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Beyond Attendance: Key Determinants to Improve Students' Course Performance at a Small Liberal Arts College

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ABSTRACT

The improvement of college students' course performance is an important topic for instructors. Many researchers have found an inverse relationship between number of absences and course performance, suggesting that attendance matters for students' course performance. The author considers that attendance alone is not the only determinant of students' course performance. This paper investigates key determinants other than attendance to improve students' course performance. Three factors—being an economics major, prerequisite economics course performance, and office visits to the instructor—were considered to help students to improve their course performance. In this research, data from students who attended intermediate microeconomics and macroeconomics courses over the past five years at a small liberal arts college were analyzed, using a pooled ordinary least square regression method, to examine these hypotheses. A main finding includes that two of these hypotheses, concerning prerequisite economics course performance and office visits to the instructor, were supported. This paper also found some other factors that had a significant effect on improvement of students' course performance while it was observed that attendance was not always the key determinant.

KEY WORDS Determinants; Course Performance; Attendance

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The improvement of college students' course performance is an important topic for instructors in all fields. At Franklin College, where the author teaches economics, we have been discussing how to help students improve their course performance in their fields. What are the determinants to improve students' course performance? Researchers have devoted considerable attention to whether students' attendance in class affects their performance (Chen and Lin 2008). Many researchers have found an inverse relationship between number of absences and course performance, suggesting that attendance has a significant effect on students' course performance (Devadoss and Foltz 1996; Durden and Ellis 1995; Kirby and McElroy 2003; Marburger 2001, 2006; Park and Kerr 1990; Rodgers 2001; Romer 1993; Stanca 2006).[1] The author considers that attendance alone is not the only determinant of students' course performance. What other factors affect students' performance? Students who wish to understand course materials better and earn an A in the course not only attend all classes but also make other efforts so they can develop and enhance their ability and try to improve their course performance.

This paper investigates key determinants other than attendance that affect students' course performance. The following three hypotheses were considered. First, being economics majors helps students to improve their performance in economics courses. If students are majoring in economics, they are more motivated to study these economics courses intently, which is expected to improve their performance of the courses. Second, performance in an intermediate economics course and in its prerequisite economics course has a positive relationship. If students can perform well in the prerequisite course (Principles of Economics), they can show better performance in the intermediate economics courses because the prerequisite course provides students with the basic fundamentals. Third, utilization of an instructor's office hours helps students to improve their course performance. We understand that an instructor's office hours are provided to help students understand class materials better. Therefore, students' frequent visits to the instructor's office for questions about course materials will result in improved performance.

In this research, using a pooled ordinary least square (OLS) regression method, data from students in the author's two intermediate economics courses—microeconomics and macroeconomics—at Franklin College over the past five years were analyzed. Several findings were observed. First, two of the author's hypotheses—regarding performance in a prerequisite economics course (Principles of Economics) and instructor's office hour visits for questions—were supported by this research. Contrary to the author's expectation, however, the third hypothesis, concerning being an economics major, was not a significant factor to improve a student's course performance. Second, attendance was not always a key determinant with a statistically significant effect on a student's performance in this research. Third, other factors such as another prerequisite course (calculus) and high school grade point average (GPA) had significant effects on helping students to improve their course performance. Fourth, students who took microeconomics first could show higher course performance in macroeconomics than those who did not. These findings provide both students and instructors with some

suggestions for students to be able to get involved in class activities and to be self-motivated to study for their better course performance.

The next section explains the methodology, including the model used for this research. The third section summarizes data and describes the specifications of the model. The fourth section gives results in details and discusses the results. Some concluding thoughts are provided in the final section.

METHODOLOGY AND MODEL

This paper analyzed data from students who took the author's intermediate microeconomics and intermediate macroeconomics courses between 2008 and 2012 at Franklin College, in order to investigate key determinants to improve students' course performance. During the five years, seven microeconomics courses were taught; each was held in a different semester and a different academic year (fall 2008, 2009, 2010, 2011, 2012 and spring 2009, 2012), and no student took the microeconomics course twice. Macroeconomics courses were held five times, in different semesters and academic years (spring 2009, 2010, 2011, 2012 and fall 2012) as well, and no student took the macroeconomics course twice. This produced an independently pooled cross-section for the microeconomics course and macroeconomics course respectively; therefore, a pooled OLS regression method could be considered to be an appropriate research method to conduct this research. The model for the research was constructed as explained below.

