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Is flexibility a dual mechanism? Evidence from the Hungarian food industry

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Abstract. There is a body of evidence that flexibility as a mechanism can help to increase a company's performance when an unexpected situation occurs. The food industry is considered one of the best industries and the performance of food industry undertakings accounts for 2.2% of Hungarian GDP. Food companies make up the third-largest manufacturing sector in Hungary. This study aims, therefore, to investigate the impact of operational flexibility on the performance of the Hungarian food industry by considering environmental uncertainty as a moderator. The research is cross-sectional. A customized questionnaire was used to obtain primary data. The questionnaires were distributed to a purposive group of managers, and there were 301 valid replies for statistical analysis. The findings revealed that operational flexibility has a beneficial impact on company success, while uncertainties in supply and demand do not have an effect on this link.

Keywords: mix flexibility, volume flexibility, product development flexibility, competitiveness, performance, food industry

JEL Classification: O01, M10, M1

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1. INTRODUCTION

From a managerial perspective, operational flexibility is a type of organizational flexibility at the operational level of a company. It is especially important because of its function of reorganizing and reforming resources for the sake of producing new goods and improving company performance (Slack, 2005; Ivanov et al., 2021), especially in the context of eco-innovation (Hajdukiewicz & Pera, 2023).

On the other hand, it is one of the elements necessary for a firm to be successful (Scherrer-Rathje et al., 2014; Sáenz et al., 2018) in regulating production levels and quantities, updating existing goods, and responding to rivals' plans more swiftly (Sáenz et al., 2018, Blecharz & Štverková, 2014, Idris et al., 2022; Oke, 2005). Furthermore, flexibility may be viewed from two perspectives: first, as a capacity in and of itself, and second, as a potent component that allows the production system to respond quickly to market changes and gain a competitive edge (Hallgren & Olhager, 2009). Jack and Raturi (2002) believed that flexibility absorbed environmental uncertainty.

Research about food is increasing in relevance and importance, as the sector is confronted with numerous challenges, such as food waste, offering products to all possible consumer generations, ensuring global access to fresh food, offering local and/or regional products, etc. (Shen et al., 2021; Yakubu et al., 2022; Pocol et al., 2021; Vasylieva, 2021; Moldovan et al., 2022; Mukaila, 2022; Chirpuci et al., 2022), and as more and more contemporary companies are using sustainable business models (Stanek-Kowalczyk, 2021).

This study accepts and supports the definition of operational flexibility offered by Yu et al. (2018), which refers to a manufacturer's capacity to adapt to uncertainties and fluctuations.

For many researchers, especially those who work in industrial groups, operational flexibility is vital and appealing. As a result, the Hungarian food industry has been selected as the target sector, since it is one of the most significant industries of the Hungarian economy. It is the manufacturing sector's second-largest employer and third-largest producer, accounting for more than 10% of total industrial production. Food export revenues contribute significantly to Hungary's total export earnings.

This research aims to know the impact of operational flexibility on the performance of the Hungarian food industry, and to find out whether operational flexibility is a dual mechanism, where it helps companies

improve their performance and at the same time reduces the negative effects of environmental uncertainty on the performance of companies (Roman & Rusu, 2021).

In this study, some abbreviations are used, such as: OF: Operational Flexibility, MF: Mix Flexibility, VF: Volume Flexibility, PDF: Product Development Flexibility, SU: Supply Uncertainty, DU: Demand uncertainty, FP: Financial Performance, OP: Operational performance, CS: Customer Satisfaction, IV: Independent Variable, DV: Dependent Variable.

2. LITERATURE REVIEW

OF assists businesses in reducing the economically damaging repercussions of disparities in demand and supply by allowing them to reallocate capacity in response to changing demand (Goyal and Netessine, 2011; Muangmee et al., 2021, Yu et al., 2018). Furthermore, Huo et al. (2018) said that embracing flexibility as an operational strategy helps organizations enhance their performance and competitiveness due to its critical role in efficiently adapting to changes and coping with volatility in a business environment.

In the operations management literature, the phrases OF and manufacturing flexibility were used interchangeably to refer to the ability of operational systems to respond to unexpected situations. According to De Toni and Tonchia (2005), the concept of OF is broader than 'manufacturing flexibility', encompassing all processes (design, purchasing, distribution, marketing, services, and so on), not just manufacturing; however, manufacturing flexibility is frequently used to refer to all production-related operations. Indicating that there is no distinction in meaning.

Volume Flexibility: Companies should find a technique to satisfy demand variations and alter output quantities to deal with fluctuations as a result of demand fluctuations; in this regard, volume flexibility arose as a strategy to cope with this case. Volume flexibility is traditionally thought to be a reaction to changing demand by varying output volumes (Dreyer and Grnhaug, 2004). According to Oke (2003), a corporation's incapacity to forecast then meet demand quantities at certain periods indicates that it lacks operational volume flexibility, even if the organization could gain it later. Essentially stated, volume flexibility refers to the capacity to modify output volumes in response to demand volatility by boosting or lowering production levels. According to Goyal and Netessine (2011), flexibility may be classed into two main categories: downside flexibility, which means producing far less than regular production capacity, and upside flexibility, which means generating more than the usual production capacity.

As a result, the primary purpose of volume flexibility is to tailor capