American Economic Review: Papers & Proceedings 2017, 107(5): 115–119
https://doi.org/10.1257/aer.p20171066

A Gender Agenda: A Progress Report on Competitiveness[†]

By Muriel Niederle*

Gender differences in education and labor market outcomes remain ubiquitous. Compared to standard economic explanations, the role of psychological attributes and their gender differences has only recently gained prominence. In this paper I review a specific behavioral trait: competitiveness. I first provide a design for measuring this trait and show that women are less likely to enter competitions than men. After confirming the robustness of this finding, I turn toward establishing the importance of competitiveness outside of experimental settings. I show that competitiveness is a psychological attribute that predicts math and science choices in school and that gender differences in competitiveness can help account for gender differences in these education choices. I then provide additional evidence of the role of a laboratory measure of competitiveness on gender differences in education choices and earnings. Establishing *external* or *economic relevance*, that is that competitiveness predicts economic outcomes we were concerned about to begin with, naturally leads to potential policy implications. Institutions can differ in the importance they place on competitiveness and hence can affect gender differences in economic outcomes. This remains an open area of research in behavioral market design.

I. The Lab: Design and Robustness

Niederle and Vesterlund (2007)—henceforth, NV—introduced a binary measure of competitiveness.[1] Specifically, students in the laboratory were asked to add up five two-digit numbers for five minutes. Their performance was the number of correctly solved problems. Subjects performed multiple times where one round was chosen for payment. In the first round (if it was chosen for payment) each subject received $0.50 for every correctly solved problem. In a second round subjects were in a group of two women and two men, where, while gender was not mentioned, they could see who was in their group of four. The subject with the highest performance received $2 for every correct problem while everyone else received no payment. At the end of this round subjects received no feedback about their relative performance and hence whether they won the tournament or not. For their third performance, subjects chose one of two incentive schemes, a piece rate or a tournament. A subject who chose piece rate received $0.50 per correct problem. A subject who chose tournament received $2 per correct problem if their round *three* performance was higher than the round *two* tournament performances of their three group members, else the subject received zero.[2]

Given the round two tournament performances, 30 percent of women and 30 percent of men would have higher earnings from the tournament than the piece rate. In fact, 35 percent of women chose the tournament compared to 73 percent of men, a significant difference. Tournament entry decisions are not strongly correlated with performances (either in round two or round three), meaning that most high-performing women and most low-performing men did not maximize their earnings.

Besides gender differences in competitiveness, there are two other prominent explanations for this result. First, the choice of incentive scheme should depend on relative performance, though subjects only knew their absolute performance. NV found that controlling for performances, men had significantly higher beliefs about their relative performance than women.

* Stanford University, Stanford, CA 94305, SIEPR, and NBER (e-mail: niederle@stanford.edu).

[†] Go to https://doi.org/10.1257/aer.p20171066 to visit the article page for additional materials and author disclosure statement.

[1] The first experiment on gender differences on competitive attitudes was Gneezy, Niederle, and Rustichini (2003), for an overview of the literature see Niederle (2016).

[2] Note that the design insures that the choice of a subject does not impose an externality, turning it into an individual decision problem. This is important to predict payoff maximizing choices.

This gender gap in beliefs accounts for about one third of the gender gap in tournament entry. A second possible explanation could be risk aversion: While the tournament incentive scheme is more competitive it is also more risky. NV find that controlling for performance and beliefs, risk aversion plays only a minor role. This has been confirmed by subsequent studies that used different ways to control for risk aversion.[3] The large and significant residual in tournament entry after controlling for performances, confidence and risk aversion is labeled as gender differences in competitiveness.

One advantage of experiments is that they can be replicated (for the role of replications see Coffman and Niederle 2015). The large and significant gender gap in tournament entry controlling for performance, beliefs, and risk aversion has been confirmed independently over a dozen times in experimental work with minor modifications. Furthermore, more than a dozen other published papers have identified situations with a large gender gap in competitiveness (see Niederle 2016).

II. The Field: External Relevance

For competitiveness to play a role outside of behavioral economics, we need to establish its external relevance: Does competitiveness correlate with education and labor market outcomes, and can gender differences in competitiveness help account for the gender gap in those outcomes. That is, does an experimental measure of competitiveness help in accounting for gender differences that motivated this line of work in the first place?

