Effects of Hexaco Personality Traits on Contracting Behavior

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Abstract

In this paper we investigate the correlation between Hexaco-100 personality traits and supply chain contracting behavior. We consider a simple one-supplier-one-retailer supply chain under linear consumer demand. First the supplier determines their price share, then receiving this information, the retailer determines their price share and these price shares in total determine the selling price and thus the demand. In this exploratory study we investigate the relationship between the aforementioned contracting behavior and the personality traits measured by Hexaco-100 inventory. Our results show that organization and creativity have significantly positive correlation with supplier price share. In terms of retailer decisions, modesty significantly reduces price decisions whereas social-boldness significantly increases.

Keywords
Behavioral Operations, Supply Chain Management, Newsvendor Model, Personality Traits, Hexaco-100

1. Introduction and Literature Review
It has been well-established by plethora of experimental and empirical studies that human decision-makers do not conform to the theoretical expectations under complex operations problems. Researchers have been trying to understand and remedy this suboptimal behavior for more than 20 years now. Schweitzer and Cachon (2000) first showed that there is a too-low-too-high pattern in the newsvendor decisions. That is, under high profit margin subjects place too low order decisions and under low profit margin they place too high orders. In a more complex setting where there is a second decision maker, the strategic interaction between the decision makers and social preferences also keeps the decision-makers from following the theory. Studies such as Keser and Paleologo (2001) have shown that decision-makers are not solely concerned with their own profit, they also care about the profit of the other firm and they want to share the total supply chain profit equitably or more equitably than the theoretical expectations. To this end Keser and Paleologo (2001) show that manufacturers offer lower than optimal prices to the retailers. Loch and Wu (2008) show that the salience of the relationship or status within the supply chain can effect how decision-makers act and thus the efficiency of the contract.

There have been some studies trying to address this suboptimal behavior by investigating a connection between personal factors. Some of these studies have shown that cognitive skills (Moritz et al. 2013), gender (de Vericourt et al. 2013), self-esteem (Akbay 2016), regret tendency (Akbay 2016), emotional stability (Akbay 2022) has effect on the order decisions of the subjects.

This study is closely related to Akbay (2022) as both studies investigate the connection between experiment data and Hexaco-100 personality traits. Hexaco-100 (Ashton and Lee 2007) is a very common personality measure that has been widely used in research and in human resource management. For instance, Hilbig and Zettler (2009), Hilbig et al. (2012), Hilbig et al. (2013) and Hilbig et al. (2014) study the effect of Hexaco personality traits on performance in economic games. They show that in ultimatum game, agreeableness subscale is related to the second player accepting more unfair offers and honesty/humility facet is related to the first player offering more favorable allocations.

To the best of our knowledge this paper is the first to consider the effect Hexaco-100 personality inventory in supply chain contracting. Hence by exploring the relationship between Hexaco-100 personality traits and supply chain

contracting behavior we are expanding the frontiers of science and bringing the behavioral operations field a little closer to explaining human decisions.

1.1 Objectives
The objective of this paper is to investigate the correlation between Hexaco-100 personality inventory and pricing decisions of the supplier and the retailer in a linear demand supply chain setting.

2. Experiment Design
We consider a simple one-supplier-one-retailer supply chain with linear demand. First the supplier determines the wholesale price and lets the retailer know. Then the retailer determines the selling price or their profit margin and consequently the demand as the demand is a linear function of the selling price. For simplicity we assume supplier doesn't have any production cost. In the rest of the paper, we will refer to the wholesale price as "supplier's price share" and retailer's profit margin as "retailer's price share". In this setting there is no uncertainty about the consumer demand, hence strategic interaction and personal factors determine how participants make their decisions.

We assume that the consumer demand is given as $D = 16 - selling\ price$. If p_1 is the supplier's price share and p_2 is the retailer's price share, then $D = 16 - (p_1 + p_2)$. The supplier will earn a profit of $Dp_1 = [16 - (p_1 + p_2)]p_1$ and similarly the retailer will earn a profit of $Dp_2 = [16 - (p_1 + p_2)]p_2$. Under these circumstances, retailer's price decision that will maximize their profit is

$$p_2^* = \frac{16 - p_1}{2}$$

and supplier's optimal price decision is 8. To this price share, retailer's optimal price response is 4. Supplier earns a profit of 32 and retailer earns a profit of 16. Hence the supplier earns 2/3 of the total supply chain profit.

