An Experimental Investigation of Gender Differences in Wage Negotiations

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Abstract

There is a consensus that there is an unexplained gap between male and female wages: even after controlling for a broad range of demographic and industry characteristics, females make less than men. This paper investigates wage discrepancies between males and females through the lens of negotiation behavior. We introduce an experimental bargaining environment — the Demand Ultimatum Game (DUG) — where the receiver makes a demand about how much she would like to receive from the proposer. After viewing the demand, the proposer makes an offer, which the receiver can then accept or reject. The results are stark: females make significantly lower demands than men, resulting in significantly lower earnings. However, this negotiation and earnings gap is mitigated when receivers are given social information about participant decisions from a previous experiment. In one treatment, receivers are informed about the distribution of male demands. In the other treatment, receivers are informed about this distribution as well as the distribution of conditional offers made to these participants. In the social information treatments, females increase their demands relative to the control treatment such that the demands of males and females are not significantly different, eliminating the negotiation gap. This mitigates eventual differences in pay between males and females within the respective treatments, eliminating the earnings gap.

JEL: C91, C72, J31

Keywords: Negotiations, gender differences, social information, social comparisons, experimental bargaining, ultimatum game, demands

1 Introduction

There is a persistent, unexplained gender gap in wages: after controlling for a broad range of demographic and industry characteristics, women make between 4.8% to 7.1% less than men (Jarrell and Stanley, 2004; Weichselbaumer and Winter-Ebmer, 2005; U.S. Department of Labor, 2009).[1] Women earn less in occupations where men are the majority, earn less in occupations where women are the majority, earn less in the highest paid occupations, and earn less in the lowest paying occupations (Hegewisch, *et al.*, 2011). Survey evidence suggests that 63% of men have higher starting wages than their female counterparts (Gilbreath and Powers, 2006). Moreover, starting wages are higher for men than for women among recent MBAs (Reder, 1978; Devanna, 1984; Strober, 1982; Bowles, *et al.*, 2005), among recent medical residents (Sasso, *et al.*, 2011), and among recent graduates across a wide variety of majors and degrees (Gerhart, 1990; Gerhart and Rynes, 1991; Stuhlmacher and Walters, 1999; Kray and Thompson, 2005). Such initial differences in starting wages has significant implications for the wage gap over time (Babcock and Laschever, 2003). In many labor relationships, starting wages are determined via negotiation. Hence, another source of the persistent unexplained gender wage gap could be gender differences in bargaining behavior. If men and women bargain differently leading to different starting salaries, then this negotiation gap can explain some of the residual wage gap. Yet, there is very little empirical evidence on gender differences in real individual wage bargaining (Gerhart and Rynes, 1991; Babcock and Laschever, 2003; Babcock, *et al.*, 2006; Hall and Krueger, 2008; Leibbrandt and List, 2012).

The purpose of this research is two-fold. First, to experimentally investigate whether females ask for less in a controlled bargaining setting that accurately models relevant aspects of negotiating over a starting wage. The advantage of the laboratory is that the method enables control over the setting and for a precise measure of individuals behavior under a set of identical conditions. This cannot be done in the field, where preferences and behaviors are found in combinations that are incredibly difficult to separate. Second, if females do ask for less, to investigate a simple mechanism — making relevant social information available — that could potentially shrink the negotiation and wage gap.

The results are stark: women ask for less, and earn less than their male counterparts. Providing social information — demands being made by others in a similar negotiating situation — directly influences the beliefs women have about the norms of negotiations. They ask for more, eliminating the

[1] In 2010, the gender wage gap — the ratio of the averages of women's and men's median annual earnings in the United States — was 0.77 (Current Population Survey, 2012).

negotiation gap. Crucially, their salary demands are met, eliminating the gender gap in wages.

The paper is organized as follows. Section 2 provides a brief review of the relevant literature on the wage gap, the competition gap, and how social information has been used successfully to alter behavior. Section 3 introduces a new experimental bargaining game called the Demand Ultimatum Game (DUG). Section 4 contains the experimental design for the bargaining environment, hypotheses to be tested, and the laboratory procedures. Section 5 discusses the experimental results of the bargaining process. Section 6 concludes including a discussion of future researchs.

2 Relevant Literature

Gerhart (1990) and Gerhart and Rynes (1991) provide the first survey data to address whether men and women have different propensities to negotiate their starting salaries. Their sample includes recent MBAs from nationally ranked top Ivy League universities. Their findings suggest that structural factors, such as whether or not a person has another job offer, are the primary reason for differences in starting salaries between men and women. Bowles, *et al.* (2005) also use survey data where the sample is recent Carnegie Mellon University graduates with a masters degree. Of men, 57% reported attempting to negotiate a higher salary from the prospective employer compared to only 7% of women. Moreover, men reported starting salaries 7.6% higher than women graduating with the same degree from the same university. In a follow-up experiment, Babcock, *et al.* (2006) had subjects perform a task where they were told they could earn between \$3 and \$10. Once finished with the task, the experimenter handed each subject three dollars and said, "Here's three dollars. Is three dollars okay?" If a subject asked for more money, the experimenter would pay that subject \$10, but they would not give anyone more money if the subject simply complained about the level of pay. The results were striking: almost nine times as many men as women subjects asked for more money.[2] Subjects were also asked to write about the most recent negotiations they had attempted or initiated. For men, the most recent negotiation had taken place an average of two weeks earlier; for women, their most recent negotiation occurred a full month earlier. The conclusion is that men were initiating negotiations two to three time more often than women. These results suggest that men have a higher propensity to initiate negotiations. This has been replicated by Greig (2008) with employees in an investment bank, and interestingly explains to a large degree why women are not as well represented in the higher ranks of

[2]Both men and women rated how well they had played the game about equally, meaning that women didn't feel they should be paid less or should accept less because they had played poorly.

the firm. Hall and Krueger (2008) surveyed a large number of Swiss individuals who recently accepted a job to examine gender differences in negotiation behavior and find bargaining is less common by women. A recent paper by Leibbrandt and List (2012) examine salary negotiations by women using a randomized field experiment, asking how details of the labor contract matter for gender differences. They find that if there is no indication that wages are negotiable in the job advertisement, men are more likely to negotiate than women; when the job advertisement mentions wages are negotiable, there is no gender difference. This previous research offers some evidence of a negotiation gap between men and women under a variety of conditions.

There are two other strands of literature relevant to this study. The first is the literature on gender and competition. A negotiation setting may viewed as a competitive environment, and so the recent research demonstrating gender differences in response to competition is related. There is ample experimental research demonstrating a gender gap in entering competitive environments: women tend to shy away from competition, and tend to perform worse than men when placed in competitive environments (Gneezy, *et al.*, 2003; Gneezy and Rustichini, 2004; Niederle and Vesterlund, 2007, 2010; Dohmen and Falk, 2011).[3] Given that women perform worse in competitive environments than men, one might predict that in a negotiation setting that is competitive, women may also fare less well.

The second is the literature on how information about others' decisions influences an observer's own decision. This is a growing area of interest in economics, demonstrated by the recent experimental research on the role social information has in influencing behavior across a variety of decision environments, including public goods (Croson and Shang, 2006; Shang and Croson, 2009; Chen, *et al.*, 2010), dictator games (Cason and Mui, 1998), and the ultimatum game (Bohnet and Zeckhauser, 2004). Overall, this research suggests that there is a nudging effect of information. There is also a large body of research in psychology demonstrating that social information impacts behavior by allowing an individual to become informed about what is typically done in the particular decision setting (i.e., the descriptive norms) (see Cialdini and Goldstein (2004) for a review). Social comparison theory posits that individuals compare themselves to others when they need an external standard against which to judge their abilities or beliefs, particularly in settings judged to be uncertain (Festinger, 1954). Below in Section 3 we introduce the Demand Ultimatum Game (DUG), an experimental bargaining environment that models salient aspects of wage negotiation. If there are gender differences in bargaining behavior in the DUG, and there is a corresponding wage gap, then this raises two questions. First, is

[3]For an overview of gender differences in preferences see Croson and Gneezy (2009).

there a simple mechanism that closes the negotiation gap? Second, does closing the negotiation gap also close the wage gap? Given what is known about the psychology of making social comparisons and the nudging impact social information can have, providing information about offer demands as well as offers conditional on demands is a simple mechanism to test. Here we examine the impact of social comparisons on offer-demand behavior, investigating the extent to which social comparisons can help diminish gender differences in the negotiation gap, and ultimately the wage gap. When relevant social comparisons are available, we expect behavior to conform more closely to the decisions made by others.

3 Negotiations and the Demand Ultimatum Game

The present research adds to the literature by investigating gender differences in the wage-negotiation process via a controlled setting with significant incentives that resembles a common bargaining situation.[4] Many job postings ask applicants to include salary history or salary requirements when applying for a position. Such a scenario requires a prospective employee to state an offer request. This salary request or demand can potentially set an anchor in the negotiation process (Galinsky and Mussweiler, 2001; Magee, *et al.*, 2007) and can lead to a higher negotiated salary (Major, *et al.*, 1984; Thorsteinson, 2011). Job candidates may want to initiate salary negotiations so that their salary request serves as the anchor for a counteroffer.

We introduce a new bargaining environment that models these essential features present in a large number of negotiation settings. The game — called the Demand Ultimatum Game (DUG) — is a modified version of the ultimatum game (UG). The UG is a simple bilateral sequential bargaining environment in which Player A makes Player B a take-it-or-leave-it offer (Güth, *et al.*, 1982; Forsythe, *et al.*, 1994). More precisely: A *offers* a division $o \in [0, m]$ of a fixed pie m and B chooses a *response* $r \in \{\text{accept, reject}\}$ where

$$u_i(o, \text{accept}) = \begin{cases} m - o & \text{if } \ i = A \\ o & \text{if } \ i = B \end{cases}$$

and

$$u_i(o, \text{reject}) = 0 \qquad \text{for } i \in \{A, B\}$$

Clearly, rational self-interested B's will accept any non-zero outcome and so rational self-interested A's knowing this should select the smallest o such that $o > 0$. Robust experimental evidence finds that

[4] See Eckel (2008) for an excellent discussion of the benefits of using laboratory experiments to study labor markets.

average offers in the UG are in the range of 30–40% of the total pie with a mode of 50%; moreover, offers of less than 20% are likely to be rejected.[5] Two laboratory experiments examine gender differences in behavior. Eckel and Grossman (2001) and Solnick (2001) both find that men and women made similar offers, and offers made to men were higher. However, in terms of Responder behavior, these studies report conflicting results: Eckel and Grossman report women are more likely to accept lower offers than men and Solnick reports that women in the role of Responder were more demanding than men.[6] So the results regarding the nature of gender differences in the one-shot UG remain mixed.

3.1 Demand Ultimatum Game (DUG)

The DUG adds two features to the standard Ultimatum Game. First, B states a non-enforceable offer-*demand* $d \in [0, m]$ before A makes an offer o. Utilities are d-independent in this sense:

$$\text{For any } i, d, o, r : u_i(d, o, r) = u_i(o, r).$$

Second, rather than having the positions of Players A and B determined randomly, B earns the right to be the Responder in the DUG. This models a simple sequence of events leading to an agreed starting salary between an employer A and a new hire B: B competes for a job among a number of potential candidates, B is successful (gets the opportunity to negotiate terms of hiring) and names a starting wage; A then makes a wage-offer that B can accept or reject. This has the structure of a DUG in which there is an earned right to be Player B. The earned property right for Player B (the new hire) serves to have all Player Bs be uniformly qualified for the position, regardless of gender. So if we observe differences in offer-demands (d), the results will not be due to gender differences in ability or perceived qualifications or even self-confidence.[7] Interestingly, there are gender differences in similar cheap-talk (i.e., non-enforcable) demands made by females of their counterpart in an investment setting. Rigdon (2009) reports observed gender difference in cheap-talk messages regarding the desired distribution of gains from exchange in a specific principal–agent game (the investment game). Females in the role of principal made significantly lower cheap-talk demands of their agents than their male counterparts, requesting a smaller share of the gains from exchange: 40% compared to 53% requested by males ($p = 0.05$). The investment game environment, however, is not ideally suited to probing the

[5] See Roth (1995) and Camerer and Thaler (1995) for a review.

[6] As noted by Croson and Gneezy (2009), these differences may be attributable to differences in the conditions of the experiment.

[7] There is significant evidence of gender differences in self-confidence in a variety of settings with men being more over-confident than women, particularly in uncertain situations (Estes and Hosseini, 1988; Lundeberg, *et al.*, 1994; Soll and Klayman, 2004; Barber and Odean, 2001).

negotiation gap and ways to remedy it: the gains that are split are generated by an investment by the principal and that does not neatly map onto a natural aspect of wage negotiation.

