STUDENT PRECONCEPTIONS AND LEARNING ECONOMIC REASONING

Isabel Busom[a]
Universitat Autonoma de Barcelona

Cristina Lopez-Mayan[b]
Universitat Autonoma de Barcelona and BGSE

December 2015

Abstract

Economic views held by the general public tend to differ significantly from those of economic experts. To what extent would these differences fade away if people were exposed to economic instruction? In this paper we identify first-year college students' initial preconceptions about economic issues, explore some cognitive biases behind them, verify their persistence, and test whether beliefs are correlated to course performance. We conduct a survey at the beginning and the end of the semester on a sample of students taking an economic principles course. We find evidence of preconception persistence, inconsistencies and self-serving bias. Most students do not incorporate the newly learned tools into their thinking process, even if they perform well. Many economics senior students have some beliefs that are contradicted in a principles course. Instruction in economics could be more efficient if it explicitly addressed students' preconceptions and biases, a path already taken in other disciplines.

JEL Classification: A12, A20, I21, Y8

Keywords: Economic education; student beliefs; cognitive bias; psychology; teaching of economics

[a] isabel.busom@uab.es, Departament d'Economia Aplicada (Universitat Autonoma de Barcelona) Edifici B- Campus UAB, 08193 Bellaterra, Spain. Phone: (+34) 935812206.
[b] clopezmayan@gmail.com (Corresponding author), Department of Economics (Universitat Autonoma de Barcelona) Edifici B- Campus UAB, 08193 Bellaterra, Spain. Phone: (+34) 935814685.

1. Introduction

The first day of the semester, 81% of our first year college students in the Principles of Economics class believed that establishing rent controls would allow more people to have access to housing. What we teach them later in the semester about the effects of price controls in competitive markets is in sharp contrast with this belief. Will taking a course in economics change it?

That differences between the economic views of economists and the general public can be large has been documented by Caplan (2002), Jacob et al. (2011) and Sapienza and Zingales (2013), among others. This is to be expected because understanding how the economy works is hard and the public generally is not exposed to systematic economic analysis. We would hope that if it were, differences would practically disappear, except for some type of normative issues, such as those related to redistribution and fairness (Haferkamp et al. 2009).

The optimism underlying this view, however, is challenged by our observation that at the end of the term, after being exposed to a standard course on economic principles, 73% of our students still believed that rent controls would make housing accessible to more people. Why do only a small percentage of young, smart college students change their minds after being exposed to rigorous economic analysis, and often to evidence, for some months?

Empirical studies have tested a range of hypotheses to explain college students' performance: class size, instructor and student characteristics and instruction methods -class experiments, on-line or computer-assisted, chalk and talk-.[1] But even if students perform well in exams, they may not have integrated the newly learned reasoning tools into their daily thinking about economic issues. Students may just study for the exam and whatever they learn may be short-lived. Whether students' beliefs change after taking a principles course in economics, and whether exam performance is associated with potential changes are unexplored questions in economic education research.

Studies in cognitive psychology show that a variety of cognitive biases affect our intuitions and beliefs about how the world works. Prior beliefs -preconceptions- and misconceptions -beliefs that can be contradicted by systematic reasoning and evidence- may be deeply entrenched and even prevent learning. That college students bring pre and misperceptions to the classroom has been acknowledged for some time in fields such as psychology (Lilienfeld 2010), physics (Hammer 1996), chemistry (Nakhleh 1992), and maths (Lucariello et al., 2014). We do not have any reason to expect economics to be an exception: if anything, preconceptions

[1] See Allgood et al. (2015) for an extensive survey of research on teaching economics to undergraduates.

about economic issues may be even stronger, as these issues are frequently debated in the media and in the political arena, as well as at family dinners.

Scholars in the fields mentioned above have been concerned about students' beliefs and misconceptions and how to address them to increase teaching effectiveness. In a series of studies they have identified common misconceptions and investigated specific teaching strategies. Kowalski and Taylor (2009) and Lilienfeld (2010), for instance, obtain evidence that uncovering and explicitly addressing pre and misconceptions in psychology may contribute to more effective learning.

In this paper we contribute to this literature by focusing on economic beliefs of college students. We first present the results of a survey we conducted to identify some student preconceptions and potential biases regarding economic issues; second, we investigate whether they change over the course of the semester -i.e., the extent of persistence-; and third, we check whether preconceptions are correlated with student course performance or with previous exposure to economics.

We find that while some preconceptions are aligned with predictions of economic models, others are in clear contradiction. Most preconceptions are highly persistent, and students stick to them even if they perform well in exams. From this evidence we conclude that approaching students' preconceptions explicitly in class may improve economics teaching effectiveness, as has been proven in other scientific fields. The next step is to experiment with ways of doing it.

The paper is organized as follows. In section 2 we review previous evidence on economic perceptions; in section 3 we explain the design of our survey; in section 4 we describe our results, and discuss and conclude in section 5.

2. What we know about economic opinions: Some evidence

Average citizens' opinions about economic issues are in general quite different from those of economists in academics (Caplan (2002), Jacob et al. (2011)). Recently, Sapienza and Zingales (2013) (hereafter S&Z) use information from two surveys conducted from December 2011 to December 2012 in the US to analyze and compare the views on economic policy issues by average Americans and a panel of economists working at top universities in the US.[2] Given a

[2] S&Z use the Chicago Booth Kellogg School Financial Trust Index survey (FTI hereafter) and the Economic Expert Panel of the Initiative on Global Markets at University of Chicago Booth School of Business (http://www.igmchicago.org/igm-economic-experts-panel), EEP hereafter. Gordon and Dahl

common set of economic policy statements, they find that opinions of a representative sample of U.S. population differ significantly from those of the panel of economists.

S&Z also find that these differences are larger on topics where economists agree the most. To test whether differences between economists and the general public arise because of an information or knowledge gap they compare the answers obtained in two different waves of the survey. In one wave the statements were formulated directly, whereas in the other respondents were given information about the experts' degree of consensus with respect to that particular statement before the respondent's view was solicited. When average Americans are informed about the experts' opinion, their answers barely vary. S&Z conclude that on average the information gap does not explain opinion differences across both samples.

In our view, the irrelevance of experts' opinion for the general public may be the outcome of different mechanisms. One possibility is that citizens do not trust economic experts in the aftermath of the economic crisis, since the survey was conducted between December 2011 and December 2012. A second possibility is that the information gap persists because of what psychologists call *confirmation bias*.[3] Since respondents are informed about the experts' view just seconds before being asked to provide an answer, they tend to retain only the experts' opinion when it matches their prior. An open question is which of these mechanisms –lack of trust and confirmation bias- can explain the irrelevance of experts' opinion and consequently to what extent they can be mitigated through training in economics.

S&Z then argue that another possible explanation for the differences between economists and the general public is that experts perceive and answer the questions differently. They find that the implicit degree of trust in government affects the answers of the general public, while it does not affect the answers of economists, except when the government is explicitly mentioned in the statement. Could this outcome be attributed, again, to lack of training in economics, which disciplines the mind by using models that obtain predictions that are independent of the researcher's beliefs? Caplan (2002) provides some evidence in this respect, as he finds that controlling for education, for self-serving bias and ideology and for economic training reduces the opinion gap between economists and the public.

But, to the best of our knowledge, the question about to what extent economic preconceptions would change by exposing people, in particular students, to economic training

(2013) use EEP to discuss differences in views among economists, but for our purposes the relevant differences are those between experts and non-experts.

