A Guide for Student-led Undergraduate Research in Empirical Micro-Economics[1]

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Abstract: This guide provides advice on doing a student-led undergraduate research project in empirical economics to both students and faculty members. For students, research projects are good preparation for graduate school or data intensive jobs. For faculty, mentorship can be a fulfilling experience, and an undergraduate research project can lead to a publication. The guide follows the steps of an empirical economics research project, including preparation before the project, matching a student and professor, writing the paper, presenting, defending a thesis, the publication process, and finally how to reap the benefits of the work. The guide also includes specific advice for doing work with data typical of applied microeconomics.

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1. Introduction

Mentoring undergraduate research in economics can be extremely rewarding for both students and faculty. For students, it is an opportunity to learn quantitative skills for their career or graduate school. For faculty, particularly at undergraduate institutions, it is a chance to mentor students. Done well and with the right students, undergraduate research has the potential to be published in good academic journals.

Many economics professors believe that teaching research skills is a vital part of the economics major. However, successful undergraduate research requires a large amount of effort (Fenn et al., 2010). This raises the question of: how best to teach these skills? Professors may have learned these skills as part of their Ph.D. training, but may have no framework for teaching them or managing students. Furthermore, unlike other traditional courses, a comprehensive guide or textbook is lacking. This paper provides a framework for how to undertake student-led economic research in empirical economics in a manner that is accessible to students and rewarding for faculty.

In a survey of 30 top liberal arts and 30 national universities (Hoyt and McGoldrick, 2017), respondents explicitly stated that research skills are essential to gaining human capital necessary for the workforce or graduate school. As Ehrenberg (2005) and Fenn et al. (2010) show, this work can also lead to academic journal publications. More recent evidence shows the potential impact of undergraduate research on the profession. For example, Alice Wu's senior thesis, "Gender Stereotyping in Academia: Evidence from Economics Job Market Rumors Forum," was one of the most talked about papers of 2018 and appeared in the *AEA Papers and Proceedings*. Also, these works can also be published in top journals as evident by Rose Khattar's senior thesis, forthcoming as a co-authored work with her advisor in the *Review of Economic Studies* (Grosjea and Khattar, 2018).

The pedagogical literature consistently discusses how research with undergraduates is time-intensive and requires keeping students on task (Fenn et al., 2010; McGoldrick, 2008; and Wagner, 2015). There are strategies to utilize economies of scope and scale in terms of research production, which may involve students working in groups either on the same question with different data or with the same data on different questions (Fenn et al., 2010). Enherberg (2005) and Wagner (2015) provide brief overviews of a four-year system of research, though Cebula (2017) points out this strategy may not work in a setting where students choose their major in their second or third year. DeLoach et al. (2012) and McGoldrick (2007) provide a general framework for doing undergraduate research institutionally and with specific areas students need to cover. McGoldrick (2007) creates a ten-step model for research from identifying an issue to presenting research to peers. For students looking for resources, Dudenhefer (2009)'s guide to undergraduate writing in economics is a comprehensive look at the writing process, including some focus on empirical projects. Nikolov (2013) provides a shorter, more writing-focused guide. Similarly, some economics departments have written theses guides, including Neugeboren and Jacobson (2005), Princeton (2017), Bates (2002), and Reed College (2018).

Papers discussing undergraduate research are typically either aimed at professors and appear in academic journals (DeLoach et al., 2012; McGoldrick, 2007; and Smith, 2009), or aimed at students and often appear on hard-to-find academic websites (Dudenhefer, 2009; Nikolov, 2013). This paper bridges that gap by providing a comprehensive guide for faculty and students that covers the research process from choosing a topic and collaborator through publication. The key contribution is to provide a framework to students and faculty next to each other so that both can see the responsibility that the

other one holds in order to complete a successful project. Furthermore, given the complexity and number of parts of the project, this guide provides a year-long framework for undertaking and succeeding in a research project.

This paper focuses mainly on student-led projects that take a comprehensive approach to teaching the research process. Student-led projects have the advantage of being tailored to a student's academic interest. This interest often drives motivation that can help students overcome the challenges of a long research project as proposed in this paper. Student-led projects teach all the steps of the research process: topic selection, finding data, doing the analysis, and write-up. An alternative is the undergraduate research assistant model, where students are hired to work on projects designed and led by a faculty member. The research assistant model has the advantage of being less intense for students and faculty with binding time constraints. The research assistant model is discussed in terms of the opportunity costs of the full student-led project in a later section (2.I).

This paper emphasizes empirical microeconomics research methods with data obtained from outside sources instead of collected by the students themselves. Some student-led undergraduate research projects have collected data themselves. This is discussed briefly in the obtaining data section, though providing a comprehensive guide to survey design, ethics, institutional review boards, and survey implementation is beyond the scope of this paper. Economic theory can also drive empirical questions or stand alone as a student-led research project. Although theory is briefly discussed to motivate how to model an empirical questions, a thorough treatment of how to undertake student-led theory projects is also beyond the scope of the paper. Finally, the paper focuses on microeconomics, omitting the whole field of macroeconomics. Much of this paper will still be of use to students who collect their own data, use theory, or are macroeconomics focused. Of the four following sections (Getting Started, Empirical Analysis, Writing, Post Writing), all but the empirical sections have application to other project types.

The paper is divided into sections based on the stages of a typical research project: getting started, empirical analysis, writing, and the follow-up after the paper is written. Each section covers multiple topics with two parts, one that is intended for the student and the other for the professor, though each party may find reading the other's entry useful. Section 2, Getting Started, highlights topics key to a successful start of a research project: (2.A) Why do an undergraduate research project?, (2.B) necessary preparation, (2.C) choosing a research partner, (2.D) choosing a topic, (2.E) approaching a professor, (2.F) writing an agreement and a timeline, (2.G) how to increase productivity, and (2.H) literature review. An alternative research model is discussed in (2.I) undergraduate research assistant. Tips for empirical analysis are highlighted in the Empirical analysis Section 3: (3.A) using theory to form a hypothesis, (3.B) obtaining data, (3.C) cleaning and preparing data, and (3.D) econometrics analysis. Writing tips are provided in Section 4: (4.A) outlining the paper and (4.B) writing the paper. There is still much work to be done even once the draft is completed. This is discussed in Section 5, Post Writing, which covers what to do after the paper is written: (5.A) presenting, (5.B) thesis defense, (5.C) submitting the paper to a journal, and (5.D) reaping the benefits of the research. Finally, in the conclusion, potential areas of research and areas needing more resources are highlighted, particularly theory focused projects or projects where students collect their own data.

Section 2: Getting Started

Section 2.A: Why Do an Undergraduate Research Project?

For the Student:
The main benefit to doing a research project is getting personalized attention from a faculty member to help explore a topic that suits their interests. This individualized attention means the student will likely learn more than in a regular class. For students considering graduate school, there are clear benefits to doing undergraduate research, as it teaches the skills needed for succeeding in graduate school and beyond. If done well, it improves the faculty member's ability to write a better letter of recommendation, which helps the student get into better schools and increases their chances of receiving funding. For students not going to graduate school, doing a research project can teach the skills required for many analytic-heavy jobs.

To be done well, these projects involve a substantial amount of work from both the student and the professor. As many economists, including Cebula (2017), point out, everything involves an opportunity cost. With the time spent on a project, the student could be earning money at a job, learning another skill (like a language, be it computer or foreign), or even just enjoying their senior year of college. In other words, students should carefully consider if the project can improve their career prospects as well as let them study a topic they are deeply interested in.

Students trying to decide if they should do an independent research project may consider making a list of the benefits and costs (including opportunity cost) of doing such a project. To fully understand the costs, see Section 2.F to see all the work that a project entails.

For the Professor:
Mentoring students can be one of the most satisfying experiences as a faculty member. Evidence from psychology, and particularly Robert Waldinger's work with Harvard's Adult Development Study, suggests that forming strong relationships like mentoring are correlated with long-term health and happiness (see Waldinger et al., 2015).[2] Based on these results, Waldinger himself has increased his own time spent mentoring students. Supervising undergraduate research has additional potential benefits beyond mentoring, including potential publications, promotions, merit raises, and funding.

There is evidence that undergraduate theses can lead to publications, as shown in the introduction. Fenn et al. (2010) describe work at Colorado College, including undergraduate co-authored publications in *Energy Economics*, *Journal of Economic Geography*, and *Journal of Sports Economics*. However, a faculty member's production when working with an undergraduate may be less than when working alone or with colleagues, even though an undergraduate can help with things such as a literature search, data cleaning/summarizing, running regressions, and even writing. A good mentor will both carefully check over the student's work and give feedback. This takes time and offsets the contribution of the student's work.

Supervising an undergraduate research project is a risk for untenured faculty worried about their research production. Supervised research is often undervalued in terms of tenure and promotion (Hoyt

[2] The lack of causal studies of the effect of supervising research is discussed in the conclusion.

and McGoldrick, 2017). One exception might be for liberal arts colleges that place a strong emphasis on teaching, including supervising undergraduate research. Untenured faculty whose research production far exceeds expectations might consider supervising an independent study project, particularly to strengthen their teaching portfolio.

There are some small potential monetary gains from student research, though they are unlikely to match the monetary opportunity cost from consulting or summer teaching for faculty. Research with students is likely to gain funding proposal favors with committees, particularly internal ones. Some universities may offer small payments (a few hundred dollars) for teaching independent studies or even give a course release after doing a dozen or more. Supervising a research project is also a long-term and possibly high-reward investment. There is even the potential to create a future co-author.

Faculty considering independent studies might ask themselves several questions: Given that the gains to mentoring undergraduate research are mostly non-pecuniary, is this motivation enough to do it? For untenured faculty members, do they already have a sufficient research portfolio to get tenure? Could student research increase the chances of receiving funding from internal sources? Are funds available for independent studies, or are course reductions given for supervising many students?

Section 2.B: Necessary Preparation

For the Student:
At a minimum before starting independent research, students should take an introduction to economics, field course(s) related to their proposed research topic (e.g., development economics, environmental economics, labor economics), and an econometrics class. The last class is the most important for data work. The student should also know how to use software such as R, STATA, or SPSS to work with the professor.

For the Professor:
Professors supervising research have already done all of these steps themselves, but must learn how to teach them and manage students. Professors that have little or no experience in the area might talk to colleagues about independent studies and theses to better understand their university's rules and evaluate the costs and benefits described in the previous section.

Learning good management practices can help faculty prepare to be mentors and enhance the student's research experience. However, faculty are rarely trained in these skills (Melusky, 2019). A guide from Northwestern advises faculty to focus on selecting a project that helps the student's career, provide an overview of the goals at the beginning of the project and update them quarterly, meet with the student regularly, scale the contribution to the student's constraints, and finally set expectations on co-authorship at the beginning (Northwestern, 2019). MacKenzie (2015) also suggests that faculty should think about how to manage the workflow and deadlines, including using project management software. She also suggests thinking about power dynamics, as faculty mentors often are future references so have a tremendous amount of power over students. In sum, the faculty-student relationship is similar to a manager and an employee and must follow the norms of the university.

Section 2.C: Choosing a Research Partner

For the Student:

Students should first consider professors they have taken courses with. Seeing a professor in the classroom can give a general sense of compatibility of interest and working styles. Students may also ask fellow economics majors for advice on good mentors. The ideal research mentor has some experience in the topic the student wants to study, so the student should consider who teaches the relevant course, such as development, environmental, or sports economics. Students can talk to other professors about who they might recommend if they do not know who to ask otherwise.

When choosing a faculty mentor, it helps to understand the different types of professors.[3] Students want to find a professor who is tenured or close to it. To do this, go to the economics department web page and look at the list of the faculty. Faculty names will be accompanied by titles, sometimes called ranks, such as professor, associate professor, assistant professor, visiting assistant professor, lecturer, and emeritus professor. Those who are listed as professor or associate professor almost always have tenure. That means they have a great deal of job security. Assistant professors are generally faculty members who will apply for tenure in their sixth year, so their research skills are typically the most up to date. Professors who do not get tenure lose their jobs. Getting tenure is a great benefit, and supervising student research may impede the faculty member's ability to get tenure, since tenure is often based on research, even in more teaching-focused schools. In short, professors and associate professors are in a good position career-wise to help students; assistant professors are perhaps less so depending on their research production.

Visiting assistant professors and lecturers are not tenure track. This means they are typically paid substantially less and receive fewer benefits than tenure track and tenured faculty. They also generally teach more courses and are often less research-oriented because of the demand on their time from teaching. Do not entirely rule lecturers out, but in most cases they have too many demands on their time and are not compensated well enough to do independent studies. Finally, emeritus professor is a title given to semiretired and retired professors. Though less likely to work with students, emeritus professors generally have more time. Finally, students want to choose a good researcher. Cebula (2017) suggests that an industrious student will look through faculty curriculum vitae (CVs). Students can usually find CVs on professors' websites, or the student can look at Google Scholar. Active researchers usually publish a paper or two a year. Also, students can see if the topics match their area of interest.

For the Professor:

A successful undergraduate student researcher requires a combination of general and specific skills. First, to evaluate general skills, the best place to start is in the classroom, including the student's overall GPA and GPA in relevant classes. Faculty can use their own experience in the classroom with the student, or if they have not taught the student, ask colleagues about the student's performance. In terms of specific skills, faculty will want a student who likely has taken at least an intermediate-level statistics class or a class that covers regression analysis such as econometrics. Having a relevant field course is also helpful. Finally, the student will need to be able to do the analysis in a statistical software

[3] Note this is based on the terminology used in the United States. You might ask a faculty member to help you compare these titles to those in your own country.

program such as STATA, SPSS, or R. Ideally, they know the program the faculty members uses for their own research. If not, someone who knows one program can quickly pick up another. Faculty should exercise extreme caution in working with a student who has only worked in Excel. Faculty want a student who can, at a minimum, open a dataset and run descriptive statistics and basic regressions. If the student does not have these skills, faculty can suggest that the student go acquire them before agreeing to do a project. Finally, recruiting students from underrepresented backgrounds in the profession may require extra effort, but is important to increasing diversity across the pipeline.

Faculty may need to recruit students if they are interested in mentoring the best undergraduate researchers. The best students also have other great opportunities, including paid summer internships, so there is a high opportunity cost to them in doing student-led research. In order to recruit, start by visiting an econometrics class and making a five-minute presentation at the beginning of class about independent research. If there are current students or recent alumni that have done student-led research projects, have them join in as part of the presentation. Students are more likely to be interested in hearing from other students.[4]

Cebula (2017) suggests that as undergraduate research programs show success, recruiting will become easier, as older students will inform younger students of the possibility. Cebula (2017) also recommends working with the school's Economics Honors Society (e.g., Omicron Delta Epsilon). If there is no honors society, thinking about ways to create one or an undergraduate research club is worthwhile.

In many econometrics classes, students are asked to do a project with data obtained from secondary sources. For faculty who teach this course, consider assigning a project and using the lessons of this guide to build a framework for the assignment. Other faculty may ask their colleagues to share the best papers from the previous semester to identify good potential students. Faculty can then recruit these students. Faculty might also consider looking for recruits in classes in related applied fields, such as Political Science, Geography, Sociology, and Public Policy.

Actively recruiting female students and those from underrepresented races and nationalities can help address the diversity problem in the economics profession: women make up roughly one third of bachelors and Ph.D. degrees, and African Americans and Hispanics receive fewer than 10% of economics degrees (CSMGEP, 2015; Goldin, 2015; Bayer and Rouse, 2016). A 2018 round table at the American Economic Association meetings provides a good set of best practices in mentoring underrepresented minority women in economics, which can be viewed online (CSWEP, 2019). One speaker on the panel, India Johnson, a social psychologist, suggests that underrepresented groups look for an identity-safety cue, that is, a signal that a professor or field is safe for someone like them. This can be a role model, such as other students with a similar background who have undertaken research. She also suggests that professors can signal these identity-safety cues just by having friends from underrepresented groups. Faculty may also consider if things in their office can signal these safety cues. She points to one of her students feeling more comfortable with her white male colleague whose office coffee mug says "Feminist as fuck."

