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Competition and Personality in a Restaurant Entry Game: Is there an Entrepreneurial Personality Type?

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Competition and Personality
in a Restaurant Entry Game

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Approximately 25 percent of all new restaurants fail within the first year of opening, and only about half survive for at least three years.[1] Similar failure rates are found for new independent businesses in a wide variety of industries.[2]

It is possible that payoffs to success are high enough to make these high failure rates consistent with rational assessment of the probability of success. But evaluating the likelihood of one's success in a new business venture is a highly complex and idiosyncratic matter. Frank Knight [23] observed that "Business decisions ... deal with situations which are far too unique, generally speaking, for any sort of statistical tabulation to have any value for guidance. The conception of an objectively measurable probability or chance is simply inapplicable."

The complexity of the determinants of success means that people are likely to differ widely in their assessments of the prospects of a new enterprise. Projects will be undertaken by those who are most optimistic. As happens with the winners' curse in common value auctions, the most optimistic investors may include not only those with the best prospects, but also those who are most deluded about their prospects. In a paper titled

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[1]H. G. Parsa et al [29] estimated that 27.5 percent of newly opened independently-operated restaurants in Columbus Ohio either disappeared or changed ownership in the first year of operation and that 61 percent were gone within three years of opening. A study by the Cline Group [15] estimated that 23 per cent of new restaurants closed in the first year after opening and 44 percent closed within three years.

[2]Amy Knaup [22] finds failure rates of startups to be about 20 percent per year in each of the first four years of life for firms in several U.S. industries. A study of manufacturing plant entrants by Timothy Dunne, Mark Roberts and Larry Samuelson [10] estimated that 61.5 percent of new entrants exited within five years.

"The borrower's curse: optimism, finance, and entrepreneurship", David De Meza and Clive Southey [9] present a formal dynamic model in which naive optimists fool themselves into becoming new entrepreneurs despite a persistently negative expected return. They suggest that this theory explains the observed high failure rate of new firms and the prevalence of self-finance and highly secured loans as sources of funds for new enterprises.

Colin Camerer and Dan Lovallo [5] conducted laboratory experiments in an entry game where players simultaneously choose whether or not to enter a contest. Expected payoff to any player depended negatively on the number of entrants and positively on the player's "rank". They found that the number of entrants was greater when rank was determined by skill (at answering trivia questions) than when rank was determined randomly, and that excess entry resulted in negative average returns for entrants. They argue that the high failure rate of small businesses may be partially explained by the entry of aspiring entrepreneurs who overestimate their own skills. Natalia Karalaia and Robin Hogarth [20] conduct similar entry experiments in which payoffs are determined partially by skill (at multiplying two-digit numbers) and partially by luck. They find that there is more excess entry when the payoff depends on both skill and luck than when it depends on skill alone, and they suggest that participants seem to confuse luck with skill.

If decisions to start new ventures are not well explained by rational assessment of probabilities, it is valuable to seek other predictors. Bryan Caplan [6] proposed that a promising way to explore differences in human preferences may lie in the use of psychological personality measures. He argues that psychological research indicates that preference differences among economic agents may differ only on a few well-defined dimensions which can be measured by psychological tests. A recent survey of literature in personality psychology and economics by Almlund, Duckworth, Heckman, and Kautz [1] also suggests that measured personality traits may be good predictors of economic behavior.

This paper explores the relation between personality traits as measured by the Myers-Briggs personality test and willingness of students to "open a restaurant" in a classroom market entry game. We find that two traits matter. Those who score low on the Sense-Intuition scale and those who score high on the Think-Feel scale are more likely to open a restaurant. However, we found no statistically significant relation between personality traits, as measured by the "Big Five" personality scale and behavior in this experiment.

1 The Restaurant Entry Experiment

Our results are based on experiments conducted in Principles of Economics classes at the University of California Santa Barbara in 2006 and 2007. Market experiments were conducted in section meetings. There were a total of 42 sections, each with approximately 35 students. Students received grade credit for class attendance and market winnings, and attendance rates were approximately 90 percent.

The restaurant entry experiment was taken from the textbook *Experiments with Economic Principles* by Ted Bergstrom and John Miller.[2] The experiment is designed to teach the concepts of short and long run equilibrium in a market with free entry and exit in the long run.

We induce a demand curve for restaurant meals by assigning a "buyer value" to each student in class and allowing each student to buy at most one meal. If the number of students in class is divisible by four, then equal numbers of students are assigned buyer values of $24, $18, $12, and $8. If the number is not divisible by four, any leftover students are assigned values of $8. We report the distribution of buyer values to all participants and draw the corresponding demand curve on the blackboard before the experiment begins.

Students are informed that they will be given a chance to open a restaurant, but in order to open a restaurant, one must pay a fixed cost of $20. A restaurant, once opened, has a capacity of four customers, and there is a constant marginal cost per meal sold.

The experiment includes two sessions, each of which has two rounds. The second round of each session is a repetition of the first round. The sessions differ only in the marginal cost of producing a meal, which is $5 in the first session and $8 in the second session.

Each round of a session consists of two stages. In Stage 1, students decide whether to open a restaurant. In Stage 2, customers shop among restaurants and decide whether and where to purchase a meal.

In Stage 1, players are asked sequentially (in a randomly determined order) whether they want to open a restaurant. When a student is asked, she knows the number of restaurants that have been opened and the number of players who remain to be asked. A decision to open a restaurant is irreversible. Stage 1 ends when all students have declared their intention to open or not to open a restaurant.

In Stage 2, restaurant owners post prices and customers shop for meals. Restaurant owners may change their posted prices and customers may bargain over the price. Each restaurant is limited by its capacity to sell at most

four meals, and each customer can buy at most one meal. The competitive equilibrium price for Stage 2 is found at the intersection of the demand curve and the "short run supply curve," which has a horizontal segment at a price equal to marginal cost and then becomes vertical at industry capacity, which is four times the number of restaurants that were opened.

In the first session of this experiment, the marginal cost of a meal is $5. Since fixed costs are $20, and capacity is 4 meals, restaurants that operate at capacity can make a profit only if they sell 4 meals for an average of at least $10 per meal. If the number of demanders willing to pay at least $10 is less than four times the number of restaurants, the short run supply curve will intersect the demand curve at a price below $10 and in competitive equilibrium all restaurants would lose money.

In the actual experiment, there are usually some buyers with relatively high buyer values who pay more than the equilibrium price. Thus we find that even when there is overcapacity, not all sellers suffer losses. But when there is excess capacity, so long as no buyer pays more than her buyer value, *some* sellers will necessarily lose money.

In the second session of the experiment, marginal costs are increased from $5 to $8. In this case, total costs of selling 4 meals are $52, and a restaurant selling 4 meals will break even or make a profit only if the price per meal is at least $13. Given the distribution of buyer values in this session, only about two-thirds as many restaurants can be profitably sustained as in the first session.

2 The Myers-Briggs Personality Inventory

Students in our classes were asked to take an online personality test, known as the Myers-Briggs Type Indicator exam, or MBTI. Taking the test was voluntary, however, about 97 percent of the students who participated in the class experiments also completed the MBTI exam.

The Myers-Briggs test is widely used by practicing psychologists and career counsellors to match workers and jobs. It is also used by marriage counsellors to identify sources of conflict, and by educators to assess the relationship between personality and learning styles.

The MBTI assigns personality scores on four separate dimensions. These are:

- Extraversion–Introversion. Extroverts are said to be energized by social contact. Introverts are said to be more private and reflective. Examples of test questions that are used to distinguish extroverts from

introverts are the following: "Do you find being around a lot of people a) gives you more energy, or b) is often draining." and "Would you say it generally takes others a) a little time to get to know you, or b) a lot of time to get to know you?"

- Sensing–Intuition. A sensing individual is said to be stimulated by details and specifics. An intuitive individual focuses on the big picture, preferring logical patterns and concepts to details. Examples of test questions that are used to distinguish sensing types from intuitive types are the following. "If you were a teacher, would you rather a) teach fact courses or b) courses involving theory?" and "Would you rather be considered a) a practical person or b) an ingenious person?"

- Thinking–Feeling. Thinkers are said to make decisions objectively, linking ideas through logical connections. Feelers are more likely to be attuned to the values of others. Examples of test questions used to distinguish thinking types from feeling types are "Do you more often let a) your head rule your heart or b) your heart rule your head?" and "Which is a higher complement, to be called a) competent or b) compassionate?"

- Judging–Perceiving. Judging types prefer an orderly environment. They are goal oriented and prefer to have plans for achieving their goals. Perceiving types tend to be spontaneous, curious, and adaptable, open to new events and changes. Examples of test questions used to distinguish judging types from perceiving types are "When you go somewhere for the day would you rather a) plan what you will do and when or b) just go?" and "In your daily work, do you a) rather enjoy an emergency that makes you work against time, or b) usually plan your work so you won't need to work under pressure?"

The MBTI questionnaire was originally developed by Isabel Myers and Katherine Briggs [26] as a practical method of implementing theories of personality type advanced by C.G. Jung.[19]. The developers and early advocates of the MBTI [26], [21] conceived of this test as "typology", dividing the population into discrete groups. Thus everyone is either an introvert or an extrovert, a thinker or a feeler, and so on. This typology classifies each person as a member of one of 16 distinct categories, defined by one's type on each of the four dimensions, Extroversion-Introversion (EI), Sensing-Intuition (SN), Thinking-Feeling (TF), and Judging-Perceiving (JP). The

Myers-Briggs test devotes about twenty questions to determining a subject's position on each of the four scales. Each question has two possible answers, with one of two answers assigned to each end of the scale. A subject is classified as belonging to one of the two possible types, depending on which of these types is indicated by the majority of his answers. For example, the examination has twenty-one questions directed toward extroversion-introversion. Someone who gives the "extrovert answer" to eleven questions and the "introvert answer" to ten questions is classified as an extrovert.

Modern psychometricians take a dim view of this dichotomization of types. David J. Pittenger[30] concludes that statistical evidence does not support dichotomous scoring of any of the personality dimensions of the MBTI. Partitioning the population into distinct types on each scale might be warranted if the distribution of the population were bimodal, with a majority of the population close to one extreme or the other. But, typically the sample distribution of responses on each of the personality scales is unimodal with greater concentrations near the middle and smaller concentrations near the extremes. Cohen [7] showed that forced dichotomization of a continuous variable results in a loss of statistical power equivalent to throwing away 38-60 percent of the data. MacCallum et al [24] conclude that dichotomization of quantitative measures in psychological tests is "rarely defensible" and often yields misleading results, particularly in cases where multiple indicators are simultaneously dichotomized. A study in which subjects were retested [17] a few weeks after their first test shows that, about 30 per cent of the time, the results of retesting would reverse the trait classifications of subjects whose scores were near the middle of the scale for that trait.

Although a dichotomous interpretation of the MBTI lacks empirical support, there is considerable evidence supporting the use of continuously-scaled MBTI scores. Tzeng et al [33] and Sipps et al [13] applied principal components analysis to MBTI responses in sample populations. They found empirical factors that coincide reasonably well with the four MBTI scales. Tzeng and his coauthors conclude that the resultant empirical factors "almost perfectly matched" the scales used by the MBTI. Sipps and his coauthors found six significant factors, four of which corresponded quite closely to the four MBTI scales.

Myers and McCaulley [27] examined results from tests administered to about two hundred different samples of workers in various occupations. They find striking differences in the distribution of personality scores across occupations. Most of these differences are consistent with general preconceptions. Not surprisingly, people engaged in sales tend to be extroverts while librarians, scientists, and computer programmers tend to be introverts. Steelwork-

ers, police, and nurses tend to be sensing types, while scientists, journalists, and artists tend to be intuitive types. Bank officers, scientists, and lawyers tend to be thinking types, while dental hygienists, clergy, and elementary school teachers tend to be feeling types. Managers, engineers, judges, and school administrators tend to be judging types, while social scientists, writers, and restaurant workers tend to be perceiving types.

3   Experimental Results

In total, 1291 students took the Myers-Briggs personality test and participated in the restaurant experiment. The experiments were conducted in 42 section groups of approximately 35 students each. Each student participated in two rounds of each of two sections.