[3] Confirmation bias is the tendency to prefer corroborative rather than refuting evidence on one's beliefs. See Kahneman (2011, pp. 80-81).

has not been investigated. In our study we identify economic preconceptions that students bring to the classroom and analyze to what extent instruction affects those beliefs. Most of the previous literature has measured, instead, the change in students' performance before and after taking a principles course in economics. The Test of Understanding College Economics (TUCE), developed and conducted in the US, is a tool designed to that end. The test questions cover the core topics of a standard principles course, with 30 items for micro and 30 for macro topics. Walstad and Rebeck (2008) conduct the TUCE on a large sample of students from about 40 US institutions of higher education. Students took the test at the beginning (pretest) and at the end (posttest) of the fall semester of 2005. After cross-tabulating test scores with student characteristics, Walstad and Rebeck conclude that "performance on the test is responsive to economics instruction". However, the test is not designed to identify student preconceptions but to measure how well the students do in applying concepts in an exam. An open question is still whether this improvement in test scores means that understanding is both persistent and deep enough to affect student preconceptions on economic issues.

Goffe (2013) is concerned about students' factual misconceptions, which he defines as "specific incorrect facts that students bring to the classroom", and suggests the hypothesis that misconceptions may hinder learning. To identify factual misconceptions, Goffe designs a questionnaire that includes mostly factual questions on micro and macro issues, as well as some on perceptions about expected living standards and impact of immigration. He surveys 255 students in a macro principles class at the State University of New York and uncovers a number of misconceptions. For instance, he finds that the median student believes that 35% of workers earn the minimum wage, while according to the Bureau of Labor Statistics, less than 2% of all workers earn it. Bice et al. (2014) explore students' misconceptions using a slightly modified version of Goffe's questionnaire. They survey students in macro and micro principles classes from eight US institutions of higher education. Like Goffe (2013), they find notable preconceptions among students. However, neither Goffe nor Bice et al. conduct the survey at the end of the semester and it is thus not possible to assess whether economic instruction makes a difference. Cipriani et al. (2009) analyze the effect of economic training on Italian students' responses to a small number of questions that raise efficiency and fairness trade-offs. They compare however students in different grades, not the same group of students over time.

We contribute to this research by identifying economic preconceptions and misconceptions of first year college students. We explore how close their beliefs are to those of the general public and economic experts, and whether, after becoming familiar with basic economic

models, their preconceptions change. We also investigate whether students answer exam questions correctly just to get a good grade or please the instructor but without revising their preconceptions.

3. Questionnaire design

To capture the extent to which formal training permeates students' thinking about economic issues -in other words, whether intuitive thinking is replaced by elaborate thinking-, we carry out a survey to elicit students' preconceptions at the beginning and at the end of the semester. The questionnaire includes nineteen statements about economic issues. For comparative purposes, we use a subset of the statements in S&Z's study (see Table A1). This will allow us to measure how close the preconceptions of students starting college in a European country are to those of US citizens or those of experts given the socio-economic differences across societies.

Some statements are related to views about specific government policies; others are about the private sector. We have to adapt the wording of some of them. Where the original reads: "The typical chief executive officer of a corporation in the US is paid more than the value they add to the firm", we just replace US for Spain. We split one statement that reads "Do you think big financial firms are big because…? a) their large size allows them to be more efficient and obtain greater profits; b) there are political benefits of being large" into two separate statements. Because some statements in the FTI survey relate to very specific US policies and cannot be used in our context, we replace them with two new but similar statements (S16, S18).

We include eight new items with the purpose of eliciting opinions on topics that are covered in an economic principles course or of detecting potential cognitive biases. Two new statements (S1, S2) relate to the expected impact of rent controls (price ceilings) and minimum wages (price floors). We want to check, first, whether the answers are coherent across both questions: are students' intuitions consistent with what in our words are respectively an excess demand and an excess supply problem, or only with one of them, revealing some type of cognitive bias? And, second, whether the response to these two questions is the same when we ask students within the context of an opinion survey and within the context of an exam. This will allow us to test whether students "learn for the exam" but preconceptions remain unchanged. Persistence of preconceptions could be interpreted as students' skepticism towards economic models, or as failure of teaching methods, or both.

The third item we add is related to an original statement in the FTI survey. The statement reads: "CEOs are in general paid more than the value they add to the firm" (S9). Since our students are law students, we add the following statement: "High ranking executives in law firms are in general paid more than the value they add to the law firm" (S19). Our purpose is to find whether answers to both questions reveal a specific type of cognitive bias, a self-serving bias. If present, we would expect students to disagree more often with the second statement than with the first.

We finally include a statement about redistribution policy (S3), one about subsidies to buy cars (S4), one on firms' profits (S5), one on retail regulation (S10), and one about the housing bubble (S14). In the Appendix we detail the statements and indicate their correspondence with S&Z.

Students are asked to indicate their degree of agreement with each particular statement in a scale that has five options: strongly disagree, disagree, don't know, agree, strongly agree. Our sample consists of first-year college students who enrolled in 2014 towards a law degree.[4] We have information on some student characteristics: birth date, gender, exposure to economics in high school, and type of high-school attended. We obtained some of this information from administrative records and some from our survey (see Table A2 in Appendix).

4. Evidence

In this section we report the results of running our opinion survey twice: at the very beginning (in February) and at the end (mid May) of the spring semester 2015. We describe responses to the surveys, compare them to Sapienza and Zingales (2013) results and identify some logical inconsistencies and cognitive biases. We also check the degree of persistence of preconceptions and analyze their correlation with course performance.

4.1. First day in class

We explicitly separate the evaluation of students' course performance through a test from the survey. We distributed the questionnaire to our first-year Law students in the first class of Principles of Economics –a compulsory course- at Universitat Autonoma de Barcelona. We made very clear to students that this was an opinion survey that in no case would be used for course evaluation, and that there was no "right" answer, so that students did not feel pressured. Eighty-one students answered (72.3% of enrolled students).

[4] In Spain first-year college students enroll directly in a specific major.

Table 1 shows the responses for each statement in the original scale of five categories. The last two columns of the table add up the two "agree" categories, and the two "disagree". We observe some interesting facts: 1) the number of statements that trigger a “Do not know” response is smaller than the number of statements where students exhibit a high consensus, whether in favor or against the statement; 2) on average, few students exhibit a strong disagree or strong agree position; 3) students do not seem to hold a bias against the private sector; 4) some preconceptions run against economic thought; and 5) students' judgments show self-serving bias. We next discuss these findings one by one.

Table 1. Preconceptions: First day

	Totally disagree	Disagree	Do not know	Agree	Fully agree	Sum Disagree	Sum Agree
1 Rent controls	0	15.66	3.61	61.45	19.28	15.66	**80.73**
2 Minimum wage	18.07	62.65	4.82	12.05	2.41	**80.72**	14.46
3 Inequality & public expenditure	4.82	31.33	**31.33**	27.71	4.82	36.15	32.53
4 Subsidies to buy cars is beneficial for society	3.61	16.87	**33.73**	44.58	1.2	20.48	45.78
5 Firms decide profits	38.55	46.99	3.61	10.84	0	**85.54**	10.84
6 2008 Stimulus	22.89	45.78	28.92	2.41	0	68.67	2.41
7 Large banks:Size increases efficiency	7.23	32.53	13.25	44.58	2.41	39.76	46.99
8 Large banks: Political influence	3.61	25.3	12.05	49.4	9.64	28.91	59.04
9 CEO overpaid	1.2	7.23	18.07	46.99	26.51	8.43	**73.5**
10 Retail regulation and employment	4.82	20.48	**38.55**	34.94	1.2	25.3	36.14
11 Savings banks bailout: positive	31.33	48.19	14.46	2.41	3.61	**79.52**	6.02
12 Raise inome tax rate increases revenues	0	7.23	8.43	55.42	28.92	7.23	**84.34**
13 Banks are large because of government support	2.41	18.07	6.02	60.24	13.25	20.48	**73.49**
14 Tax deductions contributed to housing bubble	3.61	6.02	30.12	46.99	13.25	9.63	60.24
15 It is hard to predict stock prices	0	25.3	14.46	42.17	18.07	25.3	60.24
16 Belonging to the EU benefits citizens	9.64	8.43	4.82	66.27	10.84	18.07	**77.11**
17 Eliminating tax deductions would improve decisions	6.02	32.53	**39.76**	21.69	0	38.55	21.69
18 Buying home country would increase employment	9.64	28.92	13.25	42.17	6.02	38.56	48.19
19 CEOs in law firms are overpaid	2.41	30.12	**39.76**	19.28	8.43	32.53	27.71

Note: 83 respondents. See Table A.1 in the Appendix for a detailed description of the statements.

Willingness to admit ignorance?

Since students know they are starting an economics course, our hypothesis is that the *rational response* is admitting ignorance ("Do not know") about most statements, especially because only half of the students were exposed to some economics in high school.

We find however that only for five statements (S3, S4, S10, S17, S19) a significant number of students (about one third) acknowledge ignorance (uncertainty, in S&Z study). The first four are relatively technical: whether public expenditure composition affects inequality more than tax progressivity (S3) is implicitly accepted by many to be too complex to express any extent of agreement. Still, the remaining two thirds are almost equally split between agreeing and disagreeing, for all these five statements. This means that these are controversial issues for them; this fact could be used for teaching; i.e., organizing in-class debates on issues where there is the least consensus and guiding them towards economic models. On the remaining fourteen statements, students have strong opinions. For instance, in S1 and S2 less than 5% admit not knowing.

Attitudes towards the private sector

Statements S5, S7, S8, S10, S11, S13, S15 and S18 refer to private sector behavior and to regulation. Some pertain to views about banks. Students' responses to statements S8, S11 and S13 show a high consensus –two thirds or more- in the belief that bank size and government support are positively correlated. Statements S8 and S13 are very similar, but the direction of influence between banks and government is the opposite: S13 implies that government helps banks to become large, while S8 implies that banks become large to influence the government. The extent of agreement with S13 (73%) is higher than with S8 (59%). They are almost equally split regarding the relationship between bank size and efficiency (S7), suggesting that the concept of efficiency is obscure for them. This highlights the need to thoroughly explain this concept, one of the most important in economics, in class.

Interestingly, a large majority of students (86%) do not believe that firms can decide the amount of profits (S5). They correctly perceive that firms are immersed in a wider economic context that a single firm does not control. In the same vein, many (60%) agree that stock prices are difficult to predict (S15).

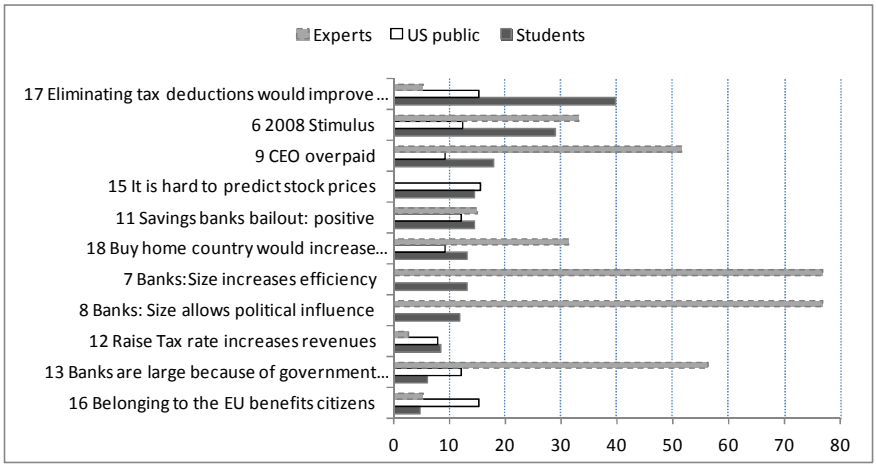
Finally students are split regarding the positive impact on employment of the home government buying home products (S18): 39% disagree with this statement, while 48% agree. It will be interesting to compare this with their opinions at the end of the semester, when the concept of comparative advantage will have been covered.

Are our students very different from the general US population?

We compare our students' responses to those of average US citizens and Economic Experts for the subset of comparable items as reported by S&Z. Figure 1 shows the percentage of "Do not know" for each statement. Ignorance of our students is similar to that of the US public, with three exceptions. One is the question on tax deductions on mortgages (S17), where a high percentage of students do not know, possibly because they are younger and more inexperienced in the housing market than the average US citizen. The other two are statements S6 and S16, which refer very specifically to the economic and political situation in each country.

We observe that admitting ignorance is more widespread among experts than among the general public or first-year college students. This result is consistent with one of the cognitive biases characterized by psychologists and summarized by Kahneman (2011): *"We're blind to our blindness. We have very little idea of how little we know. We're not designed to know how little we know" (pg 24).* These results lead us to think that a first task for effective teaching is to recognize that students bring this bias with them and find ways to make them aware of it.

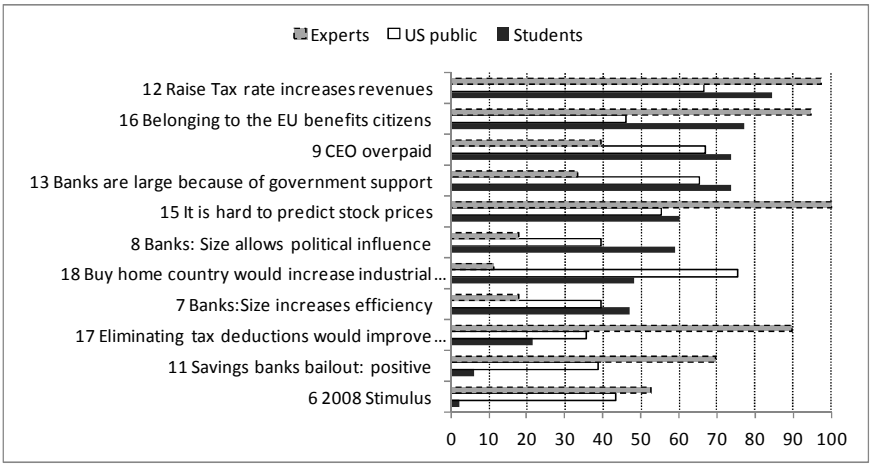
Figure 1. Admitting ignorance (% respondents)



Note: the information on the US public and Experts is drawn from Table 1 in Sapienza and Zingales (2013). See Table A.1 in the Appendix for a detailed description of the statements. N= 83 students.

Figure 2 shows that, for comparable statements, our students' agreement is similar to that of US citizens, except for statements more sensitive to the immediate political and economic situation of each country (S6, S11, S16, S18). The percentage agreeing -the sum of agree and fully agree- that CEOs are overpaid (S9) is remarkably close, as is the percentage sharing the belief bank size would be smaller if they did not have government support (S7), that it is hard to predict stock prices (S15), or that banks are large because of political influence (S13).

Figure 2. Agreement (% respondents)



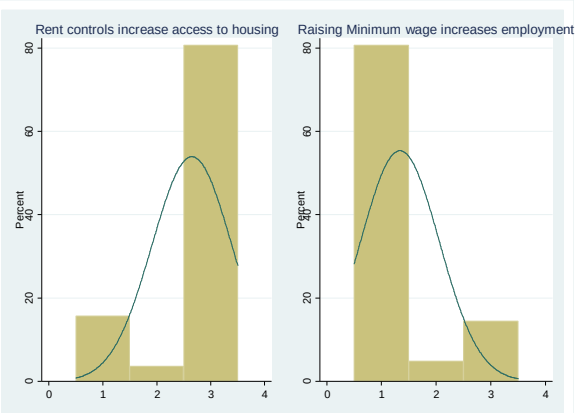
Note: The information on the US public and Experts is drawn from Table 1 in Sapienza and Zingales (2013). Agreement is the sum of "Agree" and "Fully agree". See Table A.1 in the Appendix for a detailed description of the statements. N= 83 students.