[4] Recent evidence from Porter and Serra (2017) on short visits from female alumni showed increased enrollment in economics classes, which suggests a similar result might happen if current theses students present to potential students.

Section 2.D: Choosing a Topic

For the Student:

The best thesis topics answer questions that people care about. Most importantly, the student needs to care about the answer. Miller (2008) suggests five things needed for a good economics thesis topic, which can be summarized as: (1) It is economics, (2) your idea, (3) has not been done before, (4) do-able, and (5) you really care about it. A guide from Bates College (2018) suggests continuing with work the student has already done to explore a new question. Van Gaasbeck's (2018) guide includes links to economics blogs. Davis (2001) and Pischke (2009) have guides geared toward grad students choosing a research question. Though it does not focus on empirical work, Varian's classic paper *How to Build an Economic Model in Your Spare Time* is a great guide to thinking through economic problems (Varian, 1997) and using a model to build your hypotheses (discussed in section 3.A).

Miller (2008) advises students to come up with a broad topic of interest for their research project before approaching the professor. The broad topic needs to inspire the student enough to keep them motivated to work for an entire year. The guide suggests the student thinks of topics that they have found interesting in economics classes, related course work, news stories, or their own experience.

Many applied microeconomics papers are testing a hypothesis of how does some X (e.g., cash payments, credit, or war) affect some outcome Y (e.g., schooling, health, or income). A good economics paper will focus on an X that can be influenced by policy and how it changes an outcome Y that people care about. Another issue is X needs to be exogenous, that is, independent of other influencers in the model on Y. Students also want to be aware of simultaneity. If, for example, the student is measuring the effect of health (X) on income (Y), they will need to do more complex analysis, since rising income means people have more money to spend on health, so Y could influence X too. The professor can help the student with this issue (see also endogeneity in 3.C).

Also, the student needs to consider the population of interest used in the study in terms of age, gender, or nationality. For students interested in using data from outside of the United States, specific knowledge of the country based on research for another class is extremely useful. Even better is experience living in that country.

Once the student has a broad research topic, they can begin doing literature and data searches for a couple of hours. First, to make sure the project has not been done before, do a regular google search of the topic with the name of the x variable, y outcome, and country (e.g., "microcredit and schooling and India"). Next, do a similar search in google scholar. For each search, spend about 30 minutes seeing what comes up and skimming the articles. Finally, do a search in EconLit, a database available at most schools, to find relevant papers.

For the Professor:

The advice to the student above recommends that they start by trying to find their own topic so that they are motivated and interested in it. Finding a topic is also a basic signal of a student's research ability. That said, helping a student iterate to find a doable topic and helping them find data makes sense. Faculty can also guide the student to what constitutes a policy-relevant and important question. In terms of finding data, the professor might be aware of relevant datasets. Professors' experience can help determine if the question that is being asked can be answered by the dataset of interest.

Section 2.E: Approaching a Professor

For the Student:

A good time to approach a professor is a few weeks before the end of the spring semester preceding the summer the project would start. If the student is currently enrolled in the professor's class, the student can approach the professor after class with a one-minute elevator pitch. The below is a script a student might use.

> "Hi Dr. X, Do you have a minute for a question? (if yes) I wanted to talk to you about potentially doing an independent study with you. I'm interested in working on a project related to [example] (e.g., schooling in Ghana, health care in West Virginia, or fair-trade coffee). I know you teach [Y] (related class), and I looked at your CV and see you do work on [Z]. Would you potentially be open to talking about this more? (if yes) I can send you an e-mail to schedule a time to meet. [or if you are both free, meeting right then can be good too]

The same script can be used for e-mail if the student does not have the professor in class. Below is an example e-mail that most professors would love to receive.

> Dear Dr. [*Professor's LastName*],
>
> I'm a junior Economics major here at [Student's University] and I wanted to meet with you about potentially working with you on an independent research project. I'm interested in working on women's labor force participation in Afghanistan. I studied related topics in my development and labor classes. My hope is to use this independent study as preparation for graduate school.
>
> Would you be available during your office hour 1-2 on Monday or Thursday afternoon?
>
> Regards,
> *[Students Name]*

The paragraph below discusses each sentence and some additions the student might want to make. To begin, the salutation addresses the faculty member as "Dr." and starts with the more formal "dear" (as opposed to "Hi" or "Hey"). Most, although not all, faculty members have a Ph.D., so using the title doctor is likely a safe bet. If the student is not sure, they can always google the professor and see if their Ph.D. is listed on their CV. Calling a faculty member who has not finished their degree "Dr." is unlikely to cause angst. Conversely, many professors with Ph.D.'s strongly prefer being addressed as "Dr." by their students. So, if in doubt use "Dr." In the first sentence, the faculty member now knows the student's year, that they are at their university, and what the e-mail is about. If the student has taken a class with the faculty member, the e-mail might instead say, "I'm a junior Economics major at [Student's University] and was in your Economic Development class last fall." The second sentence indicates a topic. If the student has two somewhat related ideas or wants to be more general, that is fine for the next sentence. The final sentence of the first paragraph tells the faculty member why it would be valuable to the student to do the research.

Note the separate paragraph to ask when the professor would be available to meet. This makes it easier for the professor to see. Offering time during their office hour and an alternative or two means it is much more likely the e-mail gets answered.

When the student meets with the professor, they should be prepared to talk about why they are interested in the proposed topic for a couple of minutes, relevant course work, and plans for post-graduation. Students also want to ask the professor about the professor's experience doing independent studies and if they will be available for the project.

For the Professor:
First, be kind to the student. They have worked up the courage to ask a professor to work with them. If the faculty member is not able to work with them, but still think the student would be a good fit for an independent study, they should recommend other colleagues. If the student is not qualified to do undergraduate research, point them to the classes they need to take. Students with a low GPA would likely benefit from focusing more on courses than individual study, so steer them in that direction, though gently.

At the end of the meeting, if the professor is interested, give the student the below assignment to help evaluate their potential. Make sure to set a due date (this also gives a test if the student is able to meet deadlines). Also talk with the student a little about their research ideas and help them narrow down what they want to work on. Faculty should only have the student do the assignment if they would be willing to accept them as a research student if they do it well.

> <u>The Assignment for Students:</u>
> In one page, double-spaced: Describe your qualifications to undertake an independent research study and your motivation for doing so. Describe one or two topics you would be interested in studying. Discuss a general timeline you envision, including your availability during the summer and next academic year. You may add a second page if you have a specific research idea. The second page would describe the intended data set, the relationship of interest, and a brief discussion of the related literature.

Section 2.F: Writing an Agreement and a Timeline

For the Student:
After completing the assignment described above, the student should continue working with the professor until they find a data set to work with to answer a specific research question. Once this is done, or perhaps even sooner, the student should write up a Memorandum of Understanding (MOU) or an agreement between the student and the professor. The MOU can be as formal or as informal as the student and faculty prefer. However, trying to be a little formal is good practice for the student's future career. Below is a sample for what a MOU would look like, following this guide's proposed structure of work beginning in the early summer through the end of the next academic year. It is also important to understand how an independent study for credit will fit into the student's schedule and if there is any university compensation to the professor.