3.2 Social Information

As mentioned above, gender differences in negotiation behavior in the DUG, and a corresponding wage gap, would raise two questions. First, is there a simple mechanism that closes the negotiation gap? Second, does closing the negotiation gap also close the wage gap? One mechanism is to leverage social information — provide information to a Player B before she states her offer-demand about what others in a similar situation demanded. This information on others' behavior allows Player B to directly make social comparisons.

But not just any information about similarly situated others is likely to be relevant. Suppose there is a substantial negotiation gap between genders. Thus there is an out-performing population (the hypothesis, given anecdotal and field data is that it is males). Since the idea is to explore a simple mechanism that can close that gap, the information likely to be relevant is to provide all Player B's with information about other Player B's *from the out-performing population*. The prediction is that this information will have no effect on Player B's from the out-performing population, but will move behavior of the Player B's from the under-performing population.

4 Experimental Design, Hypotheses and Procedures

The Baseline (BASE) is a one-shot Demand Ultimatum Game, where the role of Player B is earned by subjects who score in the top-half of the scores on a popular-culture quiz.[8] Then prior to Player A submitting an offer, Player B sends a message consisting of an offer-demand (d): how much of the pie she wants to receive. Player A observes this message and then submits an offer of how to divide the pie. Player B decides whether to accept, in which case each earn the amount of money specified in Player A's offer, or reject, in which case both earn no money. The two social information treatments are SOCIAL INFORMATION: OFFER-DEMANDS (DEMANDS) and SOCIAL INFORMATION: OFFER-DEMANDS AND OFFERS (BOTH). In DEMANDS, Player B prior to submitting her offer-demand is presented with

[8] This is the first experiment to implement property rights to Player B. Several different methods have been used to implement property rights, always to *Player A*. Hoffman, *et al.* (1994) allocated the role of Player A to those subjects scoring in the top-half of a popular-culture quiz. Schurter and Wilson (2009) select Player As on the basis of seniority. List and Cherry (2000) had participants earn different pie sizes based on how well they did on an effort-based task (answering questions from a GMAT exam) with those performing the best having $400 to divide versus a much smaller amount of $20 (see also Cherry, *et al.* (2002)).

a figure graphically representing the offer-demands generated by only *male Player Bs* in all previous sessions of BASE. It was not revealed to Player B that the data represented offer-demands made only by male Responders. The behavior by the males was presented because the offer-demands by males are significantly higher than female offer-demands in BASE (as will be reported below). The males are the out-performing population and therefore, the distribution of their offer-demands is the relevant social comparison. In the social information treatment BOTH, Player B prior to submitting her offer-demand is presented two figures: one displays the same figure as in DEMANDS and the other displays the average amount offered by Player As for each of the offer-demands made by male Player Bs from all previous sessions of BASE.

Subjects participated in only one of the treatments. A total of 306 students participated with 142 subjects in BASE, 82 subjects in DEMANDS, and 82 subjects in BOTH.[9] The experiment was conducted with undergraduate students at Rutgers University in the Wachtler Experimental Economics Laboratory in New Brunswick, NJ. Subjects were recruited to the lab using the Department of Economic's Sona system. Subjects were evenly distributed among major-type: 29% in the humanities, arts and social sciences, 30% in business and economics, 25% from the biological sciences, and 11% in Psychology (with the remaining undecided).

Sessions took approximately 45 minutes to complete. Upon arriving, each subject earned a $5 show-up payment and were seated in the laboratory. After they all signed a consent form, they were given a set of instructions explaining the DUG in neutral terms in order to avoid framing. The instructions were identical across the three conditions (see Appendix A). The instructions also explained that the positions of "Persons A and B" in each pairing would be determined by scores on a popular-culture quiz, and that the quiz would be given concurrently to all N participants. See Appendix D for the quiz questions that were used in all sessions. They were all asked to answer the same set of 15 questions, and the quiz score was the number of questions answered correctly. They were told that these scores would then be ranked from highest to lowest with ties decided by giving a higher ranking to the person who finished the quiz in the shortest amount of time. Once the complete ranking of participants was determined, those ranked 1–$\frac{N}{2}$ had "*earned* the right to be Bs". The other $\frac{N}{2}+1$–N participants would be As. They were informed of the matching algorithm: The B with the highest rank was paired with the highest ranking A ($\frac{N}{2}+1$), the B with the second highest rank was paired with the second highest ranking A ($\frac{N}{2}+2$), and so on. The ranking procedure used to determine roles and pairing was

[9]

common information. They were also told that the total quiz scores would not be publicized.

Subjects were informed that their counterpart would remain anonymous. Such a protocol prevents subjects from knowing information about their counterpart, such as gender. Therefore subjects are unable to form any stereotype about the person (Valian, 1999; Kray, *et al.*, 2001, 2002). This prevents players from being able to treat others differently based on such stereotypes (Ayers, 1991; Ayers and Siegelman, 1991; Altonji and Blank, 1999; Solnick and Schweitzer, 2001) or based on physical characteristics like attractiveness (Rosenblat, 2008). Subjects were also informed that they would remain anonymous with respect to the experimenter.

Before starting, the experimenter read aloud the instructions to ensure common information and subjects were given an opportunity to ask questions. Subjects were then asked to select an envelope containing a code that only they would know, enter the number into their computer terminal, and click Submit to begin the experiment.[10] Subjects proceeded to answer 15 questions on a current events quiz. Once everyone finished, total scores were ranked from highest to lowest, and the pairings were made according to the algorithm described in the instructions. The subjects played the DUG once and only once. The total pie to be divided between the two players was $20. Subjects in BASE played the DUG, Player *B*s in DEMANDS were shown the distribution of offer-demands made by male Player *B*s in previous sessions of BASE.[11] Player *B*s in BOTH were shown both the distribution of offer-demands made by male Player *B*s in previous sessions of BASE and the average amount offered by the Player *A*s for each of the offer-demands from previous sessions of BASE.[12] Once the pair completed the game, subjects completed a demographic questionnaire. They were also asked to indicate the number of days since they had last engaged in a negotiation and the nature of that negotiation (as in Babcock, *et al.* (2006)).

There are several empirical hypotheses to be tested, two concerning behavior in the baseline treatment and two concerning behavior in the presence of social information:

Hypothesis 1 In BASE, female Player *B*s make lower offer-demands than their male counterparts.

Hypothesis 2 In BASE, conditional on Hypothesis 1 being true, female Player *B*s will receive lower offers than their male counterparts, resulting in lower overall earnings.

[10] The code is what provides the subjects double-blind anonymity.