Overall, it is noteworthy that the views of our sample of Spanish college students are quite close to the views of the US average population.

Some strong preconceptions run against economic analysis

Table 1 shows a high consensus among students on some issues that are not supported by economic reasoning and evidence. For instance, most students (81%) believe that rent controls (S1) would allow more people to have access to housing, a belief that can be proved wrong when the market is competitive. In contrast, most students (80%) disagree that increasing the minimum wage (S2) would increase employment, an intuition that can be backed through supply and demand analysis when the labor market is competitive. Figure 3 illustrates the magnitude of this -almost perfect- asymmetry in reasoning. We find indeed, after cross-tabulating the responses to both statements, that 79% of those students who agreed on the beneficial effects of rent controls disagreed that increasing the minimum wage would be positive for employment.

Figure 3. Price controls: First day



Note: Values in horizontal axis are as follows: 1=Sum disagree; 2= Do not know; 3= Sum agree.N= 83 students.

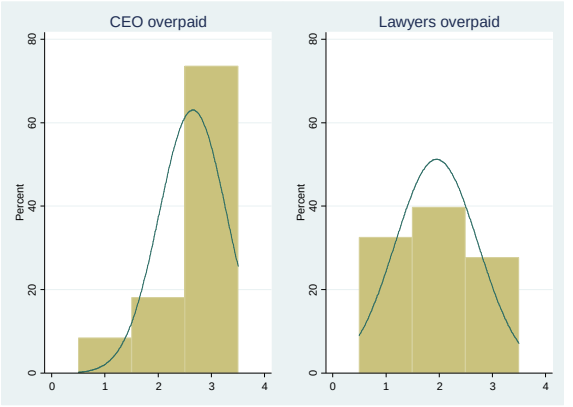
It thus seems that students are able to anticipate the reaction of employers to price floors, but not that of housing owners to price ceilings. Why this asymmetry? One hypothesis is that students may have some experience in the job market -they may have worked as babysitters or given remedial lessons to elementary school kids-, but not in the housing market, because almost all of them live with their parents.

It is clear to economists that a standard demand and supply model predicts the answer to both questions. This will come as a surprise to students in case of S1. They may ignore the model when it contradicts prior beliefs –an expression of confirmation bias- and this reaction may become a barrier to learning.

Self-serving bias?

Self-serving bias is defined in cognitive psychology as the tendency to perceive oneself favorably. Our students may exhibit this type of bias in their judgments on economic issues. We introduced Statements 9 and 19 to capture the extent of this type of bias. The only difference between both statements is that the first refers to CEOs of firms in general while the second refers specifically to CEOs of law firms. Since our students are enrolled towards a law degree, self-serving bias would show up in significantly different responses to both statements. Figure 4 shows the distribution of responses. We indeed find evidence of self-serving bias: the distribution of S9 is strongly right-skewed while the distribution of S19 is quite uniform. In addition, a cross-tabulation of responses shows that only 34% of students who agree that CEOs are overpaid agree that CEOs of law firms are overpaid as well!

Figure 4. Self-serving bias: First day



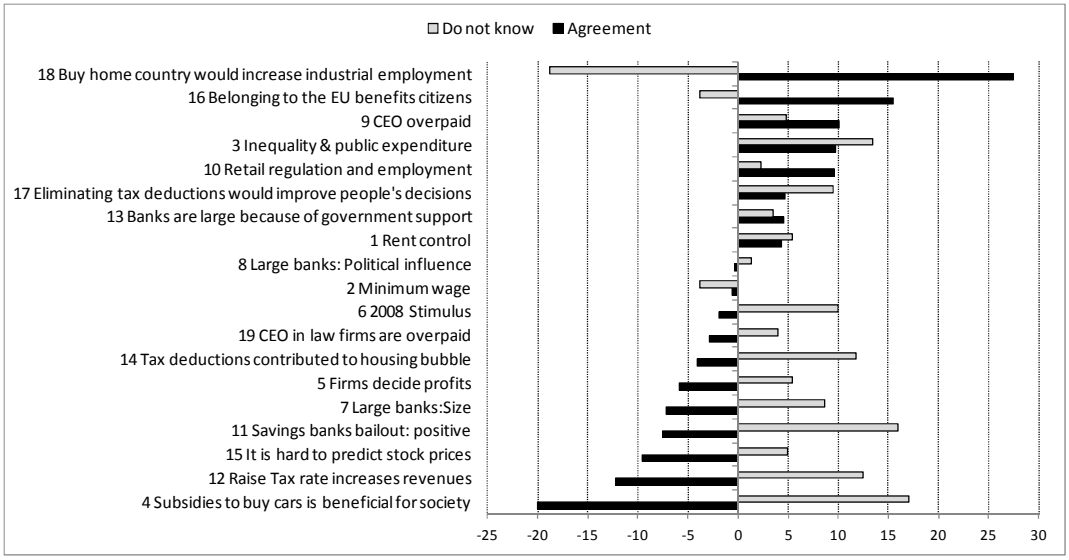
Note: Values in horizontal axis are as follows: 1=Sum disagree; 2= Do not know; 3= Sum agree. N= 83 students.

Because cognitive biases are unconscious, making students aware of them may contribute to their willingness to use economic evidence and reasoning methods, helping them revise their preconceptions and intuitive opinions.

Are preconceptions correlated with student characteristics?

Laboratory evidence suggests that women differ from men on attitudes towards risk, competition, and other psychological attributes (Bertrand (2011)). To investigate whether there is an association between gender and responses we compute the difference in percentages of female and male students who answer "Do not know", and the difference in percentages of those who agree. Figure 5 plots these differences. It does not reveal a clear pattern in agreement responses, but it shows that female students are more likely to admit ignorance. The largest differences appear in two statements. A much higher percentage of female than male students believe that buying home country products will be beneficial for employment, while, on the opposite side, a substantially higher percentage of male students believe that subsidies to buy cars are beneficial for society. The latter fits with the stereotype that men care more about cars than women!

Figure 5. Beliefs and gender: Differences in percentages between female and male students



Note: See Table A.1 in the Appendix for a detailed description of the statements. 83 respondents.

We further investigate the correlation between preconceptions and student characteristics by specifying and estimating a linear regression for each statement. We include the following characteristics: previous exposure to economics (56% had some), gender (70% female), type of high school (51% public, 28% private, 21% semi-private), and year of birth. Previous exposure to economics takes value 1 if the student took some economics in high school or she is retaking economics principles course. For year of birth we construct a dummy variable equal to one if the student was born in 1996 (58%) and 0 if earlier. 1996 is the year of birth of the youngest freshmen.

The dependent variable takes five values according to the degree of agreement with a statement: -2 fully disagree, -1 disagree, 0 “do not know”, 1 agree and 2 fully agree. In Table 2 we report results for the statements where at least one explanatory variable is significant. Controlling for other student characteristics, gender is not correlated with responses except for two statements. These results do not confirm the differential pattern of “do not know” between females and males suggested by Figure 5.