3.1   Entry and Short Run Equilibrium

We define the long run equilibrium number of restaurants in any round of the experiment to be the largest number of restaurants that can be profitably sustained in short run competitive equilibrium. Since each restaurant has a capacity of 4, this is the largest number n such that there are at least $4n$ demanders whose buyer values are at least as high as average costs for a restaurant operating at full capacity. The number of "excess entrants" in a round of the experiment is the difference between the actual number of entrants and the long run competitive equilibrium number. Table 1 reports the distribution of excess entrants in each round, for the 42 different class sections in which the experiment was performed. Excess entry was especially common in the first round of Session 1. The median difference between the number of entrants and the number of restaurants that could operate profitably was 3. In round 2, as students gained experience, excess entry was much reduced, with zero or one excess entrants in slightly more than half of the sections. In Session 2, marginal cost was increased from $5 to $8 and consequently the number of restaurants that could operate profitably decreased by about one-third. In the first round of Session 2, many students seemed to overestimate the number of firms that could be sustained and the excess entry increased somewhat. However, by the second round of Session 2, painful experience has diminished the number of excess entrants to either zero or 1 in about two thirds of the sections.

If there are no excess entrants, then the short run competitive equilibrium price in Session 1 will be between $10 and $12, and in Session it will be between $12 and $18. In either session, if there is no excess entry, then

Table 1: **Number of Sections with Excess Entrants**

Excess Entrants	Session 1		Session 2	
	Round 1	Round 2	Round 1	Round 2
0	1	12	9	5
1	6	13	8	22
2	10	6	9	12
3	9	7	13	3
4	11	3	3	-
5	3	1	-	-
6	1	-	-	-
7	1	-	-	-

Table 2: **Excess Entry and Percentile Distribution of Meal Prices**

	Session 1, Round 2			Session 2, Round 2		
Excess Entrants	25th Pctile	50th Pctile	75th Pctile	25th Pctile	50th Pctile	75th Pctile
0	$10	$11	$11.5	$13.5	$14	$14
1	$9	$10	$11	$11.5	$13	$14
2	$7	$8	$10	$11	$12	$13
3	$7	$8	$10	$10	$11	$14
4	$6.5	$7	$9	-	-	-
5	$6	$7	$9	-	-	-

in short run competitive equilibrium, all entrants will make non-negative profits. If there are excess entrants in either session, then the short run competitive equilibrium price for meals is less than average costs, which are $10 in Session 1 and $13 in Session 2. In short run competitive equilibrium with excess entrants, everyone who opened a restaurant would lose money.

In this experiment, trading is decentralized. Restaurant operators are scattered in different corners of the room, and buyers can negotiate prices individually. Demanders with high buyer values often fail to find the lowest available price. Therefore, even when there are excess entrants, some meals are sold for more than average cost, and some restaurants manage to make a profit.

Table 2 shows that, on average, the competitive model predicted prices quite well. When there were no excess entrants, almost all meals sold at prices above average cost. When there were two or more excess entrants,

more than half of the meals sold at prices below average cost. When there is only one excess entrant, about half of the meals sold at prices at or above average cost. However, even when there were two or three excess entrants, about one fourth of the meals sold for more than average cost. When there was one excess entrant, about 60 percent of those who opened restaurants lost money. With two excess entrants, more than 80 percent lost money, and with three or more excess entrants, almost all entrants suffered losses.

3.2 Personal Characteristics and Entry Decisions

For each round of each session, we estimated a probit regression of the decision to open a restaurant (yes=1, no=0) where the independent variables include continuous measures of each of the four Myers-Briggs personality dimensions, as well as gender, race/ethnicity, and rank in class examinations. These regressions also included a fixed effect variable for the section group in which the experiment was performed. The results appear in Table 3.

In the first session, personality traits had no statistically significant effect on the likelihood that a student would open a restaurant. As students became more familiar with the game, the effects of personality traits seem to emerge. In the second round of the second session, both the sensing-intuition and the thinking-feeling traits are statistically significant determinants of entry probability.

Separate regressions for each round fail to take account of the persistence of individual behavior across rounds. More than half of the students (53 percent) never opened a restaurant, while about eight percent of them opened restaurants in at least three rounds. To capture this persistence, we estimated an ordered probit relation in which the dependent variable is the number of times that a student opened a restaurant.

