

**Gender Differences in Trading Volume:
Not Just Overconfidence***

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May, 2017

Abstract

Men trade more than women. This has been attributed to men being more overconfident. However, no study has systematically tested this conjecture. We run an experiment where participants trade in a simulated market and measure *ex-ante better-than-average* confidence in an incentivized way. We find that men are more confident and trade more than women, but we do not find that our measure of confidence helps to reduce the gender gap in the number of transactions. Finally, risk aversion does not help to explain this gap either.

KEYWORDS: Behavioral Finance, Transaction Costs, Gender, Overtrading, Risk aversion.

JEL CLASSIFICATION: C91, D70, D81, D91

* We thank Esther Mata-Pérez, Haihan Yu and Vita Zhukova for their valuable research assistance. The usual disclaimers apply. Financial support from the Spanish Ministries of Education and Science and Economics and Competitiveness (ECO2015-65820-P), Generalitat Valenciana (Research Projects Gruposo3/086 and PROMETEO/2013/037) and Instituto Valenciano de Investigaciones Económicas (IVIE) is gratefully acknowledged.

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Introduction

A well-established fact in Finance is that investors trade too much, thereby lowering their average returns (Barber and Odean 2000; Barber *et al.* 2009). The most common explanation for this fact is overconfidence, meaning that investors believe that the accuracy of their knowledge about asset values is greater than that of the average investor (Odean 1998). In an influential study, Barber and Odean (2001) use gender as a proxy for overconfidence, relying on psychological evidence that men are more confident than women in areas such as Finance (Prince 1993). Barber and Odean (2001) find that men trade 45 percent more than women. Men and women reduce their net returns by trading, but the reduction for men is 0.94 percentage points higher than for women. This establishes a second well-accepted fact in the literature, namely, that men trade more than women (Agnew *et al.* 2003; Barber and Odean 2001; Grinblatt and Keloharju 2009). This gender difference in trading has been attributed to men being more overconfident. However, no study has systematically tested this interpretation.¹ The purpose of this paper is to experimentally investigate to what extent gender differences in trading activity are explained by differences in confidence.²

Experimental design

Experiments were conducted in 12 sessions with 24 subjects per session for a total of 288 (149 male, 139 female) student participants from a variety of subjects.^{3,4}

The trading task is based on the design of Weber and Camerer (1998) with some modifications. Subjects receive a fixed cash amount and are given the opportunity to buy and sell units of 6 “assets” during 9 periods lasting one minute each. Asset prices increase by 6% or decrease by 5% in each period, each with a constant but unknown probability. These probabilities are selected randomly without replacement from the set {0.6, 0.55, 0.5, 0.5, 0.45, 0.4} at the beginning of each treatment.

Participants are assigned randomly into groups of four (2 males, 2 females) who observe identical

¹ Glaser and Weber (2007) using field data find that only *better-than-average* overconfidence correlates with trading activity, although they find no gender differences in trading (however, 95% of their sample is male). Grinblatt and Keloharju (2009) find a positive correlation between trading activity and a self-confidence measure constructed from tests taken in the army, but only for men. In an experimental study, Biais *et al.* (2005) find gender differences in trading activity but no difference in *calibration-based* overconfidence (a measure of overestimation of the precision of one’s general knowledge). In two additional experimental studies, Deaves *et al.* (2008) and Fellner-Röhling and Krügel (2014) find no gender differences in overconfidence and only partial evidence of gender differences in trading activity.

² Alternative explanations which are not examined in this paper may include gender differences in sensation-seeking tendencies (Grinblatt and Keloharju 2009), and entertainment (Dorn and Sengmueller 2009).

³ 8.3% Art and Literature, 38.5% Social Sciences, 25.5% Health, 9% Science, 18.7% Engineering. These are the five official categories of fields of studies in Spanish universities.