Previous exposure to some economic knowledge is uncorrelated to the degree of agreement with most statements; in particular it is uncorrelated with the statements on rent controls and minimum wage, the two items most closely related to basic demand and supply analysis. It is correlated, however, with four statements in the right direction (negatively with agreement in statements 4, 13, and 18 and positively with agreement in statement 14). The year of birth is correlated with the degree of agreement in statements 10, 13, 14 and 18, but without a clear

pattern in terms of the coherence with model predictions. Finally, the type of high school is not correlated with responses. [5]

Table 2. Preconceptions and student characteristics

Statement	Female	Previous economics	Born in 1996	Semi-private high school[a]
4 Subsidies to buy cars	-0.42* (0.24)	-0.43** (0.20)		
9 CEO overpaid				0.51** (0.24)
10 Retail regulation			0.40* (0.23)	
12 Raise income tax rate	-0.36* (0.21)			0.52** (0.25)
13 Banks large because government		-0.36* (0.21)	-0.43** (0.21)	
14 Tax deductions and housing bubble		0.55** (0.22)	0.42* (0.23)	
18 Buying home country		-0.47* (0.27)		

Note: The Table reports OLS estimates for the statements where at least one explanatory variable is significant. Sample: 71 students of the February survey for whom we have information of all characteristics. Significant values: * 10%; ** 5%; *** 1%. [a]The omitted category is public high school. We do not report results for private high school because it is never significant. See Table A.1 in the Appendix for a detailed description of the statements.

The main conclusion is that we do not observe a systematic relationship between preconceptions and some standard characteristics. A plausible explanation is that students' preconceptions originate in a wider social environment, and are shared by many other people, as the extent of coincidence with average US public indicates.

4.2. End of semester survey: Do opinions change?

At the end of the semester, by mid-May, we run again the same opinion survey. Results for the 85 students who took it are shown in Table A3 in the Appendix. We observe some changes, not all of them consistent with the economic models covered in class (see Table A4). We observe a change in the right direction in the case of rent controls -coherent with the supply-demand model-, but a change in the wrong direction in the case of minimum wages. Consistent with the model of firm behavior, more students disagree with the statement that firms can decide profits and agree with stock prices being hard to predict. However, more students agree with buying home country products being beneficial for employment, even after having discussed in class the benefits of international trade.

[5] We also estimate, for each statement, a Multinomial Logit model, where the dependent variable can take three values: -1 for disagreement, 0 for "do not know", and 1 for agreement. Results are qualitatively similar to OLS.

These results suggest that standard teaching in economics is not very successful at triggering a significant change in students' preconceptions. The large majority of students do not appear to use the newly learned tools.

Persistence of beliefs

To study the change in preconceptions after receiving economic instruction, we focus on the 66 students who answered both surveys.[6] Differences in their responses between May and February are very similar to those shown in Table A4 for the whole sample.

We compute the transition probabilities for all statements. This will allow us to trace the direction of changes in students' responses in May conditional on their response in February. Table 3 shows the results for those statements where we observe relatively important changes between the two surveys.[7] For instance, 76% of students that had agreed in February that establishing a price ceiling would make housing more accessible still believed so in May. We also observe a high degree of persistence in beliefs about the effects of a minimum wage policy. After having been taught about trade and comparative advantage, students still think that buying home products is positive for employment. Even more worrying is that one third of students, who initially correctly disagreed, agreed in May. Local elections in May 2015 brought about debates that may have influenced students' opinions on buying local goods.

[6] Some students did not attend class when one of the surveys was carried out.
[7] The full table of transition probabilities for all statements is available upon request.

Table 3. Persistence of students' beliefs

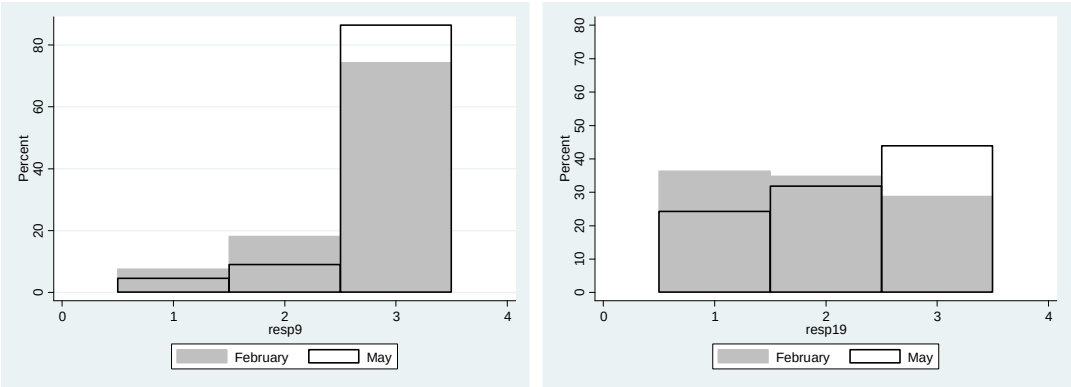
Statement	May / Feb	Disagree	Do not know	Agree	Total	N Students
1 Rent controls	Disagree	33.33	0	66.67	100	9
	Do not know	0	0	100	100	2
	Agree	18.18	5.45	**76.36**	100	55
	Total	19.7	4.55	75.76	100	66
2 Minimum wage	Disagree	**84.31**	5.88	9.8	100	51
	Do not know	75	25	0	100	4
	Agree	36.36	9.09	54.55	100	11
	Total	75.76	7.58	16.67	100	66
4 Subsidies to buy cars	Disagree	46.67	13.33	40.00	100	15
	Do not know	0.00	33.33	66.67	100	21
	Agree	3.33	13.33	**83.33**	100	30
	Total	12.12	19.70	68.18	100	66
9 CEOs overpaid	Disagree	20	0	80	100	5
	Do not know	8.33	33.33	58.33	100	12
	Agree	2.04	4.08	**93.88**	100	49
	Total	4.55	9.09	86.36	100	66
10 Retail regulation	Disagree	**61.11**	5.56	33.33	100	18
	Do not know	34.78	17.39	47.83	100	23
	Agree	36	8	**56**	100	25
	Total	42.42	10.61	46.97	100	66
15 Hard to predict stock prices	Disagree	40	6.67	53.33	100	15
	Do not know	9.09	9.09	81.82	100	11
	Agree	15	5	**80**	100	40
	Total	19.7	6.06	74.24	100	66
18 Buying home country	Disagree	52	12	36	100	25
	Do not know	37.5	25	37.5	100	8
	Agree	6.06	0	**93.94**	100	33
	Total	27.27	7.58	65.15	100	66
19 CEOs in law firms	Disagree	29.17	45.83	25	100	24
	Do not know	13.04	34.78	52.17	100	23
	Agree	31.58	10.53	**57.89**	100	19
	Total	24.24	31.82	43.94	100	66

Note: This table shows the transition probabilities. See Table A.1 in the Appendix for a detailed description of the statements.

We also observe that most students (94%) who in February held the opinion that CEOs are overpaid still believed so in May. However, when the same statement refers to law firms, a much smaller percentage believes that CEOs are overpaid. The self-serving bias observed in February still persists, although in May the percentage of those who agree that this applies to law firms as well increases somewhat.

Figure 5. Self-serving bias persistence

CEOs Lawyers



Note: Values in horizontal axis are as follows: 1=Sum disagree; 2= Do not know; 3= Sum agree. Samples: 83 respondents in February and 85 respondents in May.

These results illustrate that it is difficult to debunk students' preconceptions that are contradicted by scientific analysis. This may be explained by the prevalence of these opinions among the public, as Figures 1 and 2 show, and Table 2 reinforces.

4.3 Studying to pass the test

Puzzled by the lack of pattern of changes in students' preconceptions, we analyze the correlation between these preconceptions and course performance. Some hypotheses may explain the limited change observed in preconceptions. One possibility is that students stick to their initial intuitive ideas because they do not study and this therefore shows up in bad exam performance. Another possibility is that students do study and perform well in exams, but they do not integrate the newly learned economic tools in their rational thinking and, therefore, they do not change their preconceptions. To improve performance the first hypothesis would call for redesigning incentives to study, the second hypothesis instead would highlight the need to explicitly address preconceptions in economic instruction.