As Table 4 shows, two of the Myers-Briggs personality dimensions are associated with a higher likelihood of opening a restaurant. Those who open restaurants tend to have low scores on the Sense-Intuit scale and high scores on the Think-Feel scale. We also find that students who score well on class examinations are more likely to open restaurants and that Hispanics are significantly less likely to do so. The expected number of restaurants opened by a person who scores at the 25th percentile on the Sense-Intuit scale is about 15 percent higher than that for someone at the 75th percentile. The expected number of restaurants opened by someone who scores at the 75th percentile on the Think-Feel scale is about 18 percent higher than that for those who score at the 25th percentile. Those whose class rank on examinations is at the 75th percentile are expected to open about 31 percent

Table 3: **Characteristics and Decision to Enter:**
Probit Estimates, Marginal effects

	Session 1		Session 2	
	Round 1	Round 2	Round 1	Round 2
Extravert-Introvert	0.011	0.006	0.008	−0.053
Sense-Intuit	−0.054	−0.076	−0.049	−0.096**
Think-Feel	0.034	0.044	0.133**	0.124**
Judge-Perceive	−0.031	−0.008	−0.020	−0.009
Class Rank	0.114**	0.145**	0.101**	0.060
Male	0.002	0.012	−0.013	−0.014
African American	0.042	0.060	0.049	−0.004
Asian	−0.031	−0.026	0.011	−0.007
Hispanic	−0.072**	−0.047	−0.066**	−0.063**
Other Race	0.005	0.023	0.017	−0.020

Regression includes section fixed effects.
**Differs from zero at 5 Percent significance level.

more restaurants than those who score at the 25th percentile. The expected number of restaurants opened by a non-Hispanic is about 39 percent higher than that for Hispanics.

Recall that persons with low scores on the sense-intuit scale tend to focus on the big picture rather than on details, while those on the high end of the think-feel scale tend to seek logical connections and to be less concerned about the feelings of others. It is not so surprising that those willing to undertake an entrepreneurial venture in an unfamiliar environment would tend to be intuitive types. It is less apparent that "thinkers" would be more likely to open restaurants than "feelers" or that people with higher examination scores are more likely to do so. It may be that those who are relatively unskilled at reasoning about economic situations find the experimental environment confusing and thus take the safe, passive option of not opening a restaurant. The fact that Hispanics are less likely to open a restaurant suggests that there may be an interesting cultural difference.

We were surprised by two "dogs that didn't bark." We expected to see that extraverts would be more likely than introverts to open a restaurant, since in the experiment restaurant operators must engage in face-to-face transactions with customers and potential customers. Our results show no

Table 4: **Characteristics and Number of Decisions to Enter:**
Ordered Probit Regression

	Coefficient Estimate	Standard Error
Extravert-Introvert	-0.005	0.123
Sense-Intuit	-0.324**	0.151
Think-Feel	0.384**	0.140
Judge-Perceive	-0.108	0.137
Class Rank	0.506**	0.126
Male	-0.27	0.072
African American	0.105	0.208
Asian	-0.079	0.087
Hispanic	-0.293**	0.099
Other Race	0.024	0.117

Regression includes section fixed effects.
**Differs from zero at 5 Percent significance level.

such effect.

Several experimental and field studies suggest that men may be more overconfident and/or less risk averse than women and hence more willing to try risky endeavors.[8] In an experiment where subjects were given the option of being paid piece rates or by tournament outcomes, Niederle and Vesterlund [28] find that men "are substantially more overconfident about their relative performance than women" and hence are more likely to enter competitive tournaments. Other studies suggest that this effect is not universal.[31][32] In our classroom experiment, we find that, if anything, males are slightly less likely to open restaurants than females.

3.3 External Factors and Decision to Enter

If all students believed that they would make profits by entering, if and only if there is no excess entry, and if they were certain that all others shared this belief, then the entry game would have a simple solution. Where k is the maximal number of restaurants that can operate profitably and the entrance of an additional restaurant would cause all to lose money, the first k students called on would choose to open restaurants and the remaining students would choose not to.

Table 5: External Conditions and Decision to Enter
Probit estimates, marginal effects

	Session 1		Session 2	
	Round 1	Round 2	Round 1	Round 2
Order in Roll Call	0.747∗∗	0.667∗∗	0.863∗∗	0.942∗∗
(Standard Error)	(0.125)	(0.107)	(0.092)	(0.084)
Restaurants Open	−0.097∗∗	−0.094∗∗	−0.132∗∗	−0.167∗∗
(Standard Error)	(0.014)	(0.013)	(0.144)	(0.015)

Regression includes section fixed effects

But as Table 2 shows, not all meals sell for the same price, and some restaurants make profits even if there is excess entry. Furthermore, students are not told the number of restaurants that can be profitably sustained, though they are given sufficient information that they could deduce this number. Those who make this calculation and act accordingly are soon relieved of the impression that all of their classmates will make a similar calculation. We often hear expressions of exasperation from those who opened restaurants because there was not excess capacity when their turn arrived, only to find that some who were asked later chose to open restaurants after the number of open restaurants reached the largest number who could operate profitably.