The experiment is conducted with 46 undergraduate students who were rewarded with 1% course credit for participating in the experiment. Participants were assigned the role of the supplier or the retailer randomly by the software and through the experiment they remained in the same role. The experiment lasted for 20 decision periods and in each period participants were matched with another partner. The experiment is programmed in z-tree (Fischbacher 2007). A sample supplier decision screen is given in Figure 1. In this screen the suppliers need to enter the price they want to offer to the retailer, and enter their guess for the retailer's response. When they press the "Calculate" ("Hesapla") button, the would see the demand that would result from these price decisions and how much profit they would get. Retailer's decision screen is similar to suppler's, except that are shown the price the supplier has offered and they need to enter only their price choice into the decision support tool. After using the decision support tool as many times as they wished they would press the red "Submit" ("Gönder") button and their decision will be delivered to the system. At the bottom of each screen there is explanation for how the consumer demand and their profit is calculated.

Figure 1: Supplier's screen

The survey is conducted online, and the experiment data is matched with the survey data afterwards.

3. Experiment Results

Here we present the experiment results. Figure 2 displays the average pricing decision over the 20 periods of the experiment. In these graphs, in each period we average the pricing decisions over the 23 suppliers and 23 retailers. For the suppliers we can directly average their pricing decisions, but for the retailers since they are matched with another supplier in each period and they may be offered a different price in each period, a better measure for their decisions is the ratio of their price decisions to the optimal price corresponding to the price offered by the supplier. That is, say, if the supplier offers a price of 10, the optimal retailer response is to offer a price of 3. Or if the supplier offers a price of 4, then the optimal retailer price would be 6. Hence, the retailer's decision must be compared against this optimal response, rather than being directly averaged.
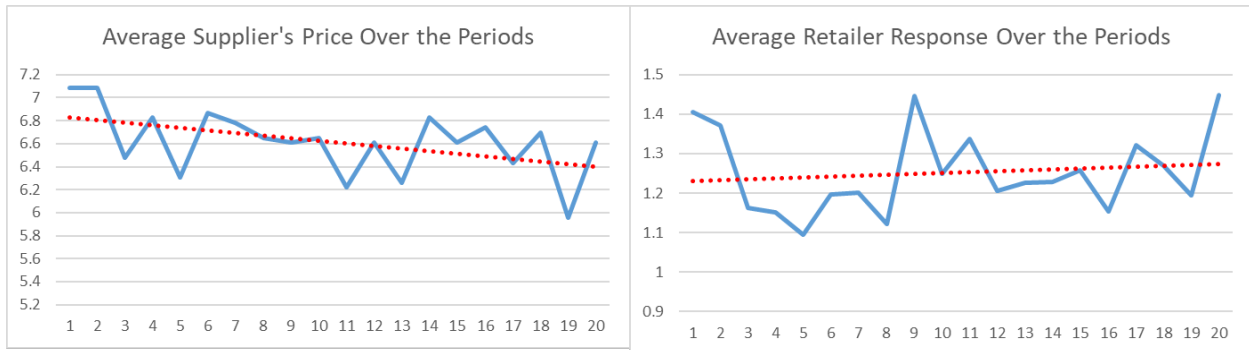

Figure 2: Evolution of the average pricing decision over the periods

Figure 2 shows that in supplier decisions there was a slight downward trend. On the other hand retailer responses seem to increase over time, meaning that they respond by determining a higher than optimal price and the ratio of this price to the optimal keeps increasing. Combining these two observations, the supplier's might be decreasing their prices in order to offer more favorable conditions to the retailers as the retailers respond more aggressively.