To test these hypotheses, in the mid-term exam we included a question about the effects of rent controls, which had been discussed in class. Students had to choose among four possible answers: a) everyone would have access to housing; b) there would be an excess supply; c) prices would fall, and d) there would be a black market or corruption. They also had the option of leaving it blank. Out of the 83 students who had answered the opinion survey in February, 71 took the midterm.

While in the February opinion survey 83% students (59 out of 71) had agreed with the statement that rent controls would increase access to housing, only one of them chose the corresponding answer in the mid-term (option a). Almost 40% chose the right answer (option d), and 22% left it blank; remaining students chose other options. So a reasonable share of students who initially had a misconception seems to have understood the economic model. The question of interest here is whether students' understanding leads them to revise their opinions.

We compare students' answers to the midterm exam question on rent controls with their degree of agreement with the same statement in the May survey. 73% students agreed again (Table A3). In fact, 67% of those who gave the correct answer in the mid-term test agreed with the statement in May! Good students fail to integrate the newly learned economic tools in their thinking process, which supports the second hypothesis. We would conclude that most students stick to their intuitions or preconceptions, produced by the minds' automatic judgments -System 1 in cognitive psychologists' terms-, and after a semester of training still do not activate their rational thinking skills -System 2- to assess economic issues. It is plausible that this is an expression of confirmation bias: students tend to retain concepts or evidence that confirm prior beliefs, and ignore those that contradict them. Only in the context of an exam they provide the answer that they anticipate will please the instructor, even if they do not agree, in order to obtain a good grade.

Either because our teaching methods are not appropriate, or students reject economic models as a valid tool to explain reality, standard economic instruction does not affect preconceptions.

End of semester's beliefs and course grades

We finally investigate whether students' preconceptions are correlated with final grades. We regress, for each statement, a student's response in the May survey (her degree of agreement with the statement) on her final grade and student characteristics.[8] Course grade is correlated with opinion for only two statements: "Firms decide the amount of profits they will earn" (S5), with a negative correlation (better performing students tend to disagree with the statement), and "Very few investors can predict whether a stock price will fall or increase in a given day" (S15), with a positive correlation. For the remaining statements we do not find any correlation between responses and grades. It is disturbing that this lack of correlation includes the

[8] We have 84 students in this sample.

statement on rent controls. This result illustrates that the standard way of explaining economic models -lectures and numerical examples- may not be sufficient to change misconceptions.

Similar to findings shown in Table 2, we do not observe a systematic relationship between preconceptions at the end of the semester and student characteristics.

Table 4. Preconceptions and course grade

Statement	Female	Previous economics	Born in 1996	Private high school[a]	Course grade
4 Subsidies to buy cars		-0.55*** (0.20)			
5 Firms decide profits	0.35* (0.20)		-0.40* (0.22)		-0.15** (0.07)
7 Large banks: Size increases efficiency	-0.55** (0.27)				
10 Retail regulation	0.90*** (0.23)				
11 Savings banks bailout		-0.40* (0.23)			
14 Tax deductions and housing bubble				0.47*** (0.18)	
15 Hard to predict stock prices		-0.43** (0.22)			0.22*** (0.08)

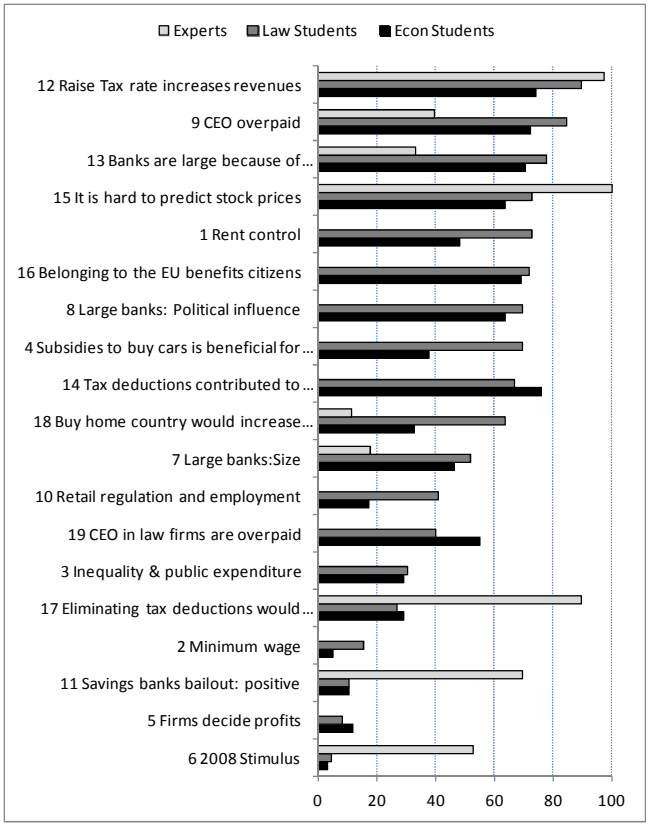
Note: The Table reports OLS estimates for the statements where at least one explanatory variable is significant. Sample: 84 students of the May survey. Significant values: * 10%; ** 5%; *** 1%. [a]The omitted category is public high school. We do not report results for semi-private high school because it is never significant. See Table A.1 in the Appendix for a detailed description of the statements.

4.4. Senior Economics Students

It is plausible that just one semester of economic instruction is too short a period to have an impact on preconceptions. To check this to some extent we ran the same survey on a sample of 4th year students majoring in economics and/or business at the same university. Figure 6 compares the degree of agreement with each statement among first year law students, fourth year economics students and, when feasible, with economic experts from the EEP in Sapienza and Zingales (2013).

In the case of statements about rent controls (S1), car subsidies (S4), retail regulation (S10) and buying home country (S18) differences are large, with more economics than law students' answering in consistence with economic models. But in most remaining cases differences between law and economic students are not very large.

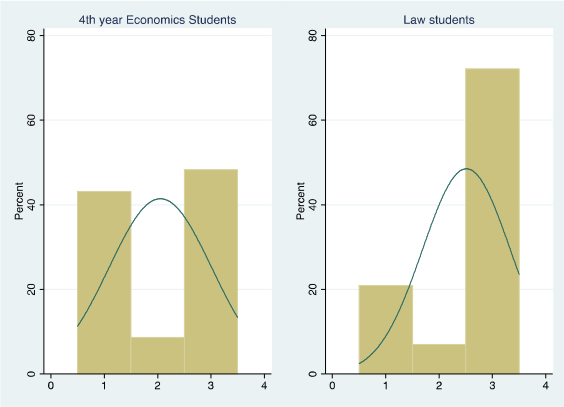
Figure 6. Experts, Law and Economics Students (% agrees with each statement)



Note: The information on Experts is drawn from Table 1 in Sapienza and Zingales (2013). Agreement is the sum of "Agree" and "Fully agree". See Table A.1 in the Appendix for a detailed description of the statements. Samples: 58 Economics students and 84 Law students (May survey).

Figure 7, however, shows that in the case of rent controls, still almost 50% of economics students agree that they would allow more people to have access to housing! After four years of economics courses this seems a very high percentage, reinforcing the conclusion that instruction in economics should explicitly address students' preconceptions and biases.