Buser, Niederle, and Oosterbeek (2014)—henceforth, BNO—generate a new dataset that combines an experimental measure of competitiveness with education outcomes. Specifically, in the Netherlands, 15-year-olds who are in the preuniversity level choose between four study tracks for their last three years of school: a Math, Biology, Economics, and Literature track. This ordering of math and science intensity is also the order of prestigiousness, where the best performing children go. Dutch boys are more likely than girls to go to more prestigious tracks, generating a gender gap in math and science education.

Virtually all ninth graders from four schools in and around Amsterdam participated in an NV-style tournament entry experiment in which BNO also collected other variables such as students' feelings about mathematics, whether it is easy or hard for them. Several months later students made their track choices. While girls have better grades than boys, they are less likely to select prestigious tracks: An ordered probit regression shows that being female bridges around 15 to 22 percent of the distance between the most and the least prestigious track. Put differently, to overcome the "being female" effect requires more than one standard deviation increase in GPA. The teenagers in BNO mirror common behavior in study track choices as well as in competitiveness: Boys are more competitive than girls and gender differences remain significant once (gender differences in) confidence and risk aversion are accounted for.

To address the external relevance of competitiveness, BNO first show that more competitive children select more prestigious tracks, where the size of the binary coefficient on tournament entry mirrors or exceeds that of the gender coefficient. In fact, almost independent of how much information one has about a child, knowing their competitiveness is a better predictor of their track choice than knowing their gender.[4]

Most importantly BNO show that controlling for competitiveness reduces the gender gap in study track choices by 20 percent when accounting for grades as well as objective and subjective math ability.

Since tournament entry is partially explained by confidence (the belief about the guessed tournament rank) and risk aversion, BNO assess the

[3] NV considered a treatment where subjects made a decision similar to the round three choice of incentive scheme though without any subsequent performance. This virtually eliminated the gender gap in choosing a tournament incentive scheme once beliefs and performances were controlled for. In a similar spirit, Grosse and Riener (2010) have participants choose an incentive scheme when the task is rolling a die, and they find no gender differences. Alternatively, researchers have controlled for one or more independent measures of risk aversion and confirm that the gender gap in tournament entry is substantial and the role of risk measures is minor once performances and beliefs are taken into account (see Niederle and Vesterlund 2011, and Niederle 2016).

[4] All the regressions also contain, among other controls, performances in the experiment.

extent to which they drive the role of tournament entry on study track choices. Controlling in addition for confidence and risk aversion, competitiveness still reduces the gender gap in study track choices by 16 percent, confirming that tournament entry captures a psychological attribute distinct from confidence and risk aversion.[5]

This paper bridges the gap between the lab and the field: BNO use an outcome measure of the laboratory to predict future education choices. Hence they establish the external economic relevance of competitiveness.

The role of an NV-style experimental measure of competitiveness on education choices of high school children has been confirmed by other researchers. Almås et al. (2016) show that competitiveness correlates with choosing the college track in Norway. Buser, Peter, and Wolter (2017) show that competitiveness helps account for the gender gap in math-intensive specializations in Switzerland.

To correlate competitiveness with earnings, Reuben, Sapienza, and Zingales (2015) performed an NV-style experiment among incoming MBA students (already in 2006). They find that two years later more "competitive" individuals earn 9 percent more than their less competitive peers, an effect similar to that of gender. Furthermore, gender differences in tournament entry account for about 10 percent of the gender gap in earnings.[6]

Several additional papers have correlated an incentivized NV-style experimental measure of competitiveness with outcomes outside of the laboratory.[7]

In summary, an incentivized laboratory measure of competitiveness is unusually successful in predicting and correlating with behavior outside of the laboratory. This confirms the external economic relevance of this new behavioral trait (and the validity of its measure by the NV design); a necessary step to establish the importance of competitiveness beyond behavioral and experimental economics.

Most important for the gender agenda, the research to date suggests that competitiveness accounts for a significant portion of gender differences in education and labor market outcomes.