Figure 3 and Figure 4 show the individual graphs for each subjects decisions over the whole experiment. We see a high level of heterogeneity and variability in these graphs.
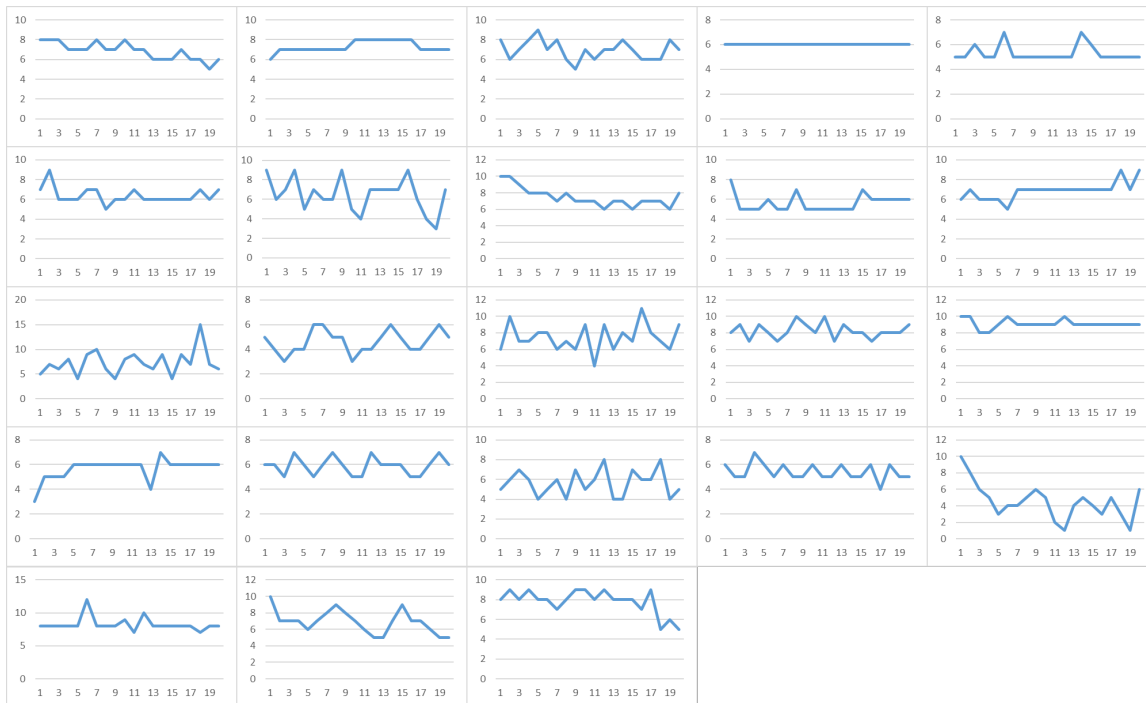

