Subject Pool Effects in Price Competition Games: Students versus Professionals

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Questioning the external validity of experiments that rely on student participants is an evergreen in experimental economics. Yet, there is ambiguous evidence of potential subject-pool bias and the subject-pool problem and the set of experiments for which subject-pool differences have been studied. In a diaplastic Bertrand market setup designed to test for collusive behavior, we test two treatments. The first is a baseline treatment, where participants cannot communicate with each other, the second is a communication treatment in which participants are allowed to communicate. Each treatment is first conducted with students and then replicated with professionals. Our results show that students and professionals differ significantly. However, the differences manifest themselves in quantitative rather than qualitative terms. Professionals do collude more, but their behavioral difference between treatments is similar. Students are thus a valid surrogate, for the research question is qualitative, but results generated by student samples should be handled with caution, if quantitative differences matter.

+ We challenges existing experiments on collusion by “gaming” with professionals rather than students.
+ Professionals collude more when compared to students.
+ Subject-pool differences manifest themselves in quantitatively rather than qualitative terms.
+ Short, one-shot-games relying on students only should be regarded with suspicion.

In this paper, we focus on the external validity of market experiments in an industrial organization context. Experimental markets in the form of diaplastic competing one-quarter (Cournot model) or prices (Bertrand model) are the most common models in this field. Central to both is that participants express a fixed and decide on quantities or prices like a real world manager. It is thus reasonable to assume that professionals conduct play a distinct role in these settings and that, hence, the subject pool effect is of particular relevance. Managers are usually not accustomed to these roles. For a Cournot setting, subject pool differences have been investigated by Walchmann et al. (2015). They indeed confirm significant differences in experimental behaviour between Malaysian students and Malaysian managers. For Bertrand markets, however, robustness regarding the subject pool has not been investigated so far. Given the high relevance especially for the type of market game, there is good reason to close this gap. Our research aims to do so.

In interest subject-pool differences and their effect on the external validity of experiments is as old as experimental economics itself. Given the steady incidence between experimental economics and experimental economics, it is not surprising that methodological problems such as the subject pool-under study, have attracted more and more interest in the last 20 years. Previous work on subject-pool differences spans a variety of experimental settings and subjects, and the results are ambivalent and there is substantial methodological heterogeneity.

Experiments for which subject-pool differences and thus external validity has been challenged, include those testing for social preferences such as bargaining games and social dilemmas, auctions, market experiments, and a long list of further behavioral settings. The subject-pool consisted of the usual student participants, range from professionals to children (Martinengo and Suess (1993)13), professionals (Block and Gaver (1995)), students and professionals (Wachtman et al. (2013)), professionals and a population of a certain domino (Kottmann et al. (2015)). Our main intuition lies with those making comparisons professionals and students. It is noteworthy that the term professional has no exact definition, and is sometimes used rather arbitrarily in the context under consideration. Some of the works presented here define their comparing groups as professionals and students, holding the blue-collar workman as a distinct professional category, such as Fehr et al. (2007) or Akerlof et al. (2000). We use a certain threshold of annual salaries as the basis for their definition. Wachtman et al. (2013) define managers as employees identifying at least five free, irrespective of the salary. In our study we do not distinguish between employees with managerial tasks and those with administrative duties. Neither do we account for geographical mobility. We classify an economist in a business environment as relevant comparison to our work, including all of the aforementioned factors; irrespective of hierarchy level, type of profession, or country of origin. As mentioned above, we believe that professional roles of conduct in general might be a source of bias, irrespective of the occupational category. Some authors point to the "social learning of the workplace" (Capraro et al. (2005)) or the "business contact" (Wright and van Wijk Dieleman (2004)).

Hypotheses

Hypothesis 1 (communication): Allowing open communication between market-participants leads to higher price levels than a situation without the option to communicate, irrespective of the subject-pool.

Hypothesis 2 (subject-pool bias): Professionals achieve higher price levels than students, irrespective of the option to communicate.

Results

The descriptive statistics indicate that, on average, professionals select lower market prices than students. Students are thus a valid surrogate, for the research question is qualitative, but results generated by student samples should be handled with caution, if quantitative differences matter.

Turning to our main research question, namely the influence of the subject pool, visual inspection (compare Figure 2 (lower panel)) implies differences between students and professionals. Median prices appear to be similar under the baseline treatment, but not under the communication treatment. We employ two non-parametric tests to test for differences between the subject pools, the Wilcoxon-Mann-Whitney rank test (for differences in central tendencies) and the Kolmogorov-Smirnov test (for differences in the cumulative distribution). The results are displayed in Table 3. The test results indicate that the distributions differ significantly and thus confirm our first research hypotheses. Pooling across the subject pools, we find a clear rise in market prices for the communication treatment (p < 0.01, SCU), compared to the Bertrand treatment. In size and magnitude, this finding is in line with that of Fehr and Nagel (2013). As expected, these differences are most pronounced for high supply sides; the market price under the communication treatment is 26.40. We proceed by refining this analysis to the subject-group level and the aforementioned treatment, respectively. This allows us to distinguish between both subject groups individually. Both groups exhibit a highly significant difference in market price between treatments (U = 28.25 in the student sample and U = 20.35 in the professional sample). Thus, we confirm our second hypothesis.

Conclusion

Our main finding is that students and professionals behave largely similarly when faced with policy changes. Despite this directional homogeneity, we cannot pinpoint differences in effect size. Our results thus support qualitatively rather than quantitative external validity and we confirm an effect which Capraro et al. (2005) have labelled limiting factors in calibration in other words, we observe qualitatively similar results, supporting external validity, but at the same time we find quantitative differences.

Students need time to converge to price levels similar to those of the professionals. For experimental economics, this makes another case. Relatively short experiments or "one-shot games" with student participants should be avoided where possible. The subject pool is an important factor in market experiments (and the real world)? If we focus on the directional effects between treatments, i.e. the question of whether the possibility to communicate has a significant influence on collusion, our answer is affirmative. If, instead, the aim is to extrapolate Q to market-level effects based on student subjects should be handled with caution. Yet, the concept of external validity, although used in various methodological approaches, has no generally accepted definition. As Kreder and Venn (2013) have pointed out, the debate should center on qualitative rather than quantitative external validity.

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