The MOU should also include a timeline for the project. Table 1 provides a suggested timeline, which runs over the course of a year. A full year gives students time to overcome hurdles, such a taking longer

to find data, having trouble completing the analysis, and doing several revisions to have a paper that can be submitted to an academic journal before the student graduates and starts a job or graduate school. Table 2 presents a condensed timeline for nine months over one academic year. The tradeoff of shortening the timeframe is that there will be less time for doing additional analysis, making revisions after presenting, and polishing the paper to submit to a journal. That said, most of the main skills can be completed over one nine-month academic year. If nine months does not seem feasible, the undergraduate research assistant model may make more sense (see section 2.I)

Table 1: Timeline of a One-Year Independent Study

June	July	August	September	October	November
* Finalize topic *Get data set *Summarize 5-10 Papers	*Clean data *Summarize 5-10 papers	*Descriptive stats *Summarize 5-10 papers	*Create tables *Regression Model	*Outline *Conference abstract submission	*Draft the paper
December	**January**	**February**	**March**	**April**	**May**
*Revise the paper *Let student focus on finals/other work	*Professor: revise with line edits *Recruit thesis committee	*Additional regressions for robustness checks	*Present paper at academic conference *Revise	*Defend thesis *Let student focus on finals/other work	*Submit to journal

Table 2: Timeline of a Condensed Nine-Month Student-led Project

September	**October**	**November**	December	**January**	**February**
* Finalize topic *Get data set *Summarize 5-10 Papers	*Clean data *Summarize 5-10 papers *Conference abstract submission	*Descriptive stats *Summarize 5-10 papers	*Create tables *Regression Model	*Outline	*Draft the paper *Recruit thesis committee

March	**April**	**May**
*Present paper at academic conference * Professor makes line edits	*Revise * Additional regressions for robustness checks	*Defend thesis *Let student focus on finals/other work

Sample MOU:
This Memorandum of Understanding (MOU) is for (student's name)'s independent research project supervised by (professor's name). The project will begin on (date likely in early summer) and is expected to end on (date likely at student's graduation).

(Student's name) agrees to the following:
During the summer, to work X hours a week (5-10 hours) on the project. This includes reviewing the literature, preparing and analyzing data, and writing. The goal by the end of the summer is to have a literature review, descriptive statistics, and all necessary data for the analysis.

During the fall semester, to work Y hours a week on the project (Y should be close to 8-10 hours, i.e., the equivalent of a full class). This includes weekly meetings with the professor, which will typically be at (Find a time that works for both the student and the faculty advisor). Continued

work on the project will include data analysis and writing. (In the one-year version) The goal by the end of the fall semester is to have a completed rough draft of the paper.

During the spring semester, to work Z hours per week on the project (Z might be less if the student is not signed up for the project as a class, but should at least 5 hours). This will include revising the paper based on the professor's comments, presenting the paper at academic conferences or workshops, scheduling and defending a thesis, and finally, submitting the paper to an academic journal at least two weeks before graduation.

The student agrees to work with the professor after graduation to publish the paper.

(Professor's name) agrees to the following:
To maintain regular contact with the student over the summer and provide feedback on all work. To continue to provide guidance so the student is prepared to begin the econometric analysis at the start of the academic year. To make themselves available for weekly meetings with the student and provide timely feedback during the semester. In the spring semester, to help the student prepare for presentation, revise the paper for submission, and give guidance on which journal to submit to. To chair the student's thesis defense. After graduation, to continue to support the student by attempting to publish the article and serving as a reference.

In Case Either Party Fails to Meet These Standards

In the case of the student: If the professor believes the student is not keeping up with the work, the professor must provide two clear warnings that the project is having issues. In these warnings, the professor must provide specific instructions and guidance on how to get back on track. Failure to do so will allow the professor to withdraw their agreement to work with the student after the second warning.

In the case of the professor: If the faculty member does not meet expectations, the student should clearly express what they need. If the faculty member is no longer able to provide that, every effort should be made to find a new faculty member to supervise the project.

The goal of the MOU is to set expectations for the student and the faculty member. The MOU also creates a plan for the entire project that can help the faculty member and the student track progress.

Section 2.G: How to Increase Productivity

Having Good Meetings

The student should e-mail the professor the agenda and completed work sufficiently in advance of each meeting, so the professor has time to review it. The pre-meeting e-mail should not be more than half a page and should provide numbered topics and highlight the major points in a sentence or two. Keep questions short, also to a sentence or two. If the student wants to provide longer pre-meeting notes, they should be in a separate document attached to the e-mail. With pre-meeting documents, the professor may respond over e-mail, potentially saving time. At the end of the meeting, the student

should receive their next assignment with a due date and an agreement on when the work will be sent. Check the MOU to see if the project is on schedule.

Software

As soon as possible, agree on the software that will be used, including statistical and file management. If the student will be using Stata or another software program that needs a license, work on getting it and testing it on their computer as soon as possible. It is highly recommended that the student and professor create a shared drive on a service like Dropbox. This is easy and free up to 2GB, which should be enough for most projects. The cost of a terabyte of storage is under $100 a year and provides a cloud backup in case of hardware failure. Within Dropbox, it is recommended that the student create folders for relevant articles, writing, do files, and data files.

Section 2.H: Literature Review

For the Student:
Before the student starts doing too much of a literature review, ask the professor for some good examples of related papers and look at the literature review or introductions in those papers. Two good resources for starting a literature review are Nikolov (2018) and Romem (2012). Nikolov (2018) has a reading guide with 14 questions to answer when reading an economics paper. Romem (2012) highlights how to find good papers for a literature review using backward and forward searches.

Good empirical papers focus on an important outcome and something that can influence it. The best place to start your literature search is to look for papers that test the same relationship with different groups of people than the ones in your research project. Groups of people can be different countries or ages. If there are many papers also examining the effect of the main influence variable on the same outcome for the same group of people in the same group as the proposed project, the student may need to find a new paper topic. Also helpful are papers that look at the effect of the influence variable on similar outcomes, or the effect of similar influences on the same outcome.

A search of google scholar and EconLit using key words to identify ten potential papers for an annotated bibliography is a good place to start. Send the papers to the professor so they can review them. Save a PDF of the papers in a folder on Dropbox, then create a document with a one-sentence description of each paper and e-mail the document to the professor. Include the file names in the document. The one-sentence descriptions should be an explanation of the effect of A on outcome B (e.g., Hunsberger and Gitter (2015) estimates the effect of college football quarterback production on football revenue). The professor should review the papers and make sure they are relevant. Once the professor says the papers are relevant, use the Nikolov (2018) guide to write one-paragraph summaries of the papers.

For the Professor:

Faculty should spend an hour or two doing a literature search after the student does to make sure they are not missing anything major. Before the student does their search, the professor might give them the names of the major field journals to check. Also check the abstracts of the papers the student wants to review before having them summarize the papers more fully.

2.I: Undergraduate Research Assistant

For the Student: Being an undergraduate research assistant—where the student does a limited scope of work assigned by a faculty member—can be a viable alternative to a student-led research project. Time or financial constraints may prohibit some students from taking on a full academic year student-led project. Some students might not find their interest in economics until their senior year. In this case, being a professor's undergraduate research assistant can be a viable alternative. With a research assistant, the professor will likely choose the project's topic and provide the student with work. This work can include many of the same steps as the student-led project: literature review, data entry and cleaning, regression analysis, and creating presentation slides. It is unlikely that a student would choose the topic or draft sections of the paper, though copy editing might be a task for a research assistant.[5]

One clear advantage of being a research assistant is that the work can be more easily divided, which can help if the student is time constrained and only has a month or a semester to work on a project. Faculty also take control of the most difficult tasks of setting the question, finding the data, and developing the empirical model. A student may only do one of the tasks, while other students or the faculty member do the rest. Starting as a research assistant may be a good first step for a motivated student early in their undergraduate career. The downside is only being a research assistant means the student does not get to experience the entire research project. Also by working on the faculty's topic of choice, the student may be less interested in the project.

Students should have in mind what skills they have that are applicable to being a research assistant when they approach a professor. This could include experience in upper level classes summarizing other literatures or programming knowledge to clean data or run analyses. The student should also think about what they want in return, including financial compensation. Some undergraduate research assistants are paid and some are not, much like internships outside the university. If a student is not paid, they should be learning valuable research skills that can be used to get jobs in the future. Students often are acknowledged in papers as providing assistance, though they would be unlikely to be a co-author if they are a research assistant.