In an environment where one can not be confident that other potential entrants will act "rationally", one's decision about opening a restaurant is likely to be influenced both by the number of restaurants that are open and the number of persons who remain to be asked when his turn to decide arrives. Table 5 shows the results of probit regressions of a student's decision to open a restaurant on the variables "Order in Roll Call" which is normalized on a scale from zero (first student called) to one (last student called) and on "Restaurants Open" which is the number of restaurants that have already been opened when one is called upon to decide.

We see that, holding constant the number of restaurants already open, students are more likely to enter as the roll call proceeds and that, adjusting for order in the roll call, students are less likely to enter if the number of restaurants already open is larger.

Despite the fact that these external variables affect entry probability, the regression reported in Table 4 did not include the variables "Order in Roll Call" and "Number of Restaurants". Excluding these variables does not

bias our estimates of the effect of personal characteristics on entry decisions because they are uncorrelated with personal characteristics. A student's order in the roll call was randomly chosen for each round. The number of restaurants open when it is a student's turn is determined by the decisions of students earlier in the roll call, a group whose members have also been randomly determined.

It may be, however, that students with different characteristics react differently to different external conditions. For example, it might be that students with high class rank or with personality scores at the "think" end of the think-feel spectrum would respond more sharply to changes in competitive conditions. We therefore ran probit regressions with the external conditions and interaction terms between personal characteristics and external conditions in each of the four rounds of play. These regressions did not find consistently significant interaction effects.

3.4   Personality and Profits

Opening a restaurant in this experiment was not in general a profitable action. In a simple regression of profits on personal traits, personal traits that promote opening of restaurants turn out to have negative coefficients. But not everyone who opens a restaurant in the same round of play makes the same profits. Therefore it is possible that personal traits that incline individuals to open restaurants are also indicators of unusual skill in selling meals once one has opened a restaurant.

A regression of profits on personal characteristics would address this issue, but interpretation of the results would be confounded by the well-known problem of sample selection bias. We address this problem using a method proposed by Heckman [16]. For this method to be effective, we need to have some variables that influence entry but that are uncorrelated with profits conditional on entry. The two variables, "Order in Roll Call" and "Restaurants Open" that we examined in Table 5 serve this role. Both affect the probability of entry, and since each is randomly determined, neither is correlated with profit-making ability conditional on entry.

When we regress personal characteristics on profits conditional on entry, using the Heckman correction, we find that none of the personal characteristics have coefficients significant at the 10 percent level. Thus there is no evidence that those with traits that attract them into opening experimental restaurants tend to be either better than or worse than average at operating their restaurants profitably.

4   The Big Five Personality Measure

Our experiments were conducted in section meetings for three large classes in the fall and winter terms of 2006 and in the winter term of 2007. After we had administered the Myers-Briggs personality test to students in the two classes that met in 2006, we discovered that the current consensus among academic personality researchers [14], [3], [25] seems to favor an alternative personality scaling, the Five Factor or "Big Five" Model. This led us to administer both the Myers-Briggs and the Big Five personality test to the class that met in 2007. The recent survey by Almlund, Duckworth, Heckman, and Kautz [1] also features the Big Five factors as the central measure of noncognitive personality traits.

The Five Factor test measures five nearly orthogonal personality factors that are known as "The Big Five". These five factors are known as *conscientiousness*, *openness to experience*, *extraversion*, *agreeableness*, and *neuroticism.* The Big Five factors are assessed by means of a test called the Revised NEO Personality Inventory.[14] A series of studies of identical and fraternal twins raised together or apart have shown "substantial heritability" of the Big Five personality traits as measured in adults.[18][3] Bouchard and Hur [4] applied similar methods to investigate the heritability of the continuously scaled MBTI personality traits. They found the heritability of MBTI traits to be very similar to that of the Big Five traits.

