Do Cooperative-Based Learning Groups Help Students Learn Microeconomics?

Jennjou Chen¹ and Tsui-Fang Lin²

Abstract
As many college students voluntarily form cooperative-based learning groups to study course materials, this article investigates whether or not such type of learning improves their academic performance. This is the first research using Taiwan’s higher education data to study cooperative learning in the field of economic education. The data used herein are from 10 intermediate microeconomics courses from 2006 to 2016 at a public university in Taiwan. The sample size is 1,389, which encompasses 120 to 150 enrolled students in each semester. We use an instrumental variables (IVs) approach to remedy the potential endogeneity problem associated with forming cooperative-based learning groups, and the key IV employed is the number of students with the same academic major. The IV estimation results show that forming cooperative-based learning groups does significantly improve college students' learning outcomes. In addition, the cooperative learning effect is heterogeneous across groups. Students with poor attendance records benefit more from voluntarily formed cooperative learning groups in learning microeconomics. Moreover, it is worth noting that the magnitude of the cooperative learning effect from our analysis is greater than the typical class attendance effect.

Keywords
cooperative learning, instrumental variables, microeconomics

Introduction
In addition to competitive learning and individualistic learning, cooperative learning has recently received increasing attention in many disciplines of higher education (Azizan et al., 2018; Foldnes, 2016; Tadessea et al., 2020; Warfa, 2016; Yusuf et al., 2019). According to Johnson et al. (2008), there are three forms of cooperative learning including formal cooperative learning, informal cooperative learning, and cooperative-based groups. Formal or well-constructed cooperative learning exercises refer to students working together for a period of time in a class to solve problems or to complete an assigned joint project. As for informal cooperative learning, students work together in temporary groups for a rather short period of time during a lecture to achieve a common goal. The widely used think–pair–share exercise falls into the informal cooperative learning category. In contrast, cooperative-based groups are long-term heterogeneous groups of students working together for the duration of a course to support each other to complete a joint task or to prepare for exams.

Compared with competitive or individualistic learning, cooperative learning has been regarded as more beneficial and would produce better learning outcomes. Johnson et al. (1998) discussed a variety of theoretical roots of cooperative learning including social interdependence, cognitive–developmental, and behavioral learning models. According to the social interdependence theory, cooperation is a result of positive interdependence among individuals. Through mutual help, exchanging ideas and resources, students can achieve a common goal with collective efforts. From the angle of cognitive science, cooperative learning reinforces the channels through which information and knowledge are transmitted, and thus promotes cognitive growth. The behavioral learning theory supports the argument that individuals choose to collaborate with each other to accomplish a task in face of external rewards associated with the task. These theories all predict that cooperative learning could enhance students’ achievement.

Lecture-based instruction has long been the predominant teaching pedagogy in the field of economics; yet, relatively few instructors in the economics discipline devote their lecture time on small group discussion or cooperative learning activities (Watts & Schaur, 2011). Even so, some economists have applied cooperative learning strategies and demonstrated that cooperative learning benefits students when...
learning economics. Using teaching the labor supply curve as an example, Maier and Keenan (1994) found that a simple cooperative learning exercise such as a think–pair–share activity changes the classroom dynamics and benefits students in learning important economic concepts. Marburger (2005) compared students’ learning outcomes in the traditional lecture group and cooperative learning group, and noted that students enrolled in a cooperative learning class exhibit better academic performance. Yamarik (2007) designed a two-group experiment and explored the effect of small group learning on students’ academic performance. Similar to findings in other disciplines, the author found that cooperative learning enhances students’ academic performance. Using a quasi-experimental research design, Emerson et al. (2015) and Emerson et al. (2018) fail to find a significant effect of cooperative learning. However, both Emerson et al. (2017) and Emerson et al. (2018) investigated the effect of applying active cooperative learning activities in large enrollment microeconomic principles courses, showing a positive cooperative learning effect in terms of student-reported satisfaction. In addition, this beneficial effect mitigates the inefficiency costs associated with large enrollment courses.