Students interested in finding a research assistant position can approach faculty members in their own institution in a similar manner to that suggested in a previous section (2.E). For those looking for opportunities outside of their own school, a short guide by the Poverty Action Lab (J-PAL 2019A) can help, and the twitter account @Econ_ra posts job ads, though often with a focus on jobs for those who have completed their BA.

For the Professor: Undergraduate research assistant experiences have the potential to increase faculty productivity; that is, the student's output exceeds the faculty member's time spent supervising. Students typically add the most value for tasks that are labor intensive, using the skills a good undergrad would have. Most commonly, this includes data entry or tracking down publicly available data. Students may also have skills, such as web scraping or GIS, that the faculty member lacks. For advanced students, data cleaning, summary, and analysis may also increase productivity.

[5] Typically, in economics, research assistants do not draft sections of the paper and are not credited as co-authors. Instead, research assistants are thanked in the acknowledgements of papers. Other fields have different norms. In lab science, often more co-authors are included, even those who do not draft any of the paper.

The clear advantage of hiring a research assistant for a limited job is that it becomes feasible for students not able to fully commit to a student-led project. This is particularly important for untenured faculty who need to ensure research production. Faculty can also get some of the same altruistic warm glow of mentoring students. Being a research assistant, particularly for students before their senior year, can also be a test run for a full student-led project. One related advantage over the student-led project is that, if the research assistant is not a good fit for the position, the faculty member can end the work without dramatically changing the student's academic plans. The downside is that students do not get the full breadth of a student-led experience. It is also worth noting that students do not always complete the tasks they are assigned, even in cases where they will be paid. To set expectations clearly, faculty can assign a one to two-hour task to evaluate if the student is capable of completing the job.

The type of task and the benefit to the student should influence the pay. In cases where students are not learning new skills, such as data entry, students should be fairly compensated for work. In cases where the student is learning or improving skills, and the faculty member provides mentorship, unpaid work may make sense. Efficiency wage theory applies to student workers too. Unpaid students are more likely to not complete tasks, particularly when not part of a class. It is important to set expectations at the beginning of the project in terms of hours and pay.

Section 3: Empirical Analysis

Section 3.A: Using Theory to Form a Hypothesis

For the Student: Theoretical models are often used to formalize the hypotheses used in empirical analyses in Economics. These models show how people, companies, or countries make choices to optimize their limited resources. To create a model, the student can ask three questions: (1) Who is making the choices? (2) What are their limitations? and (3) How do the people making the choices interact? (Varian, 1997). Next, solve the simplest model with at least one choice to be made and one decision maker. Use simple functions like linear utility or production. Modify the model with simpler or more complex assumptions to understand the relationships in a broader sense. Adjust the assumptions by changing linear utility to Cobb-Douglas or replacing linear production with diminishing returns. The model can also be changed by increasing the number of choices or people. Once the student sees the common relationships in their examples, they can try to write out the ideal model (Varian, 1997).

Students can also develop questions by making small changes to the models they are familiar with. Typically, a small change to a model is adding a single component or adjusting an assumption. For example, in macro, a student might add an additional input to the Solow growth model. In micro, a student might add credit constraints or asymmetric information to the Harris-Todaro model of migration. Once the student has outlined the model, including the inputs, outputs, and key assumptions, share it with the professor and they can help steer the student toward using empirical analysis to test the theory. Or in some cases, the fleshing out of the theory can be the entire thesis without empirical analysis.

If the student is having trouble thinking in terms of functions, they can list the main influencers on the outcome of interest and the expected direction. For example, if the outcome is education in a low-

income country, potential influencers would be family income (+), distance to school (-), and local wages (?). That is, one would expect those with more family income to attend more school (+), and those who have to travel farther to attend less school (-). Some variables like local wages may have an ambiguous effect (?), as local wages provide families more income (+), but increase opportunity cost for children who want to attend school (-).

Section 3.B: Obtaining Data

Data analysis takes time, so it is a good idea to try to have the data ready several months before the end of the project. There are thousands of great datasets out there for students to use that are publicly available. By using a publicly available dataset, students can save the time it would take to collect their own data. The American Economic Association provides links to many data resources with a US focus (AEA, 2019). For those interested in international research, the World Bank microdata library has close to 3,000 surveys (World Bank, 2019), J-PAL has data on close to 200 randomized control trials (J-PAL, 2019B), The International Food Policy Research Institute (which focuses on agriculture) has close to 100 household surveys (IFPRI, 2019), and the Demographic Health Surveys has close to five hundred surveys (DHS, 2019). The student's literature review might also point to datasets. Finally, just googling "household economic surveys and (country name)" can point the way to publicly available datasets.

Some students may wish to collect their own data, but they will face several challenges. Before distributing surveys, students or any researcher must receive approval from an Institutional Review Board (IRB) typically run by a university. The IRB committee will review the survey to make sure that it does not potentially cause harm to the respondents and that there is a protocol for keeping data anonymized. Students who collect their own surveys will need a longer time horizon, as preparing an application and receiving IRB approval will take weeks and possibly months. Additionally, students who administer their own surveys will face several issues such as getting enough data and selection bias, i.e., the students who answer the survey may not reflect the population as a whole. The process is similar for doing experiments where subjects come into a lab to play games, as in game-theory type games (e.g., dictator or public goods game). Advice for experiments is beyond the scope of this paper. Finally, students can collect their own data through web scraping or finding and entering their own data from historical records. Both methods take advanced skills and time, which may extend the project.

For the Student:

1. Consult the professor about the research question before searching for data.

2. It helps to have a country, outcome variables, and independent variables in mind before beginning a search.

3. Keep in mind if the survey year is important. If the study is trying to measure the effect of the 2015 earthquake in Nepal on education, some of the data needs to have been collected after the earthquake.
4. Check to see if the data has multiple years, and if it does, whether it is a panel (same people surveyed every year) or a repeated cross section (new people every year).

5. If it looks like a panel, google around or look up the funding agency. Future versions of the panel might be available.

6. After finding the data, check in again with the professor with a very brief summary (less than a paragraph) of the potential data set. After that, spend 1-2 hours each on steps 7-9 (below). Hopefully some steps take less time. Students who get stuck should ask their advisor for help.

Once the student has the data:

7. Look at the questionnaire usually available on the website hosting the data. Does it have questions related to the research topic? Many questionnaires are dozens of pages long. Start by using the find command to look for relevant questions by searching key words related to the topic of interest.

8. Many datasets have a report that summarizes all the variables. Read the introduction and the survey design section, plus the sections relevant to the data.

9. Download and view the data as soon as possible.

10. Make summary stats, such as means, frequencies, and maybe even cross-tabs, for the main variables of interest to ensure the needed data is there. Also make sure there is enough variation and sample size for the study. For example, if the study pertains to microcredit and only 5 households received it during the survey period, then probably another dataset or question is needed.

For the Professor:

1. Give the student an opportunity to search some of the data libraries listed in the first paragraph of this section. If the student is unable to find a dataset after a few hours of searching, the professor can search with the student.

2. It is tempting to give a student a dataset that the faculty member has already worked with. This may be a good idea if time is limited and the student is very interested in the topic. The tradeoff is the student may be less interested in the topic if they do not find it themselves.

3. Have the student write short summaries of what they find in the questionnaire, the survey report, and their initial data analysis.

4. Do the initial data work as soon as possible. The goal is to make sure the study is feasible. Having access to the data and initial descriptive statistics show that the study can be done.