Let $j = 1, -----, J$ be a student. Suppose also there is a list of K causal variables ($k = 1, --------K$), which are assumed to affect a student's performance in the intermediate microeconomics and macroeconomics course. Let Z_k be the J x 1 vector, a value of the k^{th} causal variable for student j with Z_1 consisting of all one. So, $Z = (Z_1, Z_2, --------Z_k)$, a J x K matrix of causal variables can be made. Let α, a K x 1 vector, be a parameter to estimate the effect of each causal variable Z on a student's performance in each course. Let D, a J x K matrix, be a time dummy variable showing a semester and an academic year for each intermediate microeconomics and macroeconomics course that was taught. This time dummy variable, D, helps us to be able to observe each student independently or differently. δ is an estimated coefficient of D with K x 1 vector. Let *Performance* be each student's course performance in each course, measured in points out of one hundred (100) points, in line with the instructor's course grading policy. The model to estimate the effect on a student's performance is

$$Performance = Z \cdot \alpha + D \cdot \delta + \varepsilon$$

ε is an error term with J x 1 vector. Estimated coefficients $\hat{\alpha}$ show how much each causal variable affects each student's performance in each course.

DATA AND SPECIFICATIONS

Data of students who attended my intermediate microeconomics course and intermediate macroeconomics course at Franklin College for 2008–2012 were used for this research. During these five years, the author taught the microeconomics course seven times and the macroeconomics course five times. The author made 135 observations for microeconomics and 109 observations for macroeconomics. All data excluding students' course performance were collected by the Academic Records Office[2] at Franklin College. Data about the students' performance in each course were collected by the author. Before describing data in detail, characteristics of the college and each course will be explained.

Characteristics of Franklin College

Franklin College is a small private four-year liberal arts institution located in Franklin, approximately 30 miles south of Indianapolis, Indiana, with a population of roughly 20,000. The college has approximately 1,000 full-time enrolled students, with a student body that is about 52 percent male and about 48 percent female. The student-to-faculty ratio is 16:1. About 97 percent of students at Franklin College receive some type of financial assistance. Twelve (12) percent of students identify as multicultural and international students, while more than 80 percent of students are natives of Indiana. Most of the students live on campus. More than 50 percent of Franklin's students participate in an athletic activity in the Heartland Collegiate Conference in the National Collegiate Athletic Association (NCAA) Division III. The middle 50 percent range of students' American College Testing (ACT) scores were between 20 and 25, and that of students' Scholastic Assessment Test (SAT) scores was between 1390 and 1670.[3]

Characteristics of Two Courses—Microeconomics and Macroeconomics

These two courses have a traditional lecture style for learning basic economics theories and building the fundamentals. Both courses (one section for each) are offered every semester excluding summer. Class size is capped to 20 students. Most of the students are sophomores majoring in economics (about 10 percent), business (about 40 percent), or accounting (about 40 percent). A couple of students (10 percent) majoring in secondary education and specializing in social studies usually attend the course. Prerequisite courses are Principles of Economics (ECO 115) and Calculus-I (MAT 135).[4] Each course offers three credit hours (three 50-minute classes a week) and includes 42 classes in total in each semester. There are no special classroom settings held for both courses.

Variables Used for This Research

The dependent variable, each student's course performance ("Performance"), is defined as overall course performance throughout the semester measured in points out of 100, in line with the instructor's course grading policy.[5] The author's course grading

policy to determine a student's performance consists of quizzes and examinations. That is, a total cumulative performance in each course is determined by a biweekly quiz that accounts for 35 points (35 percent), three in-class examinations accounting for 39 points (39 percent), and a comprehensive final examination accounting for 26 points (26 percent), for a possible 100 points (100 percent). Attendance is not required, but students are given an extra credit of 0.05 points based on a 100-point scale for every attendance to encourage them to attend classes. The complexity of questions and problems on every quiz and exam, including finals, during the research period was comparable to keep a consistency of similar level of difficulty on all quizzes and exams. All quizzes and exams were returned to the instructor after students saw their results, in order to prevent quiz and exam questions from being leaked among students. Homework assignments were not graded; rather, they were used as study guides to prepare for each quiz and exam, and students were told that similar questions would be included on quizzes and exams. Students were encouraged to study the assignments harder and to make more office visits for questions for these assessments.