The main purpose of this study is to examine whether or not forming voluntary cooperative-based learning groups benefits students in learning economics. Students voluntarily set up or joined a cooperative learning group and studied with their classmates to prepare for exams during the semester. Such voluntary cooperative-based groups may be different from formal and informal cooperative learning due to the voluntary nature and lack of shared group accountability. However, voluntary cooperative-based groups preserve the key elements of cooperative learning such as positive interdependence, equal participation, and simultaneous interaction and individual accountability (McGoldrick et al., 2010). It is, therefore, of great importance to better understand the effect of voluntary cooperative learning group when promoting cooperative learning and assessing its effectiveness in higher education. In addition, this is the first research using Taiwan’s higher education data to study cooperative learning in the field of economic education. The empirical results and policy implications generated from this research not only help us better understand the cooperative learning effect in economic education but also add value to literature in this line of research.

Data and Statistical Model

The main purpose of this article is to study whether or not forming cooperative learning groups helps college students learn intermediate microeconomics. To conduct this study, we collected students’ data from 10 semesters (academic years 2006–2012 and 2014–2016). In each semester, around 120 to 150 students enrolled in the intermediate microeconomics course, with most of them sophomores majoring in economics, public finance, and banking. The sample course was taught by the same instructor using identical course materials during the entire sample period. The final sample size is 1,389.

In this analysis, the major dependent variable is a student’s academic achievement measured by course grade ranking in the intermediate microeconomics course. To be able to compare students’ course grades across different semesters, every student’s intermediate microeconomics course grade is converted to a percentile. The key independent variable is whether or not a student is in a cooperative learning group. In each semester, students need to take three exams when enrolled in the sample course. In each exam, every student was asked whether or not he or she studied this subject with other classmates. If a student answered yes on any of the exams, then he or she was regarded as being in a voluntarily cooperative learning group. We expect that students benefit from voluntarily cooperative learning and would produce better learning outcomes in terms of course grade ranking.

When assessing the effect of being in a voluntarily cooperative learning group on exam performance, it is very likely for endogeneity bias to arise. For instance, students with strong learning motivation are more likely to form a cooperative learning group. These students may also spend more time on studying and, therefore, perform better in exams. As a consequence, a positive relationship between being in a cooperative learning group and one’s exam performance could be a result of unobserved motivation. However, it could also be the case that students with lower ability may be the ones seeking for peers’ help more often and they are more likely to form a cooperative learning group. In such an instance, we would otherwise observe a negative correlation between being in a cooperative learning group and one’s exam performance. To remedy the above potential endogeneity problem, an instrumental variables (IVs) approach is employed to address the issue.

A good IV needs to be highly correlated with the independent variable of interest, but cannot correlate with the random disturbance term. In Taiwan, students with the same major and entering a university in the same year typically become quite close to each other. We expect that students are more likely to form voluntarily cooperative learning groups if there are more peers with the same academic background in the same class. The number of students with the same major is also less likely to be correlated with the random disturbance term in the regression equation. Hence, we collected data on numbers of students with the same major and same year in a class and use this variable as the IV.

Other control variables used in the regression models are male, percentage of classes attended, submit all problem sets, grade point average (GPA), calculus grade, and year dummy. Among these variables, two variables including percentage of classes attended and submit all problem sets are used to capture a student’s motivation to some extent. The
variable percentage of classes attended ranges from 0 to 1. It is
defined as the ratio of classes attended to total classes for a
student within the sample semester. As for the dummy vari-
able, submit all problem sets, it is equal to 1 if a student sub-
mits all problem sets and equal to 0 otherwise. We expect
that highly motivated students are less likely to miss lectures
and tend to submit problem sets on time. Another two vari-
able, GPA and calculus grade, are used to partially control
for a student’s ability. Both variables are measured on a 100-
point scale. Students with higher academic ability probably
have higher GPA and perform better in calculus. Lastly, we
take into account gender and year effect in our empirical
models.

Table 1 lists the summary statistics of all variables used
for this analysis. Close to 60% of students are in a coopera-
tive learning group in our sample. We observe that students
in a cooperative-based learning group have higher course
grade ranking than those not in a cooperative-based learning
group. Furthermore, students in a cooperative-based learning
group have more peers with the same academic background,
attend more lectures, have higher prior GPA, and have higher
calculus grade. The findings also indicate that male students
are less likely to be in a cooperative-based learning group.