Non-Public Data:
Given the abundance of publicly available data, students should be cautious when requesting access to non-public data, that is, data not available for use without the consent of the owner such as a company

or organization. In some cases, a researcher or organization may need permission or want to sign a MOU about how the data will be used. Using non-public data sometimes works when the faculty member has a good connection or other researchers have received the data. Using non-public data may be worth the wait if the data is specialized, and using the data will help build a relationship with the researcher or organization. That said, experienced researchers know that it is all too common to be strung along for months never to receive data, which was originally promised as being "no trouble" to share. In short, if the student has time and a dataset looks promising, try to get it, but if it is taking more than a couple of weeks to get the data, then start making a backup plan with publicly available data.

Section 3.C: Cleaning and Preparing Data

For the Student:
Economists sometimes use the term "data cleaning" to mean correcting any errors in the dataset. It can also mean preparing the dataset for the regressions. The most important thing is to document the steps from the original dataset to the final one used in the regressions, so that another researcher or the faculty supervisor can recreate and understand all the choices. In some cases, there is no "right" way to clean data, though there are certainly times that it can be "wrong." For example, the variables should be defined as described in the paper, and clearly wrong data (e.g., 437-year-old children) should be addressed.

Many economists use Stata for data cleaning and analysis. A set of slides by Salomons (2013) is a good place to start. Rodríguez (2018) also has an extensive online guide for Stata. For shorter guides, Gross (2016) has a list of best practices, and Grogan-Kaylor (2019) has a 2-page Stata guide. A slightly old, though excellent, guide to Stata from Forrest (2008) is good for more Stata info. Economists also use R for data analysis, among other programs. Ismay and Kim (2019) provides the basics to analyze data in R, including data cleaning, graphing, and regression. R has a thriving online community, so students wishing to learn more can likely find other resources.

For students who run into issues with Stata or R, the first thing to do is google the problem. Next, try for 30 minutes to an hour to solve the issue alone, using google and help menus. After that, the student should ask their professor or another student for help. A brief set of tips specific to Stata is provided in Appendix A.

For the Professor:

1. Assess the student's programming skills before having them start work. Questions to ask: can they open a dataset, summarize variables, and merge data?

2. Put the data work into small chunks (variable creation, descriptive stats, regressions) and check in often.

3. Go over the student's work and rerun their code. Does it make sense? Even better, independently replicate the results and compare them to the student's results.

4. Set the student's expectations of when to ask for help.

5. If working with multiple students, put students into small groups that can help each other.

Section 3.D: Econometrics Analysis

Woolley (2014) has a great blog post on "Why do beginner econometricians get worked up about the wrong things?" Those wrong things are generally the specifics of some complicated econometric technique. Woolley argues that students should be more concerned with making sure they get the basics right.

For the Student:

Woolley suggests four main things to keep in mind:

1. Dealing with missing values. Does the analysis drop observations due to missing data in a less important variable? For example, if the analysis controls for spouse's education in a measure of food consumption, then only married households can be used.

2. Defining the sample. Does the sample actually consist of the people who would likely be influenced? For example, if the study is measuring the effect of building schools on current school attendance, the analysis should exclude older adults from the sample who would not attend school regardless.

3. What variables should be included? For each variable, the student should be able to write a sentence about why the variable might have an impact.

4. Spot any endogenous regressors. This is the most difficult one and takes many years of experience. Look for all three main types of endogeneity described below. The outline and final draft should discuss how these have been considered by going through the potential for each type of endogeneity directly.

    a. Simultaneity or Reverse Causality. Simultaneity is where the dependent variable also determines the independent variable. For example, assume a study tried to predict sales based on advertising. Even if advertising increased sales, the reverse is also likely to be true, in that companies with higher sales have larger advertising budgets. Reverse causality is when the defined dependent variable influences the independent variable, but not the other way around. An example of reverse causality could occur if a study measured how quitting smoking influences the probability of dying from cancer. If

people only quit smoking once they are diagnosed with cancer, then the effect is actually going in the reverse direction from the intended measurement.

b. Omitted variable bias. Omitted variables are those variables not in the model that both correlate with other independent variables and determine the outcome variable. For example, if a study is estimating the effect of education on wages, a person's ability might be an omitted variable. That is, high-ability people will go to more school, so the two are correlated, and high-ability people earn more even controlling for education. A basic primer is provided by Albert (2019) and a more detailed one by Cunningham (2019).

c. Measurement error. This becomes a problem when measurement error is correlated with one of the predictors. An example of this problem could occur when estimating the relationship between agricultural jobs and yearly income based on earnings in the previous month. The measurement error of yearly income based on monthly data will depend on the job type. For agricultural workers, income is higher in the harvest season than in the rest of the year, while non-agricultural workers are more likely to have a steady income. The analysis would obtain different estimates of the relationship between agricultural or other jobs and income depending on if the data was collected in a harvest or non-harvest month.

In response to Woolley's post, Bellemare (2014a) laid out three "bigger picture" things to consider:

1. Internal validity: Is the study measuring a causal relationship? The student should think carefully as to whether the independent variable is actually causing the outcome.

2. External validity: Is the relationship being tested applicable to other situations? For example, if the analysis tests the relationship between the variation in native language spoken of teammates and goals scored for a hockey team and find no effect, this might not indicate that the same relationship would be found for workers at a restaurant or other settings.

3. Precision: Is the estimated relationship precise? Dudenhefer (2009) has a good list of checks (use of fixed effects, weights, autocorrelation, multicollinearity, and heteroskedasticity).

For the Professor:

1. Have the student make a table or list of all the variables and their definitions, with short sentences on why each variable should influence the outcome variable. There should also be summary statistics, including the number of observations for all potential variables of interest, before proposing regressions. Looking at the number of observations will help determine if missing data is an issue.

2. Have the student write a sentence or two about which part of the sample should be used. For individual data, gender, age, and geography are the most common ways to divide the sample.

Have the students explain if they believe the effect they are trying to measure will be seen for all groups.

3. Have a conversation about the potential for endogeneity. At this point, it is worth lowering the standard for the student-led project from what is publishable in a top journal to what is reasonable for a thesis. The professor can teach the student that some endogeneity might be possible and it just might need to be acknowledged.

4. Have the student write out where else they think the question might be applicable and consider external validity.

5. After the student has completed steps 1-4 to satisfaction, have the student write out the regression equation. Address the question with a plan for the analysis, as raised by Dudenhefer (2009).

Section 4: Writing

Section 4.A: Writing an Outline

Chaubey (2018) provides a good structure for writing an outline using the RAP method (Research question, Answer, Position in the literature). Each paragraph or section needs a heading to tell the reader what the purpose is, and takeaways to explain what the student hopes the reader learns after reading it. A good test is to have students look over each other's outlines to see if they can easily figure out the Research Question, Answer, and Position (RAP).

For the Student:

There are six main sections in empirical economics papers that should be in an outline: Introduction, Conceptual Framework/Theory, Data Description, Econometric Model, Results, and Conclusion. See Mascarenhas and Crouter (2008).

1. Introduction: A great place to start is Keith Head's (2018) introduction formula, which consists of five parts: the hook (why the topic matters), the question, the antecedents (lit review), the value added (what is novel about the paper), and the road map.

2. Conceptual Framework/Theory: This section should lay out the evidence for why the X in the study might affect Y. This can be done by citing previous literature, describing the potential mechanism for the effect, or creating a theoretical model (see Section 3.A above).

For the next sections, some good resources are Bellemare's (2018) blog post on the middle bits of a paper, Dudenhefer (2009), and Nikolov (2013).

3. Data Description: The general idea is to talk about the "5Ws." Who was asked, what were they asked (define the variables), where was the survey (is it representative), when was the survey given (year and relationship to relevant events), and how was it administered. Present the

descriptive statistics, and use them to tell a story. Finally, a graph to set up the results is a useful connection to the econometric analysis.

4. Empirical Framework (Econometric Model): This is mostly about the regression equation the study will use. The same resources listed above for data description are very useful. Bellemare (2018) and Nikolov (2013) suggest starting with the simplest regression and explaining why it might need to be changed.

5. Results: Start with a paragraph summarizing the results. Have separate paragraphs for each additional variable or model.

6. Conclusion: Bellemare's (2018) conclusion formula is excellent. It suggests four sections: summary, limitations, policy implications, and implications for future research.