[11] Notice that Player *A*s in DEMANDS were unaware that Player *B*s received information about offer-demands made previously.

[12] Notice that Player *A*s in BOTH were unaware that the Player *B*s received information about offer-demands and conditional offers made previously.

Hypothesis 3 Female Player *B*s will ask for as much as their male counterparts when they have information with which to make social comparisons before stating their offer-demand.

Hypothesis 4 By asking for the same as their male counterparts, female Player *B*s will earn as much in the presence of information.

5 Results

Table 1 reports (across treatments) means and standard deviations of offer-demands made by male and female Player *B*s, offers made by male and female Player *A*s, offers made to male and female Player *B*s, percent of offers rejected by gender, earnings for both roles by gender, and the number of subjects by gender in each treatment. To the *right* of the average, superscripts indicate significant gender differences within a treatment; to the *left* of the average, superscripts indicate significant differences within gender across the two treatments; and in the *lower right* a subscript indicates significant differences between information treatments, DEMANDS and BOTH.[13]

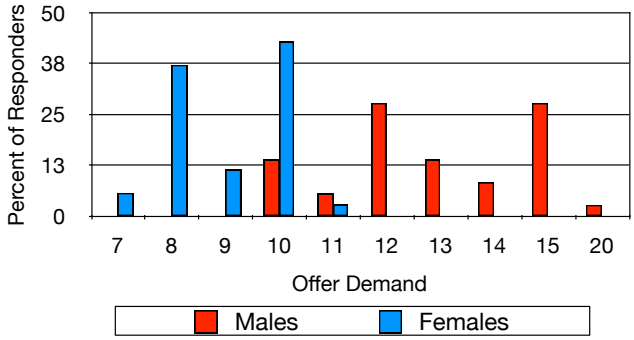


Figure 1: Offer-Demands by Gender

In BASE, females make significantly lower offer-demands than males: \$9 vs. \$13.03 ($p = 0.0000$). The data strongly confirm Hypothesis 1: females ask for less than males. Despite the earned property right over the division, females request a significantly lower fraction of the pie for themselves than males similarly situated. Figure 1 displays the offer demands made by males and females. Clearly these two distributions are significantly different with the distribution of offer demands for females

[13]For all p-values being reported are from two sample t-tests examining whether or not the means in question are different, unless otherwise noted. The results are unchanged when testing differences using a non-parametric Mann-Whitney rank-sum test.

	BASE		DEMANDS		BOTH	
	Males	**Females**	**Males**	**Females**	**Males**	**Females**
Offer-Demand	13.03	9.00^{***}	$^{**}11.74$	$^{***}11.73$	12.14	$^{***}11.43$
	(2.10)	(1.09)	(1.97)	(1.52)	(2.10)	(1.47)
Offer Made By	9	8.88	9.55	$^{***}10.29$	8.68	8.91_{***}
	(2.24)	(1.70)	(1.28)	(1.23)	(1.86)	(1.91)
% Rejected By	11.11	8.57	5.26	13.64	28.57_{**}	9.52
A **Earnings**	9.31	10.19	8.50	9.71	9.05	8.65
	(4.10)	(3.00)	(3.71)	(1.23)	(4.20)	(4.26)
B **Earnings**	9.00	7.54^{**}	9.58	$^{**}9.27$	7.10_{*}	8.62
	(3.36)	(2.93)	(2.65)	(3.06)	(4.42)	(3.09)
# Player *A*s	39	32	20	21	19	23
# Player *B*s	36	35	19	22	21	21

standard deviations reported in parentheses

*** and ** indicate significance at 0.01 and 0.05, respectively

superscript right: significant gender differences within treatment

superscript left: significant differences within gender compared to BASE

subscript lower right: significant difference between information treatments, DEMANDS and BOTH

Table 1: Summary Statistics by Gender for Each Treatment

shifted to the left of the distribution for males ($p = 0.0000$).[14] Figure 2 displays the Kernel density estimates of offer-demands by gender. The kernel density plot for females (blue dashed line) is shifted to the left of the kernel density plot for males (red solid line). The results in BASE are stark: females ask for significantly less of the pie than similarly situated males.

Do females also earn less? On average, the amount proposed to females is significantly lower than the amount proposed to males: \$7.97 vs. \$9.89 ($p = 0.0000$). Female Player *B*s earn significantly less on average than male Player *B*s: \$7.54 vs. \$9.00 ($p = 0.05$). This result strongly confirms Hypothesis 2 that the lower offer-demands made by females are met with lower offers and lower earnings. This discrepancy in earnings is not due to females rejecting more offers (and hence earning zero) than males (11.11% vs 8.57%; $p = 0.7196$).

See Figures 3a and 3b which show the distributions of proposals made to males and females, respectively, and also the percentage of offers accepted and rejected by gender.

[14] The p-value reported is from a Kolmogorov-Smirnov test examining whether or not the offer-demand distributions are the same.