On average, a student in the intermediate microeconomics
has around 31 students with the same major. Table 2 presents
the distribution of the number of students with the same
major in fall 2016. For that semester, the majority of students
majored in economics, public finance, and banking. For
instance, among 153 enrollees, 50 sophomores majored in
economics, 36 sophomores majored in public finance, 17
juniors majored in public finance, and 14 sophomores
majored in banking. On average, a student taking the inter-
mediate microeconomics course attended 82% of lectures
during the semester, whereas more than 60% of students sub-
mitt all problem sets. The number of problem sets required
in the sample period ranges from 6 to 9. The instructor
assigns certain credits to students if they submit problem
sets. Of the students enrolled in the intermediate micro-
economics course, 43% are males. The mean score of students’
prior GPA is 80.86, and the mean score of students’ calculus
grade is 81.27. Students’ GPA and calculus grade are proxies
for their academic ability.

We construct the following regression equation to explore
the relationship between a student’s intermediate microeco-
nomics course grade ranking and whether a student is in a
cooperative-based learning group.

\[ y_i = \eta c_i + \beta x_i + \varepsilon_i, i = 1, 2, \ldots, N \]  

(1)

In Equation 1, \( y_i \) is student \( i \)'s course grade ranking, \( c_i \)
is whether student \( i \) is in a cooperative learning group, \( x_i \)
is the vector of control variables such as class attendance, problem
set submission, gender, GPA, calculus grade, and year
dummy variables. \( \varepsilon_i \) is the random disturbance. As men-
tioned above, \( c_i \) is student \( i \)'s endogenous choice, which
might correlate with the random disturbance \( \varepsilon_i \). For example,
unobserved factors such as motivation and ability might
affect students’ decision to form or join a cooperative-based
learning group. In such an instance, the key estimate of inter-
est \( \eta \) might be inconsistent under the ordinary least squares
(OLS) estimation.

To fix the potential endogeneity problem, we adopt an IV
approach. The IV used in this analysis is “Number of Students
with the Same Major and Year.” As discussed above, this IV
is highly correlated to whether or not students form coopera-
tive learning groups, but less likely to be correlated to the
random disturbance \( \varepsilon_i \), which is the unobservable part of stu-
dents’ semester grade ranking.

**Estimation Result**

Table 3 reports the OLS results, and Table 4 reports the IV
estimation results. The first column in Table 3 presents the
full sample OLS results. We find that being in a cooperative-
based learning group significantly enhances students’ course
grade ranking, and that the attendance effect is also signifi-
cant and positive. This positive result is in line with estima-
tion results in most literature. Students who submit all
problem sets are found to have higher course grade rankings
as expected. Students with higher prior GPA and calculus
grade also score higher in exams.

We later conduct tests of endogeneity to see whether we
need to remedy the endogeneity problem associated with the
variable of being in a cooperative learning group. Both the
robust score chi-square value and robust regression F value
reject the null hypothesis that forming a cooperative learning
group is exogenous at the 1% level. Details of both tests can
be found in Wooldridge (1995) and Hausman (1978). The
endogeneity test results demonstrate that the key indepen-
dent variable is endogenous, which justifies our use of IV in
this study. In addition, we conduct the weak IV test to exam-
ine whether the IV chosen is appropriate. The first-stage
OLS F value is 28.66 and greater than 10, further indicating
that we might not need to worry too much about the weak IV
issue. It is worth noting that the estimated coefficients are all
positive for those control variables representing individuals’
motivation and ability, that is, percentage of classes attended,
submit all problem sets, GPA, and calculus grade, in the first-
stage regression. This implies that students with strong moti-
vation and higher ability are more likely to join cooperative
learning group voluntarily.

After employing the IV approach, we find that the magni-
tude of the cooperative-based learning effect is much greater
than that in the OLS approach, which we observe in the first
column of Table 4. The estimation result comes with a caveat
that the IV approach might not fully solve the endogeneity
problem. Highly motivated and/or high-ability students may
be those who are more likely to form cooperative learning
groups, and these students usually perform better in exams.
In such an instance, the estimated cooperative learning effect
from the IV model should be smaller than the one from the OLS model. However, it is not the case here. One plausible explanation is that the current IV might not work well. A better search of potential IVs or other experimental approaches might be a solution to better estimate the cooperative learning effect for future research.

In this analysis, the attendance effect is statistically significant, but smaller than that in the OLS model. Similar to the results in the OLS model, students who submit all problem sets and students with higher prior GPA and calculus grade perform better on intermediate microeconomics. Males relative to their female counterparts have better learning outcomes in the IV model. However, the gender variable is not statistically significant in the OLS model.

In light of the fact that the attendance variable might as well be endogenous, we next investigate whether the cooperative-based learning effect is different across various groups by students’ attendance status. In these three groups, 730 students attended more than 90% of lectures, 659 students attended 50% to 90% of lectures, and 138 students attended less than 50% of lectures. After controlling for other covariates and year dummy variables, we reject the null hypothesis that forming a cooperative learning group is exogenous. The cooperative learning effect is decreasing when attendance rate increases. The cooperative learning effect is found to be greater for students with a worse attendance record, but lower for students with a rather good attendance record. This implies that students with weaker motivation would benefit much more than their highly motivated counterparts from voluntarily formed cooperative group. We also find a significant and positive attendance effect in the full sample. This finding is consistent with that in previous literature (Chen & Lin, 2008). Furthermore, submitting all problem sets and having a higher prior GPA produce significant and positive effects on learning outcomes.

### Conclusion

This study contributes to the growing literature exploring the effect of cooperative learning in learning economics. In particular, we investigate whether or not voluntarily forming cooperative-based learning groups benefits students when they are studying intermediate microeconomics. We collected data from 10 semesters and used this rich data set to
explore the voluntarily cooperative-based learning groups' effect. We find that many students voluntarily form cooperative learning–based groups when they took the intermediate microeconomics course. More than 60% of students in our sample have studied with their classmates to prepare for exams during the duration of the course.

Using Taiwan’s higher education data, our empirical evidence shows that students benefit from voluntarily formed cooperative-based learning groups when they learn microeconomics. After considering the potential endogeneity bias, our IV estimates support a positive cooperative-based learning group effect. Students in a voluntarily cooperative-based learning group perform better in exams and have a higher course grade ranking. We also observe a heterogeneous cooperative learning effect among students with different attendance records. The cooperative learning effect is greater especially for those with poor attendance records. Less motivated students would benefit more than their highly motivated counterparts from voluntarily formed cooperative learning group. The positive cooperative learning effect conforms to conclusions reached in prior literature. Students work with their group members and gain from participating in a variety of learning activities such as discussion, coaching, and scaffolding. Hence, being in a voluntarily formed cooperative learning group produces better learning outcomes.

Teaching economics in higher education has become more and more challenging. Many teachers have adopted various ways of instruction to enhance students’ learning. In light of the above findings, informing students about the benefits of cooperative learning and implementing policies to encourage students to form study groups could enhance their learning of intermediate microeconomics and produce better academic outcomes. Moreover, in addition to the cooperative learning group approach, the instructor could consider experimenting with well-constructed cooperative learning activities to aid students in learning economics.

Lastly, it is of note that, in addition to the IV method used in this analysis, experimental approaches could be employed to
### Table 3. The Determinants of Course Grade Ranking (OLS Results).