For the Professor:

1. If working with more than one student, have them give each other advice on their outlines using Chaubey's (2018) RAP formula. This will help students realize the low-hanging fruit in edits of their own projects.

2. Review the student's outline before they begin drafting to ensure they are on track.

3. Writing still takes time. The student needs a first draft at least one month prior to the final draft. Faculty can cut that time in half if it is during the summer and the student is focused on the project.

Section 4.B: Writing the Paper

Before crafting sentences and paragraphs, there should be a complete outline that the faculty member has approved. The outline should include all of the tables that will go in the first draft and each of the six main sections of the paper (see "For the Student" in the previous section). The student can draft sections one at a time and get feedback from a peer and the professor, if possible, before going on to another section. The feedback should be general as opposed to line and grammar edits. Starting with the introduction helps, as it is usually the most important part of the paper, and writing it is like giving a narrative outline. After the introduction, students can draft the data description and results section, then edit the introduction again based on this. Students can then write up the literature review section. Having the literature review section toward the end of the writing process means that it can focus on placing the results found in the student's study within the literature, rather than just describing the literature. Finally, after editing all of the sections again, the conclusion can be drafted last.

For the Student:

1. A typical economics paper is 6,000 to 10,000 words, including tables and references. Students can check some of the works in the literature review to get an idea. This means that the aim should be about 1,000 words per section. The literature review and conclusion sections will likely be shorter than 1,000 words.

2. Chaubey (2018) is extremely helpful in discussing how to turn an outline into paragraphs. As she points out, each paragraph should start with a sentence that encapsulates the main idea of that paragraph.

3. First drafts are generally bad. The student should worry less about specific writing advice before they dive into it. The student can improve their productivity by figuring out what works best for them in terms of their biological rhythms of writing. Many writers find there is a particular time of day that works best for them. The student might also look into the promodoro technique, where time is divided into working for 25 minutes and a 5-minute break, with longer breaks after 2 hours.

4. Students generally have experience writing papers for other classes. Neugeboren and Jacobson (2005) offers some good suggestions for those new to writing in economics. Examples include: use the active voice, use positive statements, and omit needless words.

5. Economists are direct. The one place where this is less true is when considering whether something caused something else. In economic analyses, variables often approximate what we would like to test if, like the physical sciences, we could test the relationships in a lab setting. Because of this, economists are less likely to use terms like “caused” or “led to.” Instead, they use terms such as “associated with” or “is consistent with.”

For the Professor:

1. When providing feedback to students on their first draft, start by making only bigger-picture comments instead of grammar or word-choice comments. The comment feature in Microsoft Word is helpful for marking up a paper. Ask the student to respond to the comment with how they addressed it when turning in a revised draft. Professors can give the student oral feedback during meetings if they do not have time to write out comments.

2. Providing quick feedback is important and can save time. Provide feedback on each section before the student writes another one so they do not get off track. Also reread the whole paper each time and give feedback. This means the student’s introduction might get five to six sets of comments from the faculty member. This is often a new experience for students used to only getting comments on one rough draft for courses.

3. Make sure to include other students in the process of giving feedback. This teaches both the one receiving feedback and the one giving feedback.

4. The professor should make sure to set the due dates such that they have time to comment when they get drafts.
5. Consider giving only comments and not directly editing until after the student has presented the paper, and sometimes, after their thesis. This helps ensure that the submission is as much of the student's own work as possible. After the thesis and comments from presentations, the professor can edit individual words to help turn the paper into a co-authored journal article.

Section 5: Post Writing

Section 5.A: Presenting

Students who present their research get practice communicating their ideas. This is important, as research experience can be used in job interviews to demonstrate valuable skills. These include the ability to work independently and the ability to communicate the ideas in a study. Many schools have a poster symposium for student research. Students doing independent research can also give presentations to relevant classes, particularly those that might be a good pipeline for future research students, such as econometrics or statistics classes. The more expensive option is to travel to a conference. There are specific economics conferences or sessions within conferences for undergraduate researchers. Regional economics conferences (e.g., Southern, Eastern, Midwestern, and Western Economic Associations) are all affordable and have undergraduate paper sessions.

For the Student:

1. There are lots of great materials on how to present. Jackson (1998) has a formal write-up, Bellemare (2014b) has a good guide of 22 rules, Pacheco-Vega (2018) has a 12-tip guide focused on short talks, and Schwabish (2016) has a book on presentations. For posters, the American Agricultural Economics Association (2012) has some suggestions and examples.

2. The most important thing to know for the student is what level of economic knowledge the audience has and the amount of time allotted for the presentation.

3. The student should bring a copy of the paper and have something to take notes on when asked questions.

4. Consider other tangible benefits of presenting. If it is at a conference, then think about trying to meet other people, in particular students going through similar experiences. One good way to meet someone is to attend their talk and try to meet them afterwards.

5. Students in an undergraduate paper session might try to organize a small get-together (dinner or coffee) before or after the session.

6. The student's university may have funding for travel to conferences. This can help offset the cost of a conference, which can easily approach $1,000 (e.g., registration ($100), hotels ($100 per night), air travel ($300-$500), and food). If the student cannot get funds to cover the travel, they should think carefully if money and time might be better spent elsewhere.

For the Professor:

1. Submitting to conferences takes planning, as most conferences take abstracts months in advance of the sessions. Suggest conference opportunities to the student early.

2. First, have the student outline their talk before presenting. Next, review the student's slides with them. Finally, have the student do a test presentation to a small audience including other students. This could include having the student present in a related class.

3. The student might need help figuring out how to network at a conference or poster session. It is best if the professor can be there with them, though time and money may not allow it. If the professor cannot be there, they can work on a strategy with the student, including going through the program.

Section 5.B: Thesis Defense

Many students will want their research project to be included as part of a thesis for honors or a capstone project. There are several steps to this process, with some similarities and differences to presenting at a conference.

For the Student:

1. Typically a thesis needs a committee of faculty members (3-5) to evaluate it. This includes the main faculty advisor. Students can ask their advisor for help selecting other faculty members at the beginning of the semester they plan to defend their thesis. It is ideal to get commitments from other committee members at least a few months in advance.

2. Just like selecting an advisor, it makes a lot of sense for students to ask professors from whom they have taken classes.

3. Students want faculty on their committee that are willing to help and that complement their advisor. Good committee members to look for are an econometrics professor, professors from other departments with similar interests, and economics professors in fields related to the project. Also, assistant professors who are recently out of graduate school will be more up-to-date on the latest techniques.

4. When asking a faculty member to be on a committee, students should give the prospective member an abstract and a timeline early on.

5. At least one month in advance of the defense, students should confirm a defense date and time that all of the committee members can attend. Also, do not schedule the defense during the last week of class. Make sure to leave some time at the end of the semester in case someone needs to reschedule.

6. Students should check in with their committee regularly to ask if they are interested in reviewing earlier drafts and, if so, how long they need to review a draft. Most students share their draft with the whole committee one to two weeks prior to the defense.

7. The defense typically consists of a presentation of the work. Many undergraduate thesis defenses have an open part where the public can attend. Students can often invite friends and family to share their work.

8. Make sure to bring all the university paperwork needed and a pen to get signatures if all goes well.

9. The student should know their audience and the logistics. How much time will they have? What are the expectations?

10. Students will be better prepared if they practice their talk. Even better, practice the talk in the room where the defense will take place. Current or future thesis students can be a great audience.

11. At the defense, the student will first present to everyone and take some questions. Once the student has finished the talk, the non-committee members will be asked to leave. At this point, the committee will likely ask the student more questions. The student might not have all the answers, and saying "I don't know" is sometimes a good answer. After the questioning, the student typically leaves while the committee discusses their evaluation.

12. The student may pass with no revisions, in which case they can have everyone sign the forms there. If the student needs revisions, sometimes the other committee members will sign, and the advisor will withhold their signature until the student completes the revisions. In other cases, a committee member might want to review the revisions, in which case the student should set up a plan for the revisions as soon as possible.