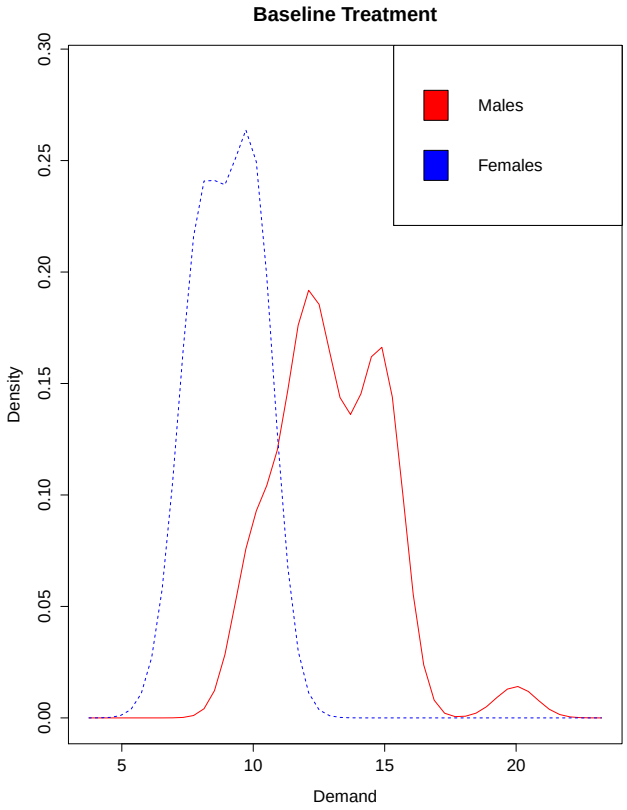


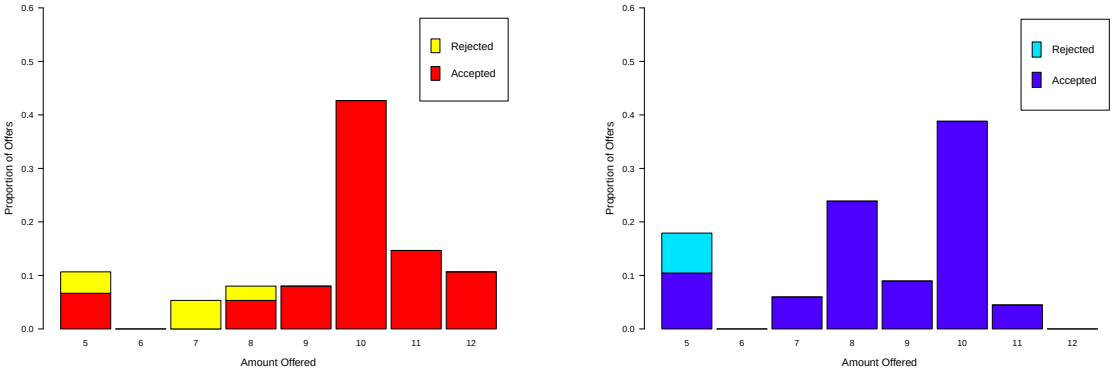
Figure 2: Kernel Density Plots of Offer-Demands by Gender

As for offers made by male and female Player As in BASE, notice that there are no significant gender differences: males offer \$9 and females offer \$8.88 ($p = 0.8069$). This lack of a gender difference in mean offers replicates earlier findings reported by Eckel and Grossman (2001) and Solnick (2001). In terms of the percentage of the pie offered, the results reported here are closer to those in Solnick (2001) with approximately 45% of the pie being offered by both males and females.

To summarize the data from BASE: in the presence of an earned property right for Player B over a fixed pie to be distributed, females ask for less of the pie than similarly situated males. Their lower offer-demands are met with lower offers. Women ask for less and earn less.

Significant Results in Base Female Player Bs ask for less, and earn less than their male counterparts.

Next, let's consider the role of social information in the DUG. In DEMANDS Player Bs have information about offer-demands made in an earlier experimental session. This information pushes offer-demands by females up: \$11.73 in DEMANDS vs. \$9.00 in BASE ($p = 0.0000$). This matches male



(a) Offers to Males in BASE

(b) Offers to Females in BASE

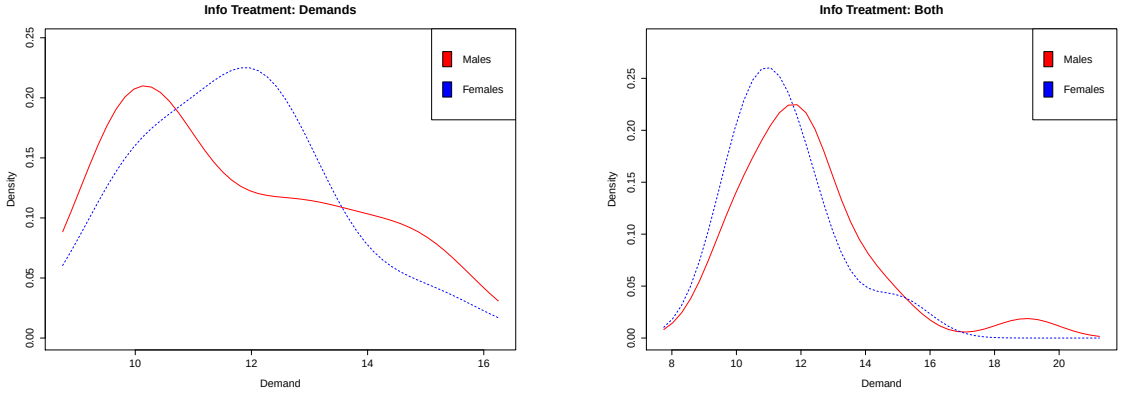
Figure 3: Distribution of Offers by Gender in Baseline

offer-demands in DEMANDS: males demand \$11.74 ($p = 0.9855$).[15] Figure 4a displays the Kernel density estimates of offer-demands by gender for DEMANDS. In the presence of social information, women ask for the same as similarly situated men. This provides confirmation for Hypothesis 3 that social information aids in closing the negotiation gap.

How does this translate to offers to and earnings for female Player Bs? The amount offered to female Player Bs is significantly higher in DEMANDS compared to BASE: \$10.09 vs. \$7.97 ($p = 0.0001$), closing the earnings gap we see in BASE ($p = 0.05$). Figures 5a and 5b show the distributions of offers made to males and females in DEMANDS and also the percentage of offers accepted and rejected by gender. This provides confirmation for Hypothesis 4.

In BOTH we see a similar improvement in offer-demands made by females over BASE. Recall that the social information provided to Player Bs in this treatment is about both offer-demands made by males and actual offers made to males conditional on offer-demands in all baseline sessions. Females ask for significantly more in BOTH than in BASE: \$11.43 vs. \$9.00 ($p = 0.0000$). The higher offer-demands by females in BOTH matches those made by males ($p = 0.2054$). Figure 4b displays the Kernel density estimates of offer-demands by gender for BOTH. There are no significant differences in the Kernel densities for males and females in the social information treatments. In fact, notice that in BOTH, the kernel density plot for females (blue dashed line) overlaps the kernel density plot for males (red solid line). These results strongly confirm Hypothesis 3: providing social information (whether of offer-demands only, or both offer-demands and conditional offers) brings the offer-demands for females

[15] Males do make lower offer-demands in DEMANDS than they do in BASE (\$11.74 vs. \$13.03, $p = 0.0291$).



(a) Offer-Demands by Gender for DEMANDS

(b) Offer-Demands by Gender for BOTH

Figure 4: Kernel Density Plots of Offer-Demands by Gender

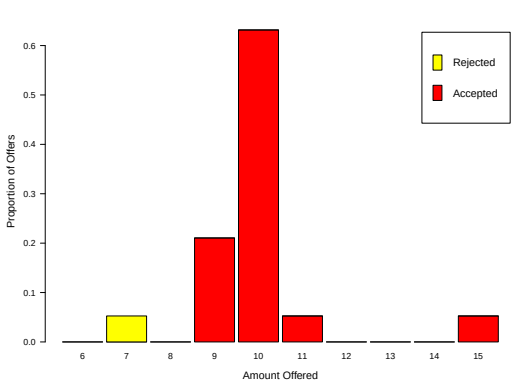
in line with offer-demands made by males. Therefore, the negotiation gap seen in BASE has been eliminated with the presence of social information in BOTH, further confirming Hypothesis 3.