Causal variables that could be considered to help improve students' course performance as independent variables include those reflected in the three hypotheses and others. Variables to represent the three hypotheses were being an economics major ("Econmajor"), performance in a prerequisite economics course ("ECO115"), and number of instructor's office hour visits ("OfficeVisit"). "Ecomajor" is a dummy variable, which is 1 if a student majors in economics and 0 if not. "ECO115" shows each student's course grade of the prerequisite economics course (Principles of Economics) based on a 4.0 scale. "OfficeVisit" shows a student's number of office visits to the instructor for questions about class materials including homework assignments. Each office visit was counted when a student came to the instructor's office for logical questions—for example, asking about concepts of the theories—but not for questions just asking about answers of homework assignments. Questions asked via e-mail were not counted as office visits, either. Students were not informed that this information was recorded for this research.

Other causal variables included grade in Calculus-I ("MAT135"), high school grade point average ("HSGPA"), number of classes attended ("Attendance"), gender ("Female"), and students' athletics ("Major_Athelete" and "Non_Major_Athelete") were included. "MAT135" shows each student's course grade of another prerequisite course (Calculus-I) for both microeconomics and macroeconomics based on a 4.0 scale. "HSGPA" is a student's cumulative grade point average (GPA) at the student's high school based on a 4.0 scale at the time when the student applied for the college. "Attendance" shows each student's number of classes attended in each course, with a total number of 42 classes in each semester. "Female" is a dummy variable for gender, which is 1 if a student is female. "Major_Athlete" is a dummy variable, which is 1 if a student is involved in one of major athletic activities at Franklin College, which are football, baseball, and basketball. "Non_Major_Athlete" is a dummy variable, which is 1 if a student is involved in a non-major athletic activity at Franklin College, which is other than major athletic activities. Lastly, I also included a variable to see if the sequence of

taking the microeconomics course first helps students to improve their performance in macroeconomics ("Micro_First") or vice versa ("Macro_First"). "Micro_First" is a dummy variable, which is 1 if a student takes microeconomics before taking macroeconomics and 0 if not. Similarly, "Macro_First" is a dummy variable, which is 1 if a student takes macroeconomics before taking microeconomics and 0 if not. A list of all variables that were used for this research and their statistics are shown and summarized in Tables 1 and 2.

Table 1. Intermediate Microeconomics

Variable	Mean	Standard Deviation	Min.	Max.
Performance	74.425	14.668	2.3	100.0
Econmajor	0.166	0.373	0	1
ECO115	2.942	0.690	0.670	4.000
OfficeVisit	1.579	2.679	0	12
MAT135	2.216	1.214	0	4.00
HSGPA	3.383	0.391	2.511	4.000
Attendance	39.222	3.438	19	42
Female	0.298	0.459	0	1
Major_Athlete	0.339	0.475	0	1
Non_Major_Athlete	0.146	0.354	0	1
Macro_First	0.877	0.329	0	1

Sources: Academic Records Office at Franklin College, author.

Table 2. Intermediate Macroeconomics

Variable	Mean	Standard Deviation	Min.	Max.
Performance	78.304	12.330	28.7	99.8
Econmajor	0.174	0.381	0	1
ECO115	2.970	0.747	0.670	4.000
OfficeVisit	2.144	3.357	0	15
MAT135	2.371	1.171	0	4.00
HSGPA	3.407	0.428	2.178	4.000
Attendance	39.455	2.521	30	42
Female	0.265	0.443	0	1
Major_Athlete	0.417	0.495	0	1
Non_Major_Athlete	0.152	0.360	0	1
Micro_First	0.598	0.492	0	1

Sources: Academic Records Office at Franklin College, author.

Specifications of the Model

For the modeling of the specification of the regression for this research, it was assumed that a student's performance depended on the variables listed above. An estimating equation for explaining course performance for a student j, $performance_j$ is given below.