13. Celebrate! Students should take the defense as an opportunity to celebrate the accomplishment.

For the Professor:

1. Faculty can help students by choosing committee members that will give them feedback in areas that their advisor lacks. Thesis committees are also relatively easy service commitments for junior faculty.

2. Make sure the student schedules a thesis defense date at least one month in advance, so scheduling is not an issue. Still, expect the date to be rescheduled, and make sure to leave a buffer at the end of the semester.
3. Help the student reserve a room for the presentation. Do this just after they confirm the date and time.
4. Make sure the student has the necessary paperwork once the thesis is complete.
5. Give feedback on a practice run of their presentation.
6. Settle on a defense format with the other committee members ahead of the defense. A typical format is 20-30 minutes of presentation, 15 minutes of audience questions, 15-30 minutes of committee questions, and 5-15 minutes of deliberation.
7. Help the student plan a post-thesis celebration.

Section 5.C: Submitting the Paper to a Journal

Think carefully about the incentives to the student and the faculty member about publishing a co-authored journal article. There are some returns, though it is important to remember that the process is extremely long. At best, an article will be accepted within six months to a year of the first submission. Fenn et al. (2010) shows the process can take up to four years.

A presentation by Beatty and Shimshack (2017) provides an overview of the process. A paper is first submitted to an academic journal. The editor will briefly review the paper, and may reject it (this is called a desk rejection) or send it on to anonymous reviewers. Reviews typically take three to six months and are 1-2 page critiques of the work. Reviewers may recommend rejecting, requesting revisions, or in rare cases, accepting. At many economics journals, the majority of papers get rejected. In the usual best case scenario, the paper gets a revision request where the author(s) responds to each of the reviewers' comments and edits the paper based on their suggestions. Upon resubmission, the editor will either accept the paper or ask for even more revisions. It is becoming increasingly common to have a second round or third round of revisions. Unfortunately, each round takes a few months, and this adds up to years of time.

Two important questions are deciding who is an author on the paper and the author order. To learn the process of doing research, faculty might consider having their students do their thesis as solo authors and then work with them to turn the thesis into a work co-authored with the faculty advisor. In terms of author order, students might be listed first if they have done the majority of the work, though the norms are unclear.

For the Student:

The student's thesis may have taken a year to complete already, but getting an accepted journal article can take close to another year even if everything goes right.

1. The benefit of submitting the paper to an academic journal is getting outside feedback and having external validation for the work. This will likely help the student in getting into graduate school or finding a job.

2. There are undergraduate economics journals. These often have shorter review times and higher acceptance rates.

3. Most employers cannot distinguish between journal quality. If the student is not considering graduate school, then an undergraduate journal is probably preferable.

4. Graduate school admissions committees, on the other hand, know about journal quality. If the student is considering graduate school, they may prefer to submit to an academic journal.

5. The Committee on the Status of Women in the Economics Profession (CSWEP) (2011) has a good writeup of tips and the process of getting published in economics.

6. The student should consider the advisor's incentives to publish. Publishing with student may help the faculty advisor get extra merit pay or resources

For the Professor:

1. After graduation, students will have other priorities. Be realistic about the student's ability to continue working on the project after graduation.

2. Given the student's timeline, it may be advisable to target journals with higher acceptance rates even if the journals are of lower quality.

3. If the paper is aimed at a higher level journal, the faculty member will likely have to take on the burden of going from thesis to published paper.

Section 5.D: Reaping the Benefits of the Research

*For the Student***:**

It is important for students to communicate the skills they have learned to potential graduate schools and employers. When applying to graduate schools, students can work with their advisor to craft their personal statement, which should include a paragraph on the work they did and how it will influence their future work in graduate school. Students might also consider looking at their works cited with their advisor to help choose where to apply to graduate school. This can help demonstrate that a student's research interest clearly aligns with the potential graduate school.

When applying for jobs, students can list their research project under their experience, similar to a job entry, by listing the specific tasks they did, particularly in terms of data work. Students should note the software used. Also, students can work with their advisor to craft a paragraph about the experience for cover letters to employers. Students should make sure to practice talking about their work with non-academics in their field to prepare for job interviews.

Finally, students should ask their advisor to serve as a letter writer for graduate school applications and/or as a reference for job applications. Make sure to give the faculty member ample lead time to write letters (a month is best) and to get their permission before listing them as a reference.

For the Professor:

Think about how to promote the work to gain resources internally and externally for future work with students. Creating a successful undergraduate research program can take years. The good news is that past or current students are the best recruiting tool for future student projects. Have students help in the recruiting process by identifying potential collaborators or helping the faculty member advertise in classes. Stay in contact with the students once they leave. Good ways to keep in touch include an annual end-of-the-year e-mail update or inviting former students to a campus event. Maintaining contact can help raise outside funds, as examples of successful students help funding applications. Internally, faculty can highlight the work in their annual review, which may facilitate tenure and promotion. Some professors even indicate on their CV which papers were co-authored with students.

Section 6: Conclusion

This guide has laid out the steps of an undergraduate student-led empirical economics research project, from choosing a question to publishing in a peer reviewed journal. Students and faculty hopefully will find this experience rewarding to their careers. That said, a clear limitation of the model proposed in this paper is the large amount of time students and faculty must spend in order to complete the project. The commitment is more likely to be beyond the time constraints of first generation and/or underrepresented minorities. Without financial support for these groups, providing such opportunities could further enhance the inequality of opportunities.

This guide focuses on projects with students analyzing data that has already been collected, with limited attention to data collection or purely theoretical work. More resources are needed to guide students on how to collect data or do theoretical work. This paper also focuses on student-led projects. More resources could potentially focus on how to do a shorter research assistant position from both the student and professor's perspective.

Finally, this guide only provides anecdotal and qualitative evidence that student-led research projects are transformative. One could empirically test the long-term effects on students (future wages, job satisfaction, and graduate school) and faculty (job satisfaction, promotion, and research output) of increasing student-led research. This guide provides a model for those seeking to undertake such a project and hopefully will lead to an increase in faculty doing student-led research.

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Appendix A:

Below are some tips for working in Stata.

Recommended Steps:

1. Save a copy of the untouched data in a separate folder. **Never ever ever ever…etc. touch this data again except to copy it.** The idea is that if somehow the original file is accidentally changed, there is a backup copy.

2. Open the copy of the original data in STATA. This can be done with the pull-down menus under the file (see the Kaylor 1-pager). The use command and the file path for the data file will be shown in the output window. Below is an example from my work. "C:" is the drive the file is saved on, the words in between the backslashes ("\") are folder names, and the file name is at the end.

```
use "C:\Users\smith\Dropbox\Ebola\data\ebola_cases_2_19_2018.dta", clear
```

3. Next, I would suggest following Salomon's slides to make a *do file* that
   a. Creates the variables needed (always label new variables and check if they work);
   b. Runs descriptive statistics (e.g., means, max, min, and standard errors); and
   c. Puts all the variables in format so that each row is an observation that can be used to run a regression.

4. Find the needed variables in the dataset by browsing the data. If the names do not directly indicate the variable, change their names, as Gross suggests. The student can use the rename command. E.g., if household ID is variable A1, rename it "ID."

5. As the Gross guide suggests, the student should "comment" on everything. That is, if they create a new variable, explain what it means in a comment. Err on the side of too many comments.

6. As Gross suggests, make the code portable. If the student does it right, the professor should only have to change the first line of code and can comment on the code. Once the student figures out the professor's file path, a nice gesture is to always put it in, so they just have to comment the student's out. The first two lines of code might be:

```
*Cd "C:\Users\profname\Dropbox\projectname\data\ "
cd "C:\Users\studentname\Dropbox\projectname\data\ "
```

7. Check the work. Gross suggests summarizing all new variables to make sure they are logical. Marc Bellemare (2015) suggests replicating the work in his post on data cleaning.