III. Policy: Behavioral Market Design

Given the role of competitiveness on the economic gender gap, one potential policy implication might be to "change the women," make them more competitive and have them "lean in." Apart from the fact that I do not know how to make someone more competitive, we also do not know what else competitiveness correlates with. Furthermore, a naïve lean in recommendation can sometimes backfire (see Exley, Niederle, and Vesterlund 2016).[8]

[5] While confidence does not predict track choices, the two risk aversion measures of BNO do—they account for 16 percent of the gender gap in track choices (though the coefficient is not always robust and depends on the specification). However, the impact of both tournament entry and risk aversion on the gender gap in track choices is 33 percent, and hence almost the sum of their separate impacts (which was 20 and 16 percent, respectively). This suggests that these two traits, risk aversion and competitiveness, are quite orthogonal to each other.

[6] This paper also confirms that competitiveness is quite a distinct trait. They find that tournament entry explains half as much of the gender gap in earnings as a rich set of variables that include demographic characteristics, academic performance, and experimental and survey measures of important psychological attributes, including risk aversion. Furthermore, the experimental measure of competitiveness is not strongly correlated with this large set of control variables.

[7] Kamas and Preston (2015) and Reuben, Wiswall, and Zafar (2017) measure competitiveness after the college students chose their major in US universities. While Reuben, Wiswall, and Zafar (2017) do not find correlations between competitiveness and major choice, Kamas and Preston (2015) find that competitive students are more likely to major in engineering, the natural sciences, and business as opposed to in the social sciences or humanities. Correlating competitiveness with earnings expectations, Reuben, Wiswall, and Zafar (2017) find that a taste for competition positively correlates with expectations of earnings 10 years after college and that gender differences in competitiveness account for about 18 percent of the gender gap in those expectations. Similarly Kamas and Preston (2015) find a strong correlation between competitiveness and self-reported earnings, and furthermore, women who are confident and competitive earn as much as men do. Additional papers that correlate competitiveness with outcomes outside of the laboratory are Berge et al. (2015) who show that competitive business entrepreneurs in Tanzania invest more and have more employees, though a positive link to profits and sales is only suggestive. Zhang (2012) finds that students more inclined to compete are more likely to take a competitive entry exam for high school.

[8] Exley, Niederle, and Vesterlund (2016) explore environments where women and men can select into negotiations. While subjects who enter negotiations in general benefit

A more cautious and prudent approach might be to address whether institutions differ in how they interact with competitiveness and hence their potential effect on gender differences in economic outcomes.

Compare the education systems in the United States and the Netherlands. Dutch children have to make quite irreversible once-and-for-all choices about the math intensity of their studies in the last three years of high school. In the United States, choices of what classes to take are much more sequential and flexible. Furthermore in the United States, in contrast to the Netherlands, there is no gender difference in how much math boys and girls take in school nowadays (see Goldin, Katz, and Kuziemko 2006).

Addressing the role of flexibility in choices, Niederle and Yestrumskas (2008) find in an experiment that among high-performing participants a gender gap in selecting challenging tasks occurs when choices are once-and-for-all as in the Dutch school system, but not when choices are sequential and flexible as in US schools. It remains an open question whether rigid choice architectures favor competitiveness and hence lead to gender differences in choices.

In general, understanding which institutions reward competitiveness beyond the trait they were initially designed to reward (e.g., presumably math ability for both the Dutch and US school system), could help in accounting for gender differences in education and labor market outcomes. It may also lead to institution or market design that may reduce the role of competitiveness and as such reduce the gender gap in outcomes.

Some institutions were explicitly designed to affect gender differences, such as a quota affirmative action. Niederle, Segal, and Vesterlund (2013) show that a quota can affect tournament entry (in environments without any discrimination) as women are more ready to compete against other women than against men. As a result, such quotas are less costly than anticipated (or when done "secretly"). Showing this supply side effect of quotas and the potential impact on investment and effort decisions by women still remains an area of active research.