Several studies [25] [11] [12] have found strong correlations between the four Myers-Briggs (MBTI) factors and four of the NEO Big Five factors. NEO Extraversion was correlated with extraversion on the MBTI Extraversion-Intraversion scale. Openness was negatively correlated with sensing and positively correlated with intuition on the MBTI Sensing-Intuition scale. Conscientiousness on the NEO scale was positively correlated with judging on the MBTI Judging-Perceiving scale. NEO Agreeableness was negatively correlated with thinking on the MBTI thinking-feeling scale. Neuroticism as measured by NEO had only a slight negative correlation with MBTI Extraversion.[12] McCrae and Costa[25] interpret these results to mean that "The five-factor model provides an alternative basis for interpreting MBTI findings within a broader, more commonly shared conceptual framework."

In the winter quarter of 2007, the last quarter of our study, we asked students to take both the Myers-Briggs test and the Revised NEO Personality test, which measures the Big Five factors. In total, 336 students took both tests. For this sample, we re-estimated the model in Table 4 using the Myers-Briggs factors. We also estimated this model with the Big Five

factors in place of the Myers-Briggs factors. The results with the Myers-Briggs factors are similar to those found in Table 4 for the larger sample used previously. The coefficients on Think-Feel and Class Rank are positive and statistically significant at the 5 percent level, and the coefficient on Hispanic is negative and significant. For this sample, the coefficient on Sense-Intuit is also negative, but now only significant at the 10 percent level. In this restricted sample, the coefficient on Male is negative and significant. When the Myers-Briggs factors are replaced by the Big Five factors, no personality trait is statistically significant.

When both the Myers-Briggs and Big Five factors are included in this model, the coefficient on Think-Feel continues to be significant, and none of the Big Five factors have statistically significant coefficients. We considered the possibility that, although no Big Five factor was significant on its own, these factors were collectively significant. However, even that seems not to be true. A likelihood ratio test shows that the hypothesis that all Big Five coefficients are zero cannot be rejected at even the 10 percent level.

5   Conclusion

Two questions addressed by our experiment are: 1) How well does competitive theory work in explaining behavior in an environment where firms make entry and pricing decisions? 2) Is personality, as measured by standard psychological tests, systematically related to behavior in this experimental market?

The experiment was designed to instruct students about the standard economic model of competitive entry. The broad predictions of competitive theory are reasonably well supported by the experimental results. In the short run, entrants lose money when there is excess entry and either break even or make profits when there is not excess entry. In successive rounds of play, the amount of excess entry decreased significantly. Time constraints in the classroom environment prevented us from running more rounds of play. If the experiment had been iterated several more times, it is likely that as students gained experience, the dispersion of prices would have been reduced, and excess entry would have been greatly reduced or perhaps eliminated.

For the purposes of our investigation, however, study of early rounds of play, in which outcomes are highly unpredictable to the participants is advantageous. Real world decisions about whether to start a new firm are loaded with uncertainty. New entrants can not know whether they will have

to compete with new entry or expansion by others, nor can they assume that potential competitors will act in a predictable way. Thus there is a reasonable chance that the personal characteristics that are associated with starting a restaurant in our experiment might be related to those associated with real world entrepreneurship.

We found that two of the four Myers-Briggs personality measure have statistically significant effects on the likelihood that an individual will open a restaurant. Persons who measure closer to the intuiting end of the sense-intuit scale and those who measure closer to the thinking end of the think-feel scale are more likely to open restaurants in our experiment. We found that, in this experiment, those who score well on classroom examinations are more likely and Hispanic students are less likely to choose to open a restaurant.

It is interesting to note some things that we *did not* find, though we searched for them in the data. We found no significant effects of observed personal characteristics on expected profits, conditional on opening a restaurant. We did not find extroverts to be more likely to open a restaurant than introverts, nor did we find any significant difference between the entrepreneurial behavior of males and of females.

Perhaps most surprisingly, although two of the four Briggs-Myers traits had significant effects on entry decisions, none of the Big Five factors were significant. Furthermore, we were unable to reject the hypothesis that collectively the Big Five factors were uncorrelated with behavior in our experiment. Of course this result applies only to behavior in one specific economic experiment. In order to determine whether personality, as measured by either scale, is a significant explanator of economic behavior it would be necessary to relate behavior in a variety of economic environment to alternative measures of personality traits. We hope that this paper has been a step in that direction.

17

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