo.com and the US Census Bureau.

Appendix I

[TG]
Total Gross
UNITS: 1 UNIT = $1 MILLION

[TS]
Tickets Sold
UNITS: 1 UNIT = 1 MILLION TICKETS

[ATP]
Average Ticket Price
UNITS: 1 UNIT = $1

[FPG]
Total Gross of the Top Grossing 5% of Releases in a Given Year
UNITS: 1 UNIT = $1 MILLION

[FPGPer]
Percentage of TG Represented by FPG
UNITS: 1 UNIT = 1%

[TPP]
Tickets Sold per Person in the US
UNITS: 1 UNIT = 1/1000 TICKET

[TPPLg]
Tickets sold per person multiplied by 100000.
UNITS: 1 UNIT = 1/100000 OF A TICKET

[LCDTV]
Expenditures on LCD TV's in the US in a Given Year
UNITS: 1 UNIT = $1 MILLION

[Plasma]
Expenditures on Plasma TV's in the US in a given year.
UNITS: 1 UNIT = $1 MILLION

[HE]
Home Electronic Expenditures in the US in a Given Year. (this category includes: home computers/accessories, home audio equipment, VCR/DVD/etc. players, blank home media, accessories, and other televisions)
UNITS: 1 UNIT = $1 MILLION

[VG]
Expenditures on video game hardware/software in the US in a given year.
UNITS: 1 UNIT = $1 MILLION

[dtXXX]
Represents a detrended value of a given variable.
UNITS: UNITS ARE THE SAME AS WITH THE ORIGINAL VARIABLE.

[XXXSq]
Represents the squared value of a given variable.
UNITS: UNITS ARE THE SQUARE OF THE UNIT OF THE ORIGINAL VARIABLE.

[LNXXX]
Natural log of a given variable.
UNITS: WHEN USED IN THE LOG-LOG REGRESSION EACH UNIT REPRESENTS A PERCENTAGE INCREASE OR DECREASE.