Figure 3: Individual graphs for supplier decisions (x-axis periods, y-axis supplier's price decision)
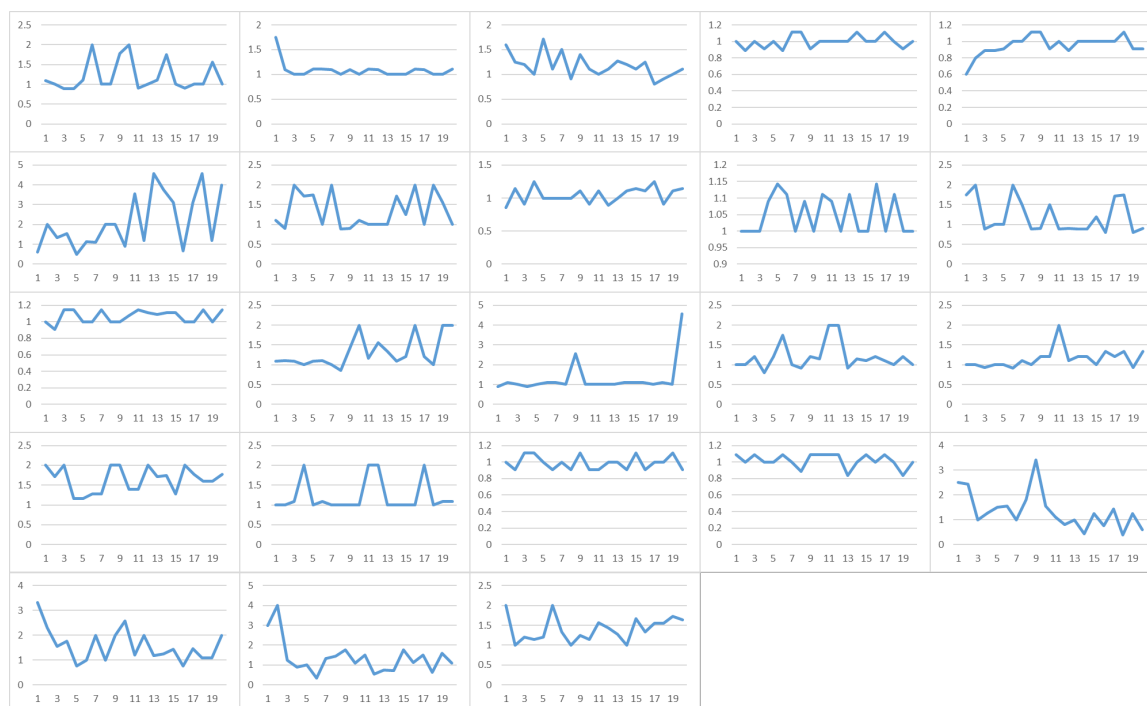
Figure 4: Individual graphs for retailer's responses (x-axis periods, y-axis ratio of retailer's price to the optimal in that period)

Table 1: Average decision of the subjects

Supplier ID	Supplier's average price share		Retailer ID	Ratio of retailer's price share to optimum
1	6.85		1	1.20
2	7.3		2	1.09
3	6.95		3	1.18
4	6		4	1.00
5	5.3		5	0.95
6	6.4		6	2.15
7	6.5		7	1.35
8	7.5		8	1.05
9	5.65		9	1.05
10	6.9		10	1.21
11	7.3		11	1.06
12	4.65		12	1.32
13	7.45		13	1.29
14	8.25		14	1.19
15	9.1		15	1.15
16	5.65		16	1.64
17	5.9		17	1.22
18	5.65		18	0.99

19	5.4		19	1.02
20	4.5		20	1.36
21	8.25		21	1.58
22	6.9		22	1.36
23	7.8		23	1.40

Table 1 displays the average decision of the participants in the experiment. Looking at these values, we can see that the suppliers offered less than their optimal price of 8. In other words, suppliers preferred to share the total supply chain profit more equitably than the theory predicts, which is parallel with the findings of earlier literature such as Keser and Paleologo (2001), Akbay (2016). Retailers' data reveals that instead of choosing the optimal price, which they could easily identify using the decision support too, they preferred higher than optimal prices which reduced both of their profit values. We can see this from their average price to optimum ratios mostly being greater than 1. This finding is parallel with earlier literature that the fairness of the contract offered by the supplier affects retailer's response. (Akbay 2016).

Table 2: Comparison with the theory

	Supplier's average price share	Ratio of retailer's price share to optimum
Average	6.62	1.25
Median	6.85	1.20
Std. Dev.	1.19	0.27
Optimal	8	1
P-value	**0.00**	**0.00**

When we compare these experiment data with the theoretical benchmarks in Table 2. As expected, supplier's price decisions are significantly below the optimal and retailer's price decisions are significantly above the corresponding optimal.

Next, we investigate the correlation between experiment data and the survey results. Table 3 shows the analysis results for the supplier's pricing decisions. We see that only "organization" scale has significant correlation with the supplier's average price. This scale measures the need to have order especially in one's surroundings. Though not significant, when we check the correlation coefficients of the honesty-humility facet and its sub scales, we see the coefficients are negative as expected. "Fearfulness" and "anxiety" lead to smaller and social self-esteem lead to higher price decisions.