For the analysis of the intermediate microeconomics course (Regression-I):

$$Performance_j^{microeconomics} = \alpha_0 + \alpha_1 \cdot Econmajor_j + \alpha_2 \cdot ECO115_j + \alpha_3 \cdot OfficeVisit_j$$
$$+\alpha_4 \cdot MAT135_j + \alpha_5 \cdot HSGPA_j + \alpha_6 \cdot Attendance_j + \alpha_7 \cdot Female_j$$
$$+\alpha_8 \cdot Major\_Athlete_j + \alpha_9 \cdot Non\_Major\_Athelete_j + \alpha_{10} \cdot Macro\_First_j$$
$$+\delta_1 \cdot D_{2008\,fall} + \delta_2 \cdot D_{2009\,spring} + \delta_3 \cdot D_{2009\,fall} + \delta_4 \cdot D_{2010\,fall} + \delta_5 \cdot D_{2011\,fall} + \delta_6 \cdot D_{2012\,spring} + \varepsilon_j$$

(Note that $\delta_7 \cdot D_{2012\,fall}$ was dropped to avoid dummy variable trap.)

For the analysis of the intermediate macroeconomics (Regression-II):

$$Performance_j^{macroeconomics} = \alpha_0 + \alpha_1 \cdot Econmajor_j + \alpha_2 \cdot ECO115_j + \alpha_3 \cdot OfficeVisit_j$$
$$+\alpha_4 \cdot MAT135_j + \alpha_5 \cdot HSGPA_j + \alpha_6 \cdot Attendance_j + \alpha_7 \cdot Female_j$$
$$+\alpha_8 \cdot Major\_Athlete_j + \alpha_9 \cdot Non\_Major\_Athelete_j + \alpha_{10} \cdot Micro\_First_j$$
$$+\delta_1 \cdot D_{2009\,spring} + \delta_2 \cdot D_{2010\,spring} + \delta_3 \cdot D_{2011\,spring} + \delta_4 \cdot D_{2012\,spring} + \varepsilon_j$$

(Note that $\delta_5 \cdot D_{2012\,fall}$ was dropped because of dummy variable trap.)

An estimated parameter, $\hat{\alpha}_k$ $(k = 1, 2, - - - - - 10)$, for both models above shows how much each causal variable affects a student's performance in each intermediate economics course.

RESULTS

The results of the regressions that were conducted to identify key determinants to improve students' performance in the author's intermediate microeconomics and macroeconomics courses, other than attendance, are shown in Table 3.

Table 3. Results

Dependent Variable: Performance		
	Regression-I Microeconomics	Regression-II Macroeconomics
Independent Variables	Pooled OLS	Pooled OLS
Econmajor	1.405	–2.846
	(1.890)	(2.086)
ECO115	2.798**	3.199**
	(1.291)	(1.466)
OfficeVisit	0.493*	0.676**
	(0.290)	(0.302)
MAT135	1.700**	1.963**
	(0.708)	(0.911)
HSGPA	7.036***	8.828***
	(2.154)	(2.501)
Attendance	1.941***	0.508
	(0.251)	(0.348)
Female	–1.704	–2.967
	(1.694)	(2.115)
Major_Athlete	–2.448	0.992
	(1.545)	(1.796)
Non_Major_Athlete	–0.614	2.247
	(1.992)	(2.415)
Micro_First	—	7.069***
		(1.847)
Macro_First	1.824	—
	(2.192)	
Constant	38.131***	24.245***
	(6.899)	(7.500)
Observations	135	109
R-squared	0.6676	0.6453

Notes: The quantities in parentheses below the estimates are the standard errors; *p < .10, **p< .05, ***p< .01

Regression-I shows the result when we see students who took the intermediate microeconomics course. Regression-II shows the result for students who learned in the intermediate macroeconomics course. Consider regression-I for the microeconomics course. Two of the author's three hypotheses—regarding performance of prerequisite economics course and frequent visits to the instructor's office for questions—were supported and showed a statistically significant effect on students' course performance at a conventional level. That is, if a student showed a better performance on a prerequisite economics course (ECO115) by one grade point based on a 4.0 scale (for example, from