How this translates to offers and earnings in BOTH is a bit more complicated than in DEMANDS. The amount offered to females is higher than under BASE ($9.24 vs. $7.97; $p = 0.0143$). However, this does not result in a significant improvement in earnings for female Player Bs over BASE ($8.62 vs. $7.54; $p = 0.2662$). Figures 5c and 5d show the distributions of offers made to males and females in BOTH and also the percentage of offers accepted and rejected by gender. One reason why earnings don't improve is that there is a decrease in offers made by female Player As in BOTH compared to DEMANDS, more than a dollar decrease or a 10% decline ($p = 0.05$). A key difference across the information treatments is the rate at which male Player Bs reject offers in BOTH compared to DEMANDS: 28.57% vs. 5.26% ($p = 0.0527$).[16] As a result, male Player Bs earn significantly less in BOTH than in DEMANDS ($p = 0.0403$). If we consider only the earnings of Player Bs who accept the offers made by Player As, then an interesting pattern emerges: males still earn more than females in BASE, males and females earn the same amounts as each other in DEMANDS and in BOTH, and females earn significantly more in DEMANDS and BOTH than females in BASE.[17]

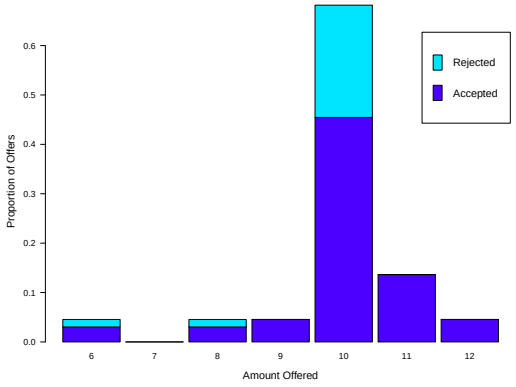
Interestingly, the percentage of equal split offers that are made by Player As in DEMANDS and in BOTH to females is significantly higher than under BASE: 68% and 71% vs. 34% ($p = 0.0126$; $p = 0.0071$). These percentages are not different for males across the three treatments, averaging

[16] The p-value being reported is a two-sample difference in proportion test examining whether or not the proportion of rejections are the same.

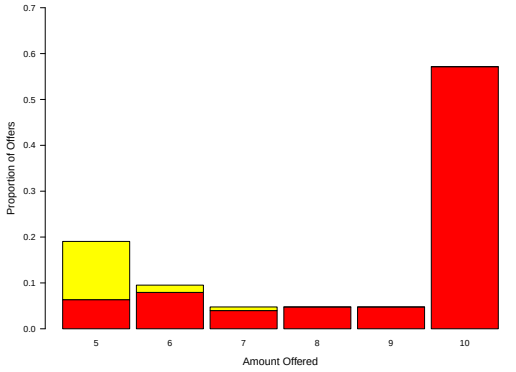
[17] $p = 0.0000$; $p = 0.7685$; $p = 1.000$; $p = 0.0000$; $p = 0.0099$



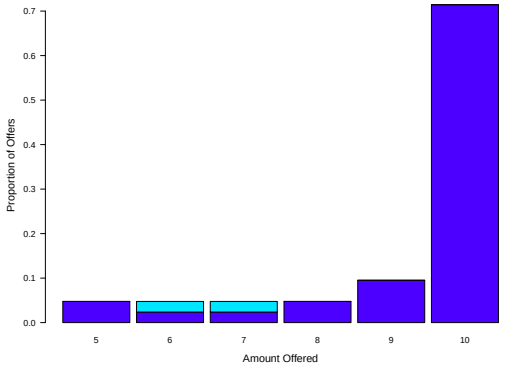
(a) Distribution of Offers to Males in DEMANDS



(b) Distribution of Offers to Females in DEMANDS



(c) Distribution of Offers to Males in BOTH



(d) Distribution of Offers to Females in BOTH

Figure 5: Distribution of Offers by Gender in Each Treatment

between 47% and 63%. The increase in the offer amount as well as the increased percentage of females receiving equal splits directly results in female and male Player Bs earning identical amounts in DEMANDS: \$9.58 vs. \$9.27 ($p = 0.7328$). The decrease in offers made by male and female Player As in BOTH results in female and male Player Bs earning identical amounts ($p = 0.2039$). The wage gap observed in BASE completely disappears in the presence of social information, and the data strongly confirm Hypothesis 4.

Significant Results with Social Information Female Player Bs ask for more than in BASE, and earn the same amounts as their male counterparts.

Table 2 reports regression results on Offer-Demands and Offers.[18] The first column reports results

[18] A Breusch-Pagan test for heteroskedasticity rejects the null hypothesis of constant variance for both regressions ($p = 0.0036$; $p = 0.0288$) so robust standard errors are reported. Censored Tobit regression specifications for both regressions provide similar results to those reported.

with the dependent variable Offer-Demand. The independent variables are GENDER, which is a dummy variable with a value of 1 for Females, 0 for Males; DEMANDS, which is a dummy variable with a value of 1 for DEMANDS, 0 otherwise; BOTH, which is a dummy variable with a value of 1 for BOTH, 0 otherwise; GENDER × DEMANDS is the interaction effect between GENDER and DEMANDS; and GENDER × BOTH is the interaction effect between GENDER and BOTH. The coefficient on GENDER is negative and highly significant, indicating that females have lower offer-demands all else equal ($p = 0.0000$). Also, notice that the interaction of gender and the two information treatments are positive and highly significant ($p = 0.0000$; $p = 0.0000$).

The second column reports regression results with the dependent variable Offer. The independent variables are FEMALE, which is a dummy variable with a value of 1 for Female Responders, 0 for Male Responders; DEMANDS, which is a dummy variable with a value of 1 for the treatmentDEMANDS, 0 otherwise; BOTH, which is a dummy variable with a value of 1 for the treatment BOTH, 0 otherwise; GENDER × DEMANDS is the interaction effect between FEMALE and DEMANDS; and FEMALE × BOTH is the interaction effect between GENDER and BOTH; and the OFFER-DEMAND made by Responders, which takes values \$7, . . . , \$20. Notice that . Overall, then, both regression specifications support the main findings in Table 1. All four hypotheses have been confirmed by the data.