| Variables                      | All sample | Percentage of classes attended (above 90%) | Percentage of classes attended (between 90% and 50%) | Percentage of classes attended (below 50%) |
|-------------------------------|------------|-------------------------------------------|-----------------------------------------------------|----------------------------------------|
| In a cooperative learning group | 2.599*     | −1.210                                     | 6.009***                                             | 8.630**                                |
|                               | (1.362)    | (1.896)                                   | (1.904)                                              | (4.214)                                 |
| Percentage of classes attended | 16.67***   | 47.91*                                     | 18.37***                                             | 25.31                                  |
|                               | (3.706)    | (24.78)                                   | (4.883)                                              | (15.77)                                 |
| Submit all problem sets       | 11.26***   | 8.793***                                   | 13.15***                                             | 7.871                                  |
|                               | (1.650)    | (2.526)                                   | (2.206)                                              | (5.680)                                 |
| Male                          | 1.961      | 2.405                                     | 0.986                                                | 2.128                                  |
|                               | (1.310)    | (1.814)                                   | (1.889)                                              | (3.858)                                 |
| GPA (100-point scale)         | 1.402***   | 1.875***                                   | 0.982***                                             | 0.835**                                |
|                               | (0.149)    | (0.218)                                   | (0.192)                                              | (0.327)                                 |
| Calculus grade (100-point scale) | 0.493***  | 0.655***                                   | 0.430***                                             | 0.107                                  |
|                               | (0.0857)   | (0.120)                                   | (0.103)                                              | (0.205)                                 |
| Constant                      | −124.1***  | −202.6***                                  | −89.35***                                            | −55.12**                               |
|                               | (9.178)    | (25.14)                                   | (12.83)                                              | (21.71)                                 |
| Year dummy                    | Yes        | Yes                                       | Yes                                                 | Yes                                    |
| Observations                  | 1,389      | 730                                       | 659                                                  | 138                                    |
| $R^2$                         | .364       | .315                                      | .324                                                 | .258                                   |

Note. White (1980) robust standard errors are in parentheses. OLS = ordinary least squares; GPA = grade point average. **"*** is significant at .01, ***" is at .05, and **" is at .1 Type I error levels.

### Table 4. The Determinants of Course Grade Ranking (IV Results).

| Variables                      | All sample | Percentage of classes attended (above 90%) | Percentage of classes attended (between 90% and 50%) | Percentage of classes attended (below 50%) |
|-------------------------------|------------|-------------------------------------------|-----------------------------------------------------|----------------------------------------|
| In a cooperative learning group | 26.41***   | 22.08***                                   | 24.82***                                             | 44.61*                                 |
|                               | (6.131)    | (8.483)                                   | (8.119)                                              | (26.94)                                 |
| Percentage of classes attended | 8.853**    | 43.9                                      | 12.86**                                              | 6.573                                  |
|                               | (4.457)    | (27.86)                                   | (5.601)                                              | (23.02)                                 |
| Submit all problem sets       | 6.600***   | 7.582***                                   | 11.43***                                             | −2.870                                 |
|                               | (1.847)    | (2.862)                                   | (2.400)                                              | (11.94)                                 |
| Male                          | 2.736*     | 3.751*                                     | 1.392                                                | 4.554                                  |
|                               | (1.447)    | (2.038)                                   | (1.996)                                              | (4.925)                                 |
| GPA (100-point scale)         | 1.458***   | 1.875***                                   | 1.069***                                             | 0.608                                  |
|                               | (0.167)    | (0.245)                                   | (0.207)                                              | (0.472)                                 |
| Calculus grade (100-point scale) | 0.430***  | 0.613***                                   | 0.365***                                             | 0.114                                  |
|                               | (0.0916)   | (0.139)                                   | (0.105)                                              | (0.245)                                 |
| Constant                      | −130.2***  | −208.8***                                  | −98.1***                                             | −40.19                                 |
|                               | (10.18)    | (28.20)                                   | (14.02)                                              | (33.14)                                 |
| Year dummy                    | Yes        | Yes                                       | Yes                                                 | Yes                                    |
| Weak IV                       | Yes        | Yes                                       | Yes                                                 | Yes                                    |
| First-stage OLS $R^2$          | .1237      | .0939                                     | .1282                                                | .1739                                  |
| First-stage OLS F value       | 15.87***   | 6.01***                                   | 7.83***                                              | 4.70***                                 |

Note. White (1980) robust standard errors are in parentheses. IV = instrumental variable; GPA = grade point average; OLS = ordinary least squares. **"*** is significant at .01, ***" is at .05, and **" is at .1 Type I error levels.
address the endogeneity issue. The fact that students voluntarily formed learning groups in this analysis indicates a potential endogeneity problem. More able or highly motivated students may be more likely to form cooperative learning groups voluntarily and they usually perform better in exams. Therefore, the positive cooperative learning effect might be a beneficial result of being in cooperative-based groups but could also be a result of the unobserved heterogeneity. To disentangle these unobserved factors from our models and better estimate the cooperative learning effect, randomized experiments or quasi-experiments could be considered in the future.