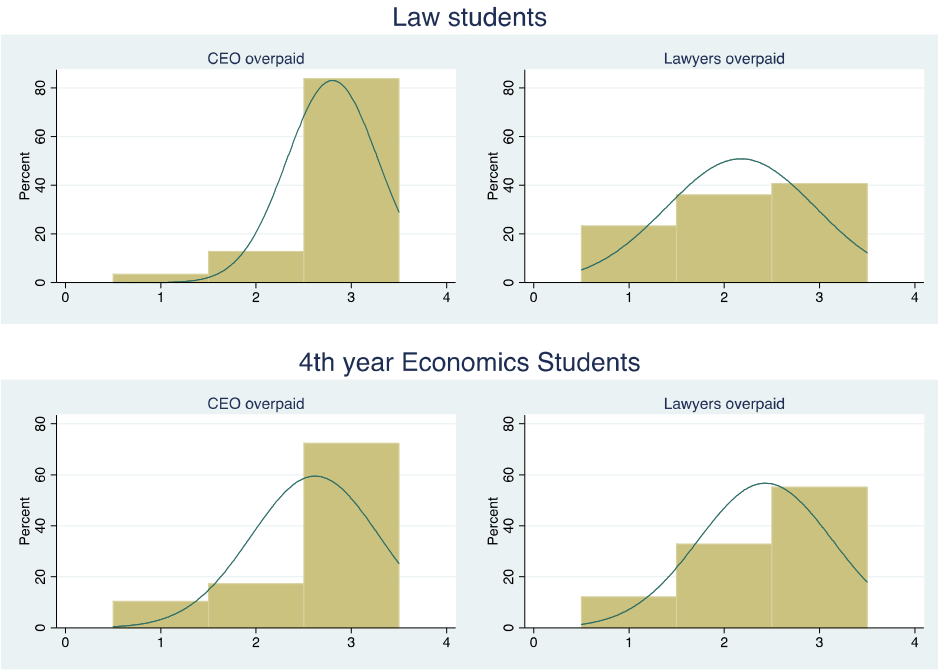
Figure 7. Rent controls



Note: Values in horizontal axis are as follows: 1=Sum disagree; 2= Do not know; 3= Sum agree. Samples: 58 Economics students and 84 Law students (May survey).

Regarding self-serving bias, we find that most economics students believe CEOs are overpaid, although interestingly a smaller percentage agrees in the case of CEOs of law firms. Economics students do not seem to identify themselves with CEOs, in contrast with law students, who were relatively more favorable towards CEOs of law firms. In both cases a large majority of students agrees that CEOs not in law firms are overpaid. This may reflect that Spanish students have a negative view of large firms, and in the statement (S9) they associate CEOs to these firms. In this case, the differences in agreement observed in Figure 4 could not be fully attributed to self-serving bias.

Figure 8. Overpaid CEOs



Note: Values in horizontal axis are as follows: 1=Sum disagree; 2= Do not know; 3= Sum agree . Samples: 58 Economics students and 84 Law students (May survey).

5. Discussion and concluding remarks

We find evidence that students have strong preconceptions about economic issues. Exposure to an economic principles course –even to several years of instruction in economics- and doing well in exams hardly affects these beliefs. We hence conclude that standard teaching practices are not very effective for achieving that students incorporate the tools of economic analysis into their reasoning processes. This calls for a reflection on how we teach economics, as academics in psychology, physics or other fields have done.

Plenty of evidence shows the commitment of the academic community to reflecting on what we teach and how we teach, and the concern about how good we are at it. In addition to

dedicated journals –e.g., the Journal of Economic Education, International Review of Economic Education-, the American Economic Association organizes regular specific sessions on teaching economics at the annual meetings; the European Economic Association also created an education committee some years ago.[9] All these efforts, however, may be only partially successful if psychological aspects of learning are not taken into account.

Research in the field of cognitive psychology, as applied to learning processes, shows that beliefs, myths, preconceptions and misconceptions are often a manifestation of cognitive biases or illusions that are known to affect human thought. Availability bias, priming, jumping to conclusions, confirmation bias, self-serving bias.... are just some of a long list of biases. We have found evidence of some of these biases among our students. Standard teaching methods, based on lectures, problem sets and connecting the concepts to the real world do not explicitly address these biases, and therefore are not powerful enough to affect students' preconceptions. Psychologists have been aware of this in their field (Lilienfeld (2010); Kowalski and Taylor (2009)). Kahneman (2011) notes that simply providing students with statistical facts is unlikely to change their beliefs.

What can be done to improve teaching effectiveness? Kahneman's observation that "you are more likely to learn something by finding surprises in your own behavior than by hearing surprising facts about people in general" (pg 174) provides a clue. We are usually unaware of the tricks that our senses and mind play on us, until we are personally involved in some kind of experiment that allows us to verify it. For instance, visual illusions illustrate how easily we make mistakes when we try to interpret what we see without tools for verification.[10]

Because awareness of these biases helps us accept that the way our mind works may lead us to make mistakes, teaching tools to make students aware of these biases, and of how they affect economic opinions, should be provided all along the semester, in connection with each of the core topics in economics.

Designing and conducting a survey to identify preconceptions of student enrolled in class to find out controversial issues –divided opinions-, misconceptions, self-serving bias, strong

[9] The outbreak of the financial crisis has contributed to open a debate as well on what we teach in economic principles courses. A recent and ambitious initiative in that respect is the CoreEcon project (http://www.core-econ.org/), which has assembled a wide group of academic economists to produce a text and website with the double purpose of bringing economic principles closer to reality as perceived by students, and incorporating recent scientific economic knowledge in introductory textbooks.

[10] For instance, the length of a line between two outward pointing arrows, or inward pointing arrows, is perceived to be different, when it is in fact identical. Use of a ruler would prevent us from making the mistake.

opinions, confusions about technical terms, and discussing the results of the survey with students may be a first step.

An additional tool to deal with preconceptions may be to have textbooks address them explicitly, showing how the scientific method helps us discriminate between beliefs that stand to logic and evidence, and those that do not. Paul A. Samuelson warned about fallacies in the introductory chapter of his Economics textbook, thus calling for using the scientific approach in economic analysis. Perhaps new introductory economics textbooks could develop these ideas further.

Acknowledgements

We are indebted to Jordi Brandts for very helpful comments.

References

Allgood, Sam; William B. Walstad and John J. Siegfried (2015), “Research on Teaching Economics to Undergraduates”, *Journal of Economic Literature,* 53(2), pp. 285-325.

Bice, Douglas; Elisabeth S. Curtis, Wayne Geerling, William Goffe, Adam Hoffer, Solina Lindahl, Mark Maier, Brain Peterson, and Wendy Stock (2014), "Preconceptions of Principles Students", mimeo, accessed September 2015 from http://cook.rfe.org/

Bertrand, Marianne (2011), "New perspectives on gender", Chapter 17 in O. Ashenfelter & D. Card (ed.), *Handbook of Labor Economics*, Elsevier, edition 1, volume 4, number 5.

Caplan, Bryan (2002), "Systematically Biased Beliefs about Economics: Robust Evidence of Judgemental Anomalies from the Survey of Americans and Economists on the Economy," *Economic Journal*, 112 (479), pp 433-458.

Cipriani, Giam Pietro; Diego Lubian, Angelo Zago (2009), “Natural born economists?”, *Journal of Economic Psychology* 30, pp. 455-468.

Goffe, William L. (2013), “Initial Misconceptions in Macro Principles Classes”, mimeo, accessed in September 2015 from http://cook.rfe.org/

Gordon, Roger and Gordon B. Dahl (2013), “What Do Economists Think About Major Public Policy Issues?,” *American Economic Review: Papers & Proceedings*, 103 (3), pp 629-635.

Haferkamp, Alexandra; Fetchenhauer, Detlef; Belschak, Frank; Enste, Dominik (2009), Efficiency versus fairness: “The evaluation of labor market policies by economists and laypeople”, *Journal of Economic Psychology* 30 (4), pp. 527-539.

Hammer, D. (1996), "More than misconceptions: Multiple perspectives on student knowledge and reasoning, and an appropriate role for education research", American Journal of Physics 64, pp 1316-1325.

Jacob, Robert; Fabian Christandl and Detlef Fetechenhauer (2011), “Economic experts or laypeople? How teachers and journalists judge trade and immigration policies,” *Journal of Economic Psychology,* 32, pp. 662-671.