⁴ Recruitment was carried out using ORSEE (Greiner 2004). Sessions lasted approximately 2 hours and average payment was around 19€.

prices. Subjects know that they are in a group of four but are not told the identity, or gender, of their group mates.⁵ They observe prices from period -3 to 10, but can only trade from period 1 to 9. Prices at period 10 are only used to liquidate portfolios.

In the baseline treatment, buying and selling assets comes at no additional cost. In the transaction costs treatment (TC), a third of the groups have to pay a fee of 1%, 4% or 7%, respectively, for each transaction. In 4 sessions, subjects receive a 50% rebate on their fees for every sale performed at a loss.⁶ Subjects participated in both treatments, and the order of treatments was counterbalanced.⁷

To measure confidence, we ask subjects at the beginning and end of each treatment to forecast their own ranking within their group in terms of total earnings (final cash + portfolio value). Subjects are paid a fixed prize for guessing their position correctly.

To measure risk aversion, subjects complete a Multiple Price List task (MPL, Holt and Laury, 2002) at the beginning of the session, consisting of a sequence of 21 binary decisions between a lottery and an increasing safe option.⁸

Results

Table 1 summarizes overall treatment and gender effects on our variables of interest. Our experiment captures the most important stylized facts documented in the empirical literature, summarized by the following 5 results:⁹

Result 1. Trading activity is substantially larger in males.

In the baseline, males make 48% more trades than females, a number very close to the 45% difference

⁵ To ensure that subjects perceive a similar gender-balanced environment in every session, their positions in the laboratory were always male, female, male, female... This is done by asking male and female subjects to randomly draw a number from different boxes: one box contains odd numbers and the other contains even numbers. Subjects are then seated on the cubicle corresponding to their drawn number.

⁶ This is defined as a sale at a price below the purchase price. When multiple units of the asset were purchased at different prices, the purchase price is measured as the weighted average price of these purchases. Rebates were paid at the end of the treatment. This modification of the transaction costs treatment was carried out in the last 4 sessions, consisting of a total of 96 subjects.

⁷ Sessions involved two additional treatments reported in Cueva *et al.* (2017). Further details and full instructions can be found in the online Appendix.

⁸ The lottery pays a fixed prize of 5,000 pesetas (experimental currency) with 50% probability and nothing otherwise. The safe option ranges from 0 to 5,000 pesetas. At the end of the experiment, one of the 21 decisions is randomly selected for payment. Risk aversion is measured by the difference between the elicited certainty equivalent (the safe amount first preferred to the lottery along the sequence) and the expected value of the lottery (2,500 ptas) rescaled from -1 to +1, with 0 representing risk neutrality.

⁹ One (male) subject is excluded from our dataset as a clear outlier. This subject averaged 76 transactions per period in the baseline treatment, which is over 14 standard deviations above the mean of the rest of our sample (8.5). No other outliers were detected. For instance, the second most active subject in our sample averaged 29 transactions per period.

reported by Barber and Odean (2001). In TC the difference is 32%.

		Baseline	TC	N	p-value ^a
Transactions	Male	10.055 (5.087)	6.693 (3.922)	134	<0.0001
	Female	6.805 (3.599)	5.063 (2.810)	129	<0.0001
	p-value^b	<0.0001	0.0001		
Profit (%)	Male	4.569 (8.604)	-1.691 (10.018)	134	<0.0001
	Female	2.871 (6.938)	-2.124 (7.048)	129 ^c	<0.0001
	p-value	0.035	0.634		
Confidence	Male	3.127 (0.770)	3.000 (0.855)	134	0.188
	Female	2.776 (0.742)	2.624 (0.798)	129	0.051
	p-value	0.0003	0.0001		
Overconfidence	Male	0.537 (1.278)	0.500 (1.444)	134	0.915
	Female	0.331 (1.328)	0.135 (1.353)	129 ^c	0.203
	p-value	0.296	0.059		
Risk aversion	Male	0.035 (0.359)		115	
	Female	0.213 (0.443)		102	
	p-value		0.001		

Note: Transactions = mean number of transactions per period; Profit = rate of return from initial endowment; Confidence = pre-task guess of position in the group of 4 (1 lowest, 4 highest); Overconfidence = Confidence – Realized position (-3 lowest, +3 highest). ^a Treatment effects are computed using paired Wilcoxon signed-rank tests. ^b Gender differences are computed using Mann-Whitney U-tests. ^c 2 female observations missing in baseline treatment due to a computer crash in period 7.