B to A), then the student's performance improved by 2.80 points based on a 100-point scale (that is, 2.80 percent). Similarly, a student could improve performance by 0.49 points based on a 100-point scale (that is, 0.49 percent) for every office visit to the instructor for questions. Another hypothesis, regarding the student being an economics major, did not have any significant effect on improvement of student performance in the microeconomics course despite the author's expectation. Other variables with a significant effect on students' performance in the microeconomics course were also observed. First, "MAT 135": if a student improved a performance on another prerequisite course of calculus (MAT135) by one grade point (for example, from B to A), the student's performance improved by 1.70 points based on a 100-point scale (that is, 1.7 percent). Second, "HSGPA": if a student could raise HSGPA by one grade point on a 4.0 scale (for example, from C to B), it helped the student's course performance to improve by 7.04 points based on a 100-point scale (that is, 7.40 percent). Third, "Attendance": if a student had another absence, performance fell by 1.94 points based on a 100-point scale (that is, 1.94 percent). Variables such as gender and athletic activity were found to be insignificant in the microeconomics course. Also, it was found that the sequence of taking macroeconomics first did not matter for students' course performance in microeconomics.

It may be important to clarify the significance of a 1-point change in a student's performance (100-point scale). The maximum total points that a student can earn throughout the course is 100 points. The instructor used a grading scale of $A \geq 93\ points, 90 \leq A- < 93, 88 \leq B+ < 90, 84 \leq B < 88, 80 \leq B- < 84$ and so on. Based on this grading scale, readers can understand that students need to improve their performance by 4 points out of a 100-point scale (that is, 4 percent) to improve their final grade by one rank (from B– to B). An increase in 1 point based on a 100-point scale (that is, 1 percent) in course performance may not change a student's final grade. In this sense, for example, a student needs to make office visits eight times to improve the final letter grade by one rank (for example, from B to B+) based on a 4.0 scale. Also, if a student misses two classes, then the student's performance falls by 3.8 points out of 100 points (that is, 3.8 percent), which results in the falling final grade by one rank (for example, from A– to B+).

The result of the performance of the macroeconomics course is shown in regression-II in Table 3. Similar results about three hypotheses were obtained. The performance in the prerequisite course and frequent visits to the instructor's office for questions demonstrated a statistically significant effect on improvement of students' course performance, while being an economics major did not. That is, if a student showed a better performance on the prerequisite economics course (ECO 115) by one grade point based on a 4.0 scale (for example, from B to A), then the student's performance in the macroeconomics course improved by 3.30 points based on a 100-point scale (that is, 3.3 percent), or by one final letter grade (for example, A– to A). If a student came to the instructor for questions, the student's performance improved by 0.57 points out of a 100-point scale (that is, 0.57 percent), or by one final letter grade (for example, from C to C+) for every seven visits.

Other determinants with a significant effect on students' performance in the macroeconomics course were also observed. First, "MAT 135": if a student improved a performance on another prerequisite course of Calculus-I (MAT135) by one grade point based on a 4.0 scale (for example, from B to A), the student's performance improved by 1.96 points based on a 100-point scale (that is, 1.96 percent). Second, "HSGPA": if a student could raise HSGPA by one grade point on a 4.0 scale (for example, from C to B), it helped the student's course performance to improve by 8.83 points based on a 100-point scale (that is, 8.83 percent), or by two final letter grades (for example, from B to A–). Third, "Micro_First": if a student took microeconomics first, the student showed higher performance in macroeconomics by 7.07 points out of 100 points (that is 7.07 percent) than did other students who did not, or such a student could earn a higher final letter grade by two letter grades than one who did not (that is A– versus B). Meanwhile, the results showed that "Attendance" did not matter for improvement of students' course performance in macroeconomics. Also, variables such as gender and athletic activity were found to be statistically insignificant as well.