Kahneman, Daniel (2011), Thinking, fast and slow, Allen Lane, Penguin Books.

Kowalski, Patricia and Annete K. Taylor (2009), "The Effect of Refuting Misconceptions in the Introductory Pshychology Class", Teaching of Psychology, 36(3), pp. 153-159.

Lilienfeld, Scott O. (2010), “Confronting Psychological Misconceptions in the Classroom”, *Observer* 23 (7), Association for Psychological Science.

Lucariello, Joan; Michele T. Tine and Colleen M. Ganley (2014), “A formative assessment of students’algebraic variable misconceptions”, *The Journal of Mathematical Behavior* 33, pp. 30-41.

Nakhleh, Mary B. (1992), "Why Some Students Don't Learn Chemistry: Chemical Misconceptions", Journal of Chemical Education, 69(3), pp. 191-

Sapienza, Paola and Luigi Zingales (2013), “Economic Experts versus Average Americans”, *American Economic Review: Papers & Proceedings*, 103(3), pp. 636-642.

Walstad, William B. and Ken Rebeck (2008), “The Test of Understanding of College Economics”, *American Economic Review*, 98 (2), pp. 547-551.

Appendix

Table A1. The statements

	Statement	S&Z
S1	Rent controls Establishing rent controls, such that rents should not exceed a certain amount of money, would increase the number of people who have access to housing facilities	No
S2	Minimum wage Raising the minimum wage would increase employment and reduce unemployment	No
S3	Inequality & public expenditure To change the degree of inequality in a society, the composition of public expenditure is more important than tax progressivity	No
S4	Subsidies to buy cars are beneficial for society Subsidies to buy energy efficient cars are beneficial for society, since their benefits are higher than their costs.	No
S5	Firms decide profits Firms decide the amount of profits they will have every year	No
S6	2008 Stimulus The former Spanish president Rodriguez Zapatero's 2008 program to reactivate the economy when the crisis started had more positive than negative effects	Yes
S7	Large banks: size increases efficiency Large banks are large because this allows them to be more efficient.	Yes*
S8	Large banks: political influence Large banks are large because there are political benefits of being large	Yes*
S9	CEOs overpaid CEOs are paid more than the value they add to the firm	Yes
S10	Retail regulation and employment Retail opening hours regulation allows employment in this industry to be higher than otherwise	No
S11	Savings banks bailout: positive The benefits of savings banks bailout outweighed the costs	Yes
S12	Raise Income tax rate increases revenues Raising income tax rates of the wealthiest would increase tax revenues	Yes
S13	Banks are large because of government support The size of large banks would be smaller if they did not have the implicit government support	Yes
S14	Tax deductions contributed to housing bubble In Spain, deductions for buying a home contributed to the housing bubble	No
S15	It is hard to predict stock prices Very few investors can make accurate predictions about whether the price of an individual stock will rise or fall on a given day	Yes
S16	Belonging to the EU benefits citizens On average, being in the EU has been beneficial for Spanish citizens	Yes*
S17	Eliminating tax deductions would improve people's decisions Eliminating tax deductions for buying a home would lead to better financing decisions by individuals	Yes
S18	Buying home country would increase industrial employment If the home government bought only home products, the impact on industrial employment would be positive.	Yes*
S19	CEOs in law firms are overpaid Law firms' CEOs are paid more than the value they add to the firm	No

Note: The first line in the second column for each statement shows the short version that appears in the tables and figures inserted in the text. The second line is the full statement, as shown in the questionnaire that students answer. The last column indicates whether the statement was included in Sapienza and Zingales (2013). *The original statements have been adapted as follows: the original statement on financial firms (banks) size in S&Z contained two questions that we have split in two statements (S7 and S8); the original statement 16 referred to NAFTA benefits; statement 18 referred to buying American.

Table A2. Sample characteristics (N = 85)

Female	69%
Year of birth	
1996	56%
Before 1996	44%
Had some Economics in High School	50%
Type of High School	
Public	51%
Private	28%
Semi-Private	21%
First time enrolled	88%

Note: This table reports the characteristics of the 85 students who took the survey the last day of class.

Table A3. May Survey results (N = 85)

	Totally disagree	Disagree	Do not know	Agree	Totally agree	Sum Disagree	Sum Agree
1 Rent controls	4.71	15.29	7.06	51.76	21.18	20.00	72.94
2 Minimum wage	20	55.29	9.41	14.12	1.18	75.29	15.3
3 Inequality & public expenditure	2.35	41.18	25.88	25.88	4.71	43.53	30.59
4 Subsidies to buy cars is beneficial for society	3.53	10.59	16.47	61.18	8.24	14.12	69.42
5 Firms decide profits	49.41	42.35	0	7.06	1.18	91.76	8.24
6 2008 Stimulus	22.35	40	32.94	4.71	0	62.35	4.71
7 Large banks: Size increases efficiency	5.88	32.94	9.41	47.06	4.71	38.82	51.77
8 Large banks: Political influence	4.71	12.94	12.94	48.24	21.18	17.65	69.42
9 CEO overpaid	0	3.53	11.76	45.88	38.82	3.53	84.7
10 Retail regulation and employment	4.71	38.82	15.29	37.65	3.53	43.53	41.18
11 Savings banks bailout: positive	42.35	31.76	15.29	10.59	0	74.11	10.59
12 Raise Income tax rate increases revenues	0	1.18	9.41	67.06	22.35	1.18	89.41
13 Banks are large because of government support	3.53	9.41	9.41	58.82	18.82	12.94	77.64
14 Tax deductions contributed to housing bubble	0	10.59	22.35	56.47	10.59	10.59	67.06
15 It is hard to predict stock prices	0	21.18	5.88	52.94	20	21.18	72.94
16 Belonging to the EU benefits citizens	5.88	14.12	8.24	49.41	22.35	20.00	71.76
17 Eliminating tax deductions would improve people's decisions	5.88	29.41	37.65	22.35	4.71	35.29	27.06
18 Buying home country would increase industrial employment	5.88	22.35	8.24	48.24	15.29	28.23	63.53
19 Top executives in law firms are overpaid	3.53	20	36.47	32.94	7.06	23.53	40

Table A4. Preconceptions: differences between May and February

	Sum disagree	Do not know	Sum agree
1 Rent controls	4.34	3.45	-7.79
2 Minimum wage	-5.43	4.59	0.84
3 Inequality & public expenditure	7.38	-5.45	-1.94
4 Subsidies to buy cars is beneficial for society	-6.36	**-17.26**	**23.64**
5 Firms decide profits	6.22	-3.61	-2.60
6 2008 Stimulus	-6.32	4.02	2.30
7 Large banks:Size increases efficiency	-0.94	-3.84	4.78
8 Large banks: Political influence	**-11.26**	0.89	10.38
9 CEO overpaid	-4.90	-6.31	11.20
10 Retail regulation and employment	**18.23**	**-23.26**	5.04
11 Savings banks bailout: positive	-5.41	0.83	4.57
12 Raise income tax rate increases revenues	-6.05	0.98	5.07
13 Banks are large because of government support	-7.54	3.39	4.15
14 Tax deductions contributed to housing bubble	0.96	-7.77	6.82
15 It is hard to predict stock prices	-4.12	-8.58	**12.70**
16 Belonging to the EU benefits citizens	1.93	3.42	-5.35
17 Eliminating tax deductions would improve people's decisions	-3.26	-2.11	5.37
18 Buying home country would increase industrial employment	-10.33	-5.01	**15.34**
19 Top executives in law firms are overpaid	-9.00	-3.29	12.29

Note: Differences in the percentages that agree, disagree and do not know between May (N=85) and February (N=83).