One final result provides further evidence of a negotiation gap: women participating in the experiment have a lower propensity to initiate negotiations than men. Recall that following the experiment subjects were asked to indicate the number of days since they had last engaged in a negotiation. For men, the most recent negotiation they had engaged in had occurred four days ago on average, while for women the most recent negotiation they had engaged in had occurred eleven days ago on average. This gender difference is statistically significant ($p = 0.0000$). Moreover, the results are similar to those reported by Babcock, *et al.* (2006) with people of all ages and from a wide variety of professions (and reported in Babcock and Laschever (2003)): for men, the most recent negotiation they had initiated themselves had occurred two weeks earlier on average, while for women the most recent negotiation they had initiated themselves had occurred one month earlier on average.

6 Conclusion

Women have made notable gains in the workplace, making up half of the workforce, and yet the gender wage gap — measured as the ratio of the median earnings of women and the median earnings of men — persists. Even once factors such as occupation, human capital development, work experience,

	Offer-Demand	Offer
Intercept	13.03^{***}	10.04^{***}
	(0.35)	(1.01)
Female	-4.03^{***}	-1.85^{***}
	(0.40)	(0.55)
Demands	-1.29^{**}	0.08
	(0.57)	(0.41)
Both	-0.89	-1.49^{***}
	(0.58)	(0.54)
Female × Demands	4.02^{***}	1.81^{***}
	(0.68)	(0.66)
Female × Both	3.31^{***}	2.70^{***}
	(0.69)	(0.77)
Offer-Demand	–	1.81^{***}
		(0.66)
N	154	154
R^2	0.4131	0.1879
Prob $> F$	0.0000	0.0001

$^{***} \geq 99\%$ significance, $^{**} \geq 95\%$ significance

Standard errors in parentheses

Table 2: Linear Regression Results with Robust Standard Errors

career interruption, motherhood, and industry sector are controlled for in the analysis of the determinants of wages, there still remains an unexplained gender gap in wages. Starting salaries play a crucial role in the wage gap — if an employee starts out with a lower salary, this impacts the level of raises received, and new employers use the information to determine a new wage offer. The data show that women have lower average starting salaries. If women systematically ask for less — if there is a gender negotiation gap — this can explain the wage gap. In the experiment reported here, modeling essential features of a labor-market negotiation while controlling for confounding variables, there is robust evidence of a negotiation gap. When women have an earned property right over a fixed pie, they systematically ask for less of that pie than do similarly situated men. And there is a wage gap: women subsequently get offered less of the pie than do males.

So what is one mechanism for closing the observed wage gap? In 2012, the U.S. Department of

Labor conducted a contest called the "Equal Pay App Challenge" inviting submissions of applications that could help mitigate the unexplained wage gap.[19] All of the winning entries have as an important feature the ability to look up salary information for relevant job positions. This social information is believed to be an important component to closing the gap. By providing women with information about what others are earning in a similar position, women are able to adjust their expectations and be in a better negotiating position for their first salary. But there is virtually no evidence that this information does what it is hoped to do. The experimental results presented here provide that evidence. Simply providing social information — learning what others have demanded, or what others have received conditional on their demands — eliminates the negotiation gap and the residual wage gap. It pushes female demands up: women ask for more. And it pushes female earnings up: women get offered more and, ultimately, earn more.

[19] You can access details at the Department of Labor's website dedicated to the Equal Pay Act: http://www.dol.gov/equalpay

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A Instructions

You have been asked to participate in an economics experiment. In addition to the $5 you have already received for participation, you may earn an additional amount of money, which will be paid to you at the end of the experiment.

In this experiment each of you will be paired with another person in this room. You will not be told who that person is either during or after the experiment, and he or she will not be told who you are either during or after the experiment.

The experiment is conducted as follows: a sum of $20 has been provisionally allocated to each pair, and Person A in each pair can propose how much of this each person is to receive. The positions of Persons A and B in each pairing will be determined by your scores on a popular culture quiz. The quiz will be given concurrently to all N participants. Each of you will be asked to answer the same set of 15 questions, selected from a large data bank of questions. Your quiz score will be the number of questions you answer correctly. Quiz scores will be ranked from highest to lowest and ties will be decided by giving a higher ranking to the person who finishes the quiz in the shortest amount of time. Note #1 is the highest rank, while #N is the lowest. Once the complete ranking of participants is determined, those ranked 1–$\frac{N}{2}$ will have *earned* the right to be Bs. The other $\frac{N}{2} + 1$–N participants will be As. The B with the highest rank (B1) will be paired with the highest ranking A ($\frac{N}{2} + 1$), the B with the second highest rank (B2) will be paired with the second highest ranking A ($\frac{N}{2} + 2$) and so on. Your total score will not be publicized.

Person B will have the opportunity to send a message to Person A requesting an amount he or she would like to receive out of the amount to be divided, $20. The amount that Person A would receive is the amount to be divided minus the amount Person B requests to receive.

Person A will see the request. Then Person A will make a proposal. The proposal consists of an amount that Person B is to receive. The amount that Person A is to receive is simply the amount to be divided, $20, minus the amount that Person B is to receive.

When each Person A has made a proposal, each Person B will be given the chance to accept or reject the proposal made by his or her counterpart Person A. If Person B accepts the proposal, then the amount of money will be divided as specified in the proposal. If Person B rejects the proposal, both Persons A and B will be paid nothing.

After all the Person Bs have accepted or rejected the proposal made by the Person As, each person will be paid accordingly.

You will participate in this decision problem once.

You will never be asked to reveal your identity to anyone during the course of the experiment. Neither the experimenters nor the other subjects will be able to link you to any of your decisions. You will receive a code in a blank envelope and you will be asked to enter it into your computer. You will use this code at the end of the experiment to receive your cash payment from a randomly selected monitor. In order to keep your decisions private, *please do not reveal your choices to any other participant.*

This completes the instructions. Please raise your hand if you have any questions.