Table 3: Correlation of the supplier's price decisions with the survey results

	Sincerity	Fairness	Greed-avoidance	Modesty	Honesty-Humility
Coeff.	-0.03	-0.21	0.07	-0.15	-0.09
P-value	0.89	0.33	0.75	0.51	0.67
	Fearfulness	Anxiety	Dependence	Sentimentality	Emotionality
Coeff.	-0.21	-0.16	0.00	0.00	-0.13
P-value	0.33	0.47	0.99	0.99	0.56
	Social Self-esteem	Social Boldness	Sociability	Liveliness	Extraversion
Coeff.	0.33	0.24	0.11	-0.13	0.18
P-value	0.12	0.27	0.63	0.56	0.41
	Forgiveness	Gentleness	Flexibility	Patience	Agreeableness
Coeff.	0.20	0.16	0.21	-0.03	0.15
P-value	0.36	0.47	0.35	0.89	0.48
	Organization	Diligence	Perfectionism	Prudence	Conscientiousness
Coeff.	0.47	-0.12	0.24	-0.10	0.21

P-value	**0.02**	0.58	0.28	0.65	0.33
	Aesthetic App	Inquisitiveness	Creativity	Unconventionality	Openness to Experience
Coeff.	0.24	-0.06	0.37	0.05	0.21
P-value	0.27	0.80	0.08	0.81	0.33

Table 4 presents the correlation coefficients of the survey results with the retailers' pricing decisions. Only "modesty" has significant correlation, and it is negative. As modesty score of the subjects increase they are expected to react with smaller price decisions. Sincerity, greed-avoidance sub scales and honesty-humility facet also have negative correlation as expected. All of the sub scales in emotionality facet have negative correlations coefficients. This may be explained by as the person becomes more in need to emotional support or more sentimental they respond to supplier's prices more timidly and make smaller price decisions. Conversely social self-esteem, social boldness and other scales in extraversion facet lead to increased price decisions.

Table 4: Correlation of the retailer's price decisions with the survey results

	Sincerity	Fairness	Greed-avoidance	Modesty	Honesty-Humility
Coeff.	-0.33	0.05	-0.29	-0.45	-0.37
P-value	0.13	0.83	0.17	**0.03**	0.08
	Fearfulness	Anxiety	Dependence	Sentimentality	Emotionality
Coeff.	-0.13	-0.14	-0.15	-0.26	-0.20
P-value	0.57	0.52	0.49	0.24	0.36
	Social Self-esteem	Social Boldness	Sociability	Liveliness	Extraversion
Coeff.	0.16	0.39	0.20	0.15	0.33
P-value	0.47	0.07	0.35	0.50	0.12
	Forgiveness	Gentleness	Flexibility	Patience	Agreeableness
Coeff.	0.07	-0.21	0.14	0.04	0.02
P-value	0.75	0.34	0.51	0.85	0.93
	Organization	Diligence	Perfectionism	Prudence	Conscientiousness
Coeff.	-0.07	0.26	-0.05	0.11	0.05
P-value	0.74	0.23	0.81	0.61	0.83
	Aesthetic App	Inquisitiveness	Creativity	Unconventionality	Openness to Experience
Coeff.	0.19	0.05	0.34	0.29	0.30
P-value	0.38	0.82	0.11	0.17	0.17

Due to space restrictions, correlation results for altruism are presented in Table 5. For the supplier decisions, the coefficient sign is expectedly negative, but it is not significant. For the retailer decisions, the coefficient is positive but very small and not significant.

Table 5: Correlation of altruism scale with experiment data

	Supplier's price decisions	Retailer's price decisions
Coeff.	-0.18	0.04
P-value	0.41	0.87

4. Conclusion

In this study we explored the connection between Hexaco-100 personality traits and supply chain pricing decisions. We have seen that parallel to earlier literature, Honesty- Humility scale leads to suppliers offering smaller prices to the retailers. Altruism has a similar effect on supplier decisions, as well. Retailer decisions decrease with Honesty-

Humility. Emotionality leads to both suppliers and retailers make smaller pricing decisions. Due to small sample size the findings of the experiment are not significant. Further research with larger sample sizes may reveal more significant results. Nonetheless, we believe we have made a key contribution to the literature with this study.

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Biography

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