To conclude, gender differences in competitiveness have proven to be robust in experiments. Furthermore, the experimental measure of competitiveness has external economic relevance: Competitiveness correlates with education and labor market outcomes and can help account for gender differences therein. More research is needed to correlate between competitiveness and other behavioral traits, and to further establish the role of competitiveness on economic outcomes. Finally, institutions can differ in the importance they place on competitiveness and hence can affect gender differences in education and labor market outcomes. Exploring these institutional differences and their effects remains an open area of behavioral market design.

from doing so, women enter much less often than men. However, forcing subjects to always negotiate (having them lean in) results in significantly more instances of negative returns to negotiations for women (and significantly more so for women than men).

REFERENCES

Almås, Ingvild, Alexander W. Cappelen, Kjell G. Salvanes, Erik O. Sorensen, and Bertil Tungodden. 2016. "What Explains the Gender Gap in College Track Dropout? Experimental and Administrative Evidence." *American Economic Review* 106 (5): 296–302.

Berge, Lars Ivar Oppedal, Kjetil Bjorvatn, Armando Jose Garcia Pires, and Bertil Tungodden. 2015. "Competitive in the Lab, Successful in the Field?" *Journal of Economic Behavior and Organization* 118: 303–17.

Buser, Thomas, Muriel Niederle, and Hessel Oosterbeek. 2014. "Gender, Competitiveness, and Career Choices." *Quarterly Journal of Economics* 129 (3): 1409–47.

Buser, Thomas, Noemi Peter, and Stefan C. Wolter. 2017. "Gender, Competitiveness, and Study Choices in High School: Evidence from Switzerland." *American Economic Review*. https://doi.org/10.1257/aer.p20171017.

Coffman, Lucas C., and Muriel Niederle. 2015. "Pre-analysis Plans Have Limited Upside, Especially Where Replications Are Feasible." *Journal of Economic Perspectives* 29 (3): 81–98.

Exley, Christine L., Muriel Niederle, and Lise Vesterlund. 2016. "Knowing When to Ask: The Cost of Leaning In." National Bureau of Economic Research Working Paper 22961.

Gneezy, Uri, Muriel Niederle, and Aldo Rustichini. 2003. "Performance in Competitive Environments: Gender Differences." *Quarterly Journal of Economics* 118 (3): 1049–74.

Goldin, Claudia, Lawrence F. Katz, and Ilyana Kuziemko. 2006. "The Homecoming of American College Women: The Reversal of the College Gender Gap." *Journal of Economic Perspectives* 20 (4): 133–56.

Grosse, Niels D., and Gerhard Riener. 2010. "Explaining Gender Differences in Competitiveness: Gender-Task Stereotypes." Jena Economic Research Paper 2010–017.

Kamas, Linda, and Anne Preston. 2015. "Competing with Confidence: The Ticket to Labor Market Success for College-Educated Women." Unpublished.

Niederle, Muriel. 2016. "Gender." In *Handbook of Experimental Economics*, 2nd ed., edited by John Kagel and Alvin E. Roth, 481–553. Princeton: Princeton University Press.

Niederle, Muriel, Carmit Segal, and Lise Vesterlund. 2013. "How Costly Is Diversity? Affirmative Action in Light of Gender Differences in Competitiveness." *Management Science* 59 (1): 1–16.

Niederle, Muriel, and Lise Vesterlund. 2007. "Do Women Shy Away from Competition? Do Men Compete Too Much?" *Quarterly Journal of Economics* 122 (3): 1067–101.

Niederle, Muriel, and Lise Vesterlund. 2011. "Gender and Competition." *Annual Review of Economics* 3 (1): 601–30.

Niederle, Muriel, and Alexandra H. Yestrumskas. 2008. "Gender Differences in Seeking Challenges: The Role of Institutions." National Bureau of Economic Research Working Paper 13922.

Reuben, Ernesto, Paola Sapienza, and Luigi Zingales. 2015. "Taste for Competition and the Gender Gap Among Young Business Professionals." National Bureau of Economic Research Working Paper 21695.

Reuben, Ernesto, Matthew Wiswall, and Basit Zafar. 2017. "Preferences and Biases in Educational Choices and Labour Market Expectations: Shrinking the Black Box of Gender." *Economic Journal*. http://dx.doi.org/10.1111/ecoj.12350.

Zhang, Y. Jane. 2012. "Can Experimental Economics Explain Competitive Behavior Outside the Lab?" Unpublished.