In summary, this research identified several determinants that had a statistically significant effect on students' course performance. First, one of these three hypotheses, regarding prerequisite economics course performance, was supported. The results showed that Principles of Economics, a prerequisite course, helped students to build fundamentals for better understanding of the intermediate level of courses and improvement of their performance. Second, another hypothesis, regarding students' frequent office visits, was also supported by this research. The instructor has set up a wider range of office hours, ranging from two to four hours every day for students. It was demonstrated by this research that the instructor's office hours helped students to improve their course performance. Third, another prerequisite course, Calculus-I was observed as a determinant that had a statistically significant effect on students' course performance. The instructor added Calculus-I as another prerequisite for both courses when he joined Franklin College in 2008 because he understands that calculus not only provides students with a tool to analyze economic problems but also helps them to develop a logical way of thinking. This result implied that the addition of Calculus-I as a prerequisite course for the two intermediate economic courses was a right decision for Franklin College students. Fourth, high school GPA was also shown as a determinant to improve students' course performance. This result showed that students who had higher GPAs at their high schools could show higher performance in the two courses than those who did not. This implies that such students understand why they study at the college and know how to study—that is, they are well motivated, resulting in higher course performance. Fifth, a different result was found for "Attendance" between the microeconomics and macroeconomics courses. While "Attendance" showed a positive effect on students' course performance on both courses, the effect on microeconomics was statistically significant even at the 1 percent level, but that on macroeconomics was not. This result demonstrated that attendance was not always a key determinant in this research, which was not consistent with other previous researchers (Durden and Ellis 1995; Devadoss and Foltz 1996; Kirby and McElroy 2003; Marburger 2001, 2006; Park and Kerr 1990;

Rodgers 2001; Romer 1993; Stanca 2006). Students have to study course materials hard for their success, and just attending classes constantly does not help students to improve course performance. Finally, it was also observed that students who took microeconomics first could show higher course performance in macroeconomics than those who did not.

Various model specifications were estimated to test the robustness of the results in Table 3 in a couple of ways. First, the author tested an extended model that has some dummy variables with interaction terms. Second, the author included in the model other student demographic variables such as commuter or live on campus, mother/father's education, and class size (more than 20 or less than 20). Third, the author conducted the same analysis by combining the intermediate microeconomics and macroeconomics to see the effect of the same causal variables on students' performance. These tests indicated that the results did not change.

CONCLUSION

Researchers have devoted considerable attention to whether students' attendance in class affects their performance. Many researchers have found an inverse relationship between number of absences and course performance, suggesting that attendance has a significant effect on course performance. The author considers that attendance alone is not the only determinant of students' course performance. This paper investigated key determinants other than attendance to improve students' course performance. Three hypotheses—regarding being an economics major, prerequisite economics course performance, and office visits to the instructor—were considered to help students improve their performance in economics courses. This research, using a pooled OLS regression method to examine these hypotheses, analyzed data from students who attended intermediate microeconomics and macroeconomics courses over the past five years at Franklin College. As explained and summarized in the Results section, this paper identified several determinants that had a statistically significant effect on students' course performance, including two of the author's three hypotheses—those regarding prerequisite economics course performance and office visits to the instructor. This paper suggests that both students' effort and instructor's continuous help inside and outside of classroom are essential for students' academic success. Students must study hard to understand course materials well and must recognize that just attending classes does not help them to improve their course performance. At the same time, instructors consider making proper circumstances for both inside and outside classroom. These efforts make students have much interest in class materials, feel encouraged to study, get involved in class activities, and feel self-motivated to study. The author understands that this involvement and motivation help enhance students' engagement in learning so they can improve academic performance in their fields. How about other factors that affect students' course performance? Setting up a wider range of office hours is a good idea, as shown in this research. Classroom experiments including a teaching innovation will also help students achieve the goal. These issues will be the focus of the author's future research.

Although the author recognizes that these results were obtained based on research using data from students who were mainly economics and business majors, he believes that these results could be applied to students in other social science fields. The author notes, however, that the results obtained in this research have some limitations: (1) The instructor is the same for all courses considered in this research. (2) All data were obtained from students studying economics and business at a small liberal arts college, and data may not reflect general cases; for example, few nontraditional students or commuter students were observed. The author understands that it will be interesting if he, taking these factors into consideration, expands this research to more general cases, which will also be part of his future research.

ENDNOTES

1. Marburger (2001, 2006) and Stanca (2006) review these past literatures examining the relationship between attendance and students' academic performance.
2. I owe all members of the Academic Records Office at Franklin College a huge debt for collecting data.
3. Data source: Admission Offices at Franklin College, fall 2011.
4. Calculus-I (MAT 135) includes derivatives for a single variable.
5. I had another option to use a final course letter grade as a measure of student performance; however, if a final course letter grade is used, a dependent variable becomes discrete (A = 4.00, A– = 3.67, B+ = 3.33 and so on) and this may cause OLS estimation to be inappropriate because of violation of OLS assumption (Pindyck and Rubinfeld 1981).

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