Table 1. Means and standard deviations (in parentheses) of the variables of interest disaggregated by treatment and gender.

Result 2. Males are more confident than females in their relative trading ability.

On average, males believe that they will come second best in their group of four, whereas women tend to believe they will be between second and third. However, although the gender difference in confidence is highly significant, the same cannot be said of overconfidence (expected rank minus actual rank in the group). Both males and females are overconfident in the baseline (Wilcoxon signed-rank tests: $p < 0.0001$ and $p = 0.007$, respectively), whereas only males are overconfident in TC (males: $p = 0.0002$, females: $p = 0.206$).

Result 3. Males are less risk averse.

Females are risk averse (Wilcoxon signed-rank test: $p < 0.0001$) while we cannot reject risk neutrality for males ($p = 0.436$).

Result 4. Average profits in TC are negative for both males and females.

Subjects averaged negative profits in TC, meaning that they ended up being worse off by trading than

if they had not traded at all. Indeed, profits are significantly below zero for both males and females (Wilcoxon signed-rank test, $p = 0.001$ and $p < 0.0001$, respectively). However, we do not observe that males perform worse than females in TC as implied by the evidence in Barber and Odean (2001).¹⁰ Finally, trading volume (transactions) correlates positively with profits in the baseline (Spearman's $\rho = 0.194$; $p = 0.002$) and negatively in TC ($\rho = -0.185$; $p = 0.002$).

Result 5. Trading volume is positively correlated with confidence in the baseline.

We find a positive correlation between confidence and trading volume in the baseline (Spearman's $\rho = 0.141$; $p = 0.022$), but not in TC ($\rho = -0.041$; $p = 0.487$). This relationship can be examined in more detail in Figure 1.

Figure 1 displays average transactions per period separately for males and females and for each confidence level. In the baseline, males guessing they will be the best in their group trade more than the rest (Mann-Whitney U-test: $p = 0.07$). However, no relationship seems to be present between confidence and trading in females or in TC.

Having established these 5 preliminary results which are in line with the empirical evidence that concerns us, we now state our main result.

Result 6. Observed gender differences in trading volume cannot be explained by gender differences in confidence.

Figure 1 shows that the gender gap in trading volume is persistent across confidence levels. Furthermore, regression results displayed in Table 2 and 3 suggest that controlling for confidence (as well as risk aversion and field of studies) does not help to explain any significant portion of this gender gap.

Table 2 reports gender marginal effects on trading activity according to 4 different OLS regressions. Full regression results are shown in Table 3 in the Appendix. The dependent variable is the natural logarithm of average transactions per period. Regressors include *gender*, *experience* (= 0 in the first treatment, = 1 in the second treatment), *year* dummies,¹¹ *transaction cost level* dummies (1%, 3% and 7%) and 68 *group* dummies. Models 1 and 3 include three confidence dummies and their interactions with gender and treatment. Models 2 and 4 exclude confidence measures. Models 1 and 2 control for risk aversion whereas Models 3 and 4 replace risk aversion by the variable “*erratic*” (= 1 if a subject

¹⁰ As an additional check, we perform a diff-in-diffs test of profits in baseline vs profits in TC and continue to find no gender effect ($p = 0.314$, Mann-Whitney U-test).