Acknowledgments
We are grateful to Sudipta Roy and seminar participants at the 2018 Annual American Economic Association (AEA) Conference on Teaching and Research in Economic Education for their thoughtful comments and suggestions. All errors are our own.

Declaration of Conflicting Interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
The author(s) received no financial support for the research, authorship, and/or publication of this article.

ORCID iD
Jennjou Chen https://orcid.org/0000-0002-9305-3173

References
Azizan, M. T., Mellon, N., Ramli, R. M., & Yusup, S. (2018). Improving teamwork skills and enhancing deep learning via development of board game using cooperative learning method in reacting engineering course. ‘Educational for Chemical Engineers, 22, 1–13.

Chen, J., & Lin, T. F. (2008). Class attendance and exam performance: A randomized experiment. Journal of Economic Education, 39, 213–227.

Emerson, L. N., English, L., & McGoldrick, K. (2015). Evaluating the cooperative component in cooperative learning: A quasi-experimental study. Journal of Economic Education, 46, 1–13.

Emerson, L. N., English, L., & McGoldrick, K. (2017). Cooperative learning and personality types. International Review of Economics Education, 21, 21–29.

Emerson, L. N., English, L., & McGoldrick, K. (2018). The high costs of large enrollment classes: Can cooperative learning help? Eastern Economic Journal, 44, 455–474.

Foldnes, N. (2016). The flipped classroom and cooperative learning: Evidence from a randomised experiment. Active Learning in Higher Education, 17, 39–49.

Hausman, J. A. (1978). Specification tests in econometrics. Econometrica, 46, 1251–1271.

Johnson, D. W., Johnson, R. T., & Holubec, E. J. (2008). Cooperation in the classroom (8th ed.). Interaction Book.

Johnson, D. W., Johnson, R. T., & Smith, K. A. (1998). Cooperative learning returns to college what evidence is there that it works? Change: The Magazine of Higher Learning, 30, 26–35.

Maier, M. H., & Keenan, D. (1994). Teaching tools: Cooperative learning in economics. Economic Inquiry, 32, 358–361.

Marburger, D. R. (2005). Comparing student performance using cooperative learning. International Review of Economics Education, 4, 46–57.

McGoldrick, K., Rebelein, R., Rhoads, J. K., & Stockly, S. (2010). Making cooperative learning effective for economics. In M. K. Salemi & W. B. Walstad (Eds.), Teaching innovations in economics, chapter 4. Edward Elgar Publishing.

Tadessea, T., Gilliesb, R. M., & Manathungac, C. (2020). Shifting the instructional paradigm in higher education classrooms in Ethiopia: What happens when we use cooperative learning pedagogies more seriously? International Journal of Educational Research, 99, Article 101509.

Warfa, A. (2016). Using cooperative learning to teach chemistry: A meta-analytic review. Journal of Chemical Education, 93, 248–255.

Watts, M., & Schaur, G. (2011). Teaching and assessment methods in undergraduate economics: A fourth national quinquennial survey. Journal of Economic Education, 42, 294–309.

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. Econometrica, 48, 817–838.

Wooldridge, J. M. (1995). Score diagnostics for linear models estimated by two stage least squares. In G. S. Maddala, P. C. B. Phillips, & T. N. Srinivasan (Eds.), Advances in econometrics and quantitative economics: Essays in honor of professor C. R. Rao (pp. 66–87). Blackwell.

Yamarik, S. (2007). Does cooperative learning improve student learning outcomes? Journal of Economic Education, 38, 259–277.

Yusuf, Q., Jusoh, Z., & Yusuf, Y. Q. (2019). Cooperative learning strategies to enhance writing skills among second language learners. International Journal of Instruction, 12, 1399–1412.