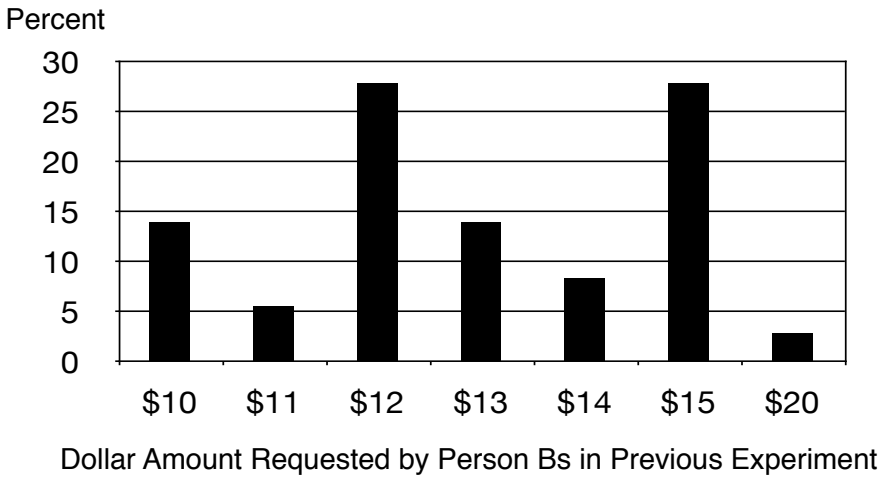
The Task

1. Quiz ranking determines whether you are a Person A or a Person B
2. Amount to be divided $20
3. Person B sends a message to Person A requesting an amount they would like to receive out of the amount to be divided.
4. Person A makes a proposal: An amount Person B receives

   (Note: the amount Person A receives is $20 minus the amount Person B receives if Person B accepts the proposal)
5. Person B accepts or rejects Person A's proposal:

   If accept, earnings are as division proposed by Person A.

   If reject, earnings for both Person A and B are 0.

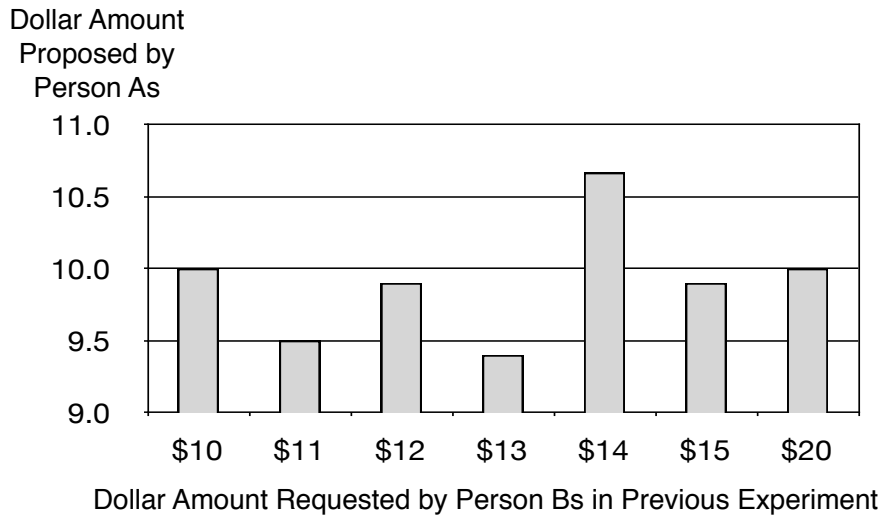


B Instructions - Social Information: Demands

The instructions subjects received were identical to baseline instructions. The following statement was added on the screen for Player *B*s where they enter their offer-demand:

"Below is a chart that reports information about participant decisions from a previous experiment.

The horizontal axis (x-axis) shows the messages sent by Person Bs, and the vertical axis (y-axis) shows the percentage of Persons B that sent each of the messages."



C Instructions - Social Information: Both

The instructions subjects received were identical to baseline instructions. The following statement was added on the screen for Player Bs where they enter their offer-demand:

"Below are two charts that report information about participant decisions from a previous experiment.

In the chart on the LEFT, the horizontal axis (x-axis) shows the messages sent by Person Bs, and the vertical axis (y-axis) shows the percentage of Persons B that sent each of the messages [Note: see Appendix B for graph].

In the chart on the RIGHT, the horizontal axis (x-axis) shows the messages sent by Person Bs, and the vertical axis (y-axis) shows the amount proposed by Person As for each message sent."

D Popular Culture Quiz Questions

1. What is the name of Lady Gaga's upcoming album?

   a) The Fame Monster Part II

   b) The Fame Cyclops

   c) Born This Way

   d) Haus of Gaga

2. Which one of the Jonas brothers is married?

   a) Kevin

   b) Nick

   c) Joe

3. In what year did the first episode of the Simpsons air on TV?

   a) 1987

   b) 1990

   c) 1989

   d) 1991

   e) 1992

4. Which member of the "Jersey Shore" is currently on the show "Dancing with the Stars"?

   a) Nicole "Snooki"

   b) Jenni "J-WoWW"

   c) Pauly D

   d) Mike "The Situation"

5. Which actor played the character of the "Green Goblin" in the 2002 movie release of Spiderman?

   a) Tobey McGuire

   b) Bill Murray

   c) Christian Bale

d) Johnny Depp

e) William DeFoe

6. Which social networking site is the second most popular?

a) LinkedIn

b) Myspace

c) Twitter

d) Facebook

7. Who plays Don Draper in the TV series Mad Men?

a) Joel McHale

b) Steve Carell

c) Jason Schwartzman

d) John Hamm

e) Matt LeBlanc

8. Which university did Natalie Portman receive a bachelor's degree from?

a) Brown University

b) New York University

c) Rutgers University

d) Harvard University

9. Which musical artist and album has had the most Billboard #1 hits from one album release?

a) Michael Jackson – "Bad"

b) The Beatles – "Magical Mystery Tour"

c) Eminem – "The Eminem Show"

d) Taylor Swift – "Fearless"

e) Madonna – "Like a Virgin"

10. For how many seasons did the TV series Friends run?

a) 7

b) 8

c) 9

d) 10

e) 12

11. Who won the MLB World Series of Baseball in 2007?

a) Philadelphia Phillies

b) New York Yankees

c) Anaheim Angels

d) Florida Marlins

e) Boston Red Sox

12. In the J.K. Rowling Harry Potter novels, what is the name of Ron Weasley's pet Rat?

a) Scabbers

b) Riley

c) Hedwig

d) Crookshanks

13. Where is the rock band The Beatles originally from?

a) Kent, England

b) Liverpool, England

c) Edinburgh, Scotland

d) Glasgow, Scotland

e) London, England

14. Although they might not still be together, which of the following celebrity couples DID NOT meet while filming a movie?

a) Will Smith and Jada Pinkett

b) Taylor Swift and Taylor Lautner

c) Brad Pitt and Angelina Jolie

d) Ben Affleck and Jennifer Garner

15. In what state was President Barack Obama born?

a) Illinois

b) Florida

c) Hawaii

d) Alabama

e) Utah