¹¹ Experiments were conducted in three waves: 2014, 2015 and 2016. While 2014 and 2015 sessions were identical, 2016 sessions involved a 50% rebate on transaction costs incurred on losing sales, as explained earlier.

made inconsistent choices in the MPL task, = 0 otherwise).¹² According to these marginal effects, males make between 3.2-3.8 more trades per period than females in the baseline treatment, which represents between 47-55% of the average transactions of females (6.8). In the TC treatment, the difference is between 1.3-1.9 trades per period, between 26-37% of the average transactions of females (5.1). Note that in the baseline treatment, controlling for confidence has a negligible impact, reducing the estimated marginal effects by only 3-6%. On the other hand, in the TC treatment the marginal effect actually increases after controlling for confidence (by 16-26%).

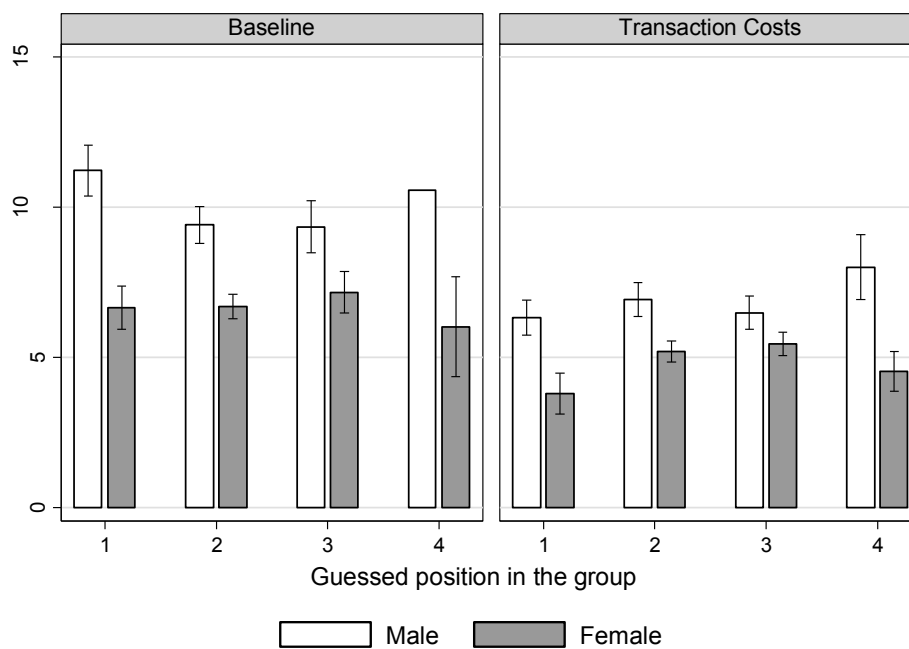


Figure 1. Average number of transactions per period separated by gender and by the (ex-ante) guessed position in the group of four (1 = first, 4 = last). Error bars represent ± 1 std. error of the mean.¹³

Conclusion

Our experimental evidence replicates the findings documented in the empirical literature that males are (1) more confident and (2) more active in financial markets. However, we do not find any support for the conjecture by which (1) explains (2). We believe other mechanisms suggested in the literature to promote trading activity might explain the gender gap in trading volume, such as sensation-seeking preferences (Grinblatt and Keloharju, 2009), or attitudes towards entertainment or gambling (Dorn and Sengmueller, 2009; Dorn *et al.*, 2014).

¹² We use this alternative “erratic” measure to avoid the exclusion of a significant portion of subjects who made inconsistent choices in the MPL. In particular, 24% of them switched more than once in the MPL task, making it impossible to determine their risk aversion.

¹³ No error bar is shown for the mean of males with guess = 4 in the baseline due to having only 1 observation.

	Model 1	Model 2	Model 3	Model 4
Baseline	3.55	3.77	3.20	3.30
t-statistic	5.38	5.67	6.05	6.41
p-value	<0.001	<0.001	<0.001	<0.001
TC	1.88	1.49	1.52	1.31
t-statistic	3.31	2.67	3.17	2.89
p-value	0.001	0.008	0.002	0.004
Confidence	YES	NO	YES	NO
Risk aversion	YES	YES	NO	NO
N	408	408	545	545

Note: We use the estimations of Table 3 to compute for each treatment (baseline, TC) the marginal effect of “male” on the log of average transactions. We multiply these marginal effects by the average number of transactions in each treatment to get the numbers in the table.

Table 2. Marginal effects of “male” on average number of transactions per period. Models 1 and 3 control for ex-ante confidence and Models 2 and 4 do not.

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VARIABLES	(1)	(2)	(3)	(4)
Male	0.936** (0.457)	0.445*** (0.0786)	0.651* (0.343)	0.390*** (0.0609)
TC	-0.0740 (0.386)	-0.336*** (0.103)	-0.256 (0.312)	-0.349*** (0.0827)
Male x TC	-0.240 (0.488)	-0.192 (0.117)	-0.0374 (0.379)	-0.168* (0.0975)
Confidence = 2	0.522 (0.368)		0.319 (0.290)	
Confidence = 3	0.391 (0.351)		0.157 (0.277)	
Confidence = 4	0.418 (0.361)		0.131 (0.297)	
Male x (Confidence = 2)	-0.896* (0.490)		-0.551 (0.364)	
Male x (Confidence = 3)	-0.398 (0.476)		-0.221 (0.352)	
Male x (Confidence = 4)	-0.457 (0.486)		-0.110 (0.376)	
TC x (Confidence = 2)	-0.279 (0.416)		-0.130 (0.332)	
TC x (Confidence = 3)	-0.265 (0.402)		-0.0831 (0.321)	
TC x (Confidence = 4)	-0.556 (0.492)		-0.234 (0.386)	
Male x TC x (Confidence = 2)	0.488 (0.527)		0.0783 (0.419)	
Male x TC x (Confidence = 3)	-0.0496 (0.522)		-0.139 (0.403)	
Male x TC x (Confidence = 4)	0.119 (0.643)		-0.175 (0.491)	
Risk Aversion	-0.135 (0.0922)	-0.109 (0.0878)		
Experienced	-0.0931 (0.0610)	-0.0844 (0.0616)	-0.0598 (0.0511)	-0.0573 (0.0509)
Year = 2015	-0.139 (0.256)	-0.179 (0.233)	-0.441 (0.323)	-0.468 (0.309)
Year = 2016	0.232 (0.234)	0.150 (0.235)	0.0279 (0.294)	-0.00101 (0.300)
Cost = 1%	0.167 (0.134)	0.124 (0.133)	0.148 (0.116)	0.125 (0.116)
Cost = 3%	0.0471 (0.163)	-0.00820 (0.152)	0.0349 (0.125)	0.0210 (0.119)
Arts	-0.0534 (0.155)	-0.0644 (0.152)	-0.0385 (0.111)	-0.0250 (0.108)

Health Sciences	-0.147 (0.116)	-0.137 (0.114)	-0.0843 (0.0894)	-0.0793 (0.0886)
Sciences	-0.0434 (0.148)	-0.0596 (0.152)	0.0358 (0.113)	0.00526 (0.111)
Engineering	0.00356 (0.106)	-0.0113 (0.105)	-0.00819 (0.0920)	-0.0190 (0.0905)
Erratic			0.0592 (0.0628)	0.0613 (0.0628)
Observations	408	408	545	545
R-squared	0.397	0.369	0.328	0.312

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3. OLS estimation of (log) average transactions with group dummies (omitted) and robust standard errors (Huber/White/sandwich estimator). Models 1 and 3 include ex-ante confidence dummies and their interaction with gender and treatment. Models 2 and 4 exclude confidence measures. Models 1 and 2 control for risk aversion whereas Models 3 and 4 replace risk aversion by the variable “erratic” = 1 if a subject made inconsistent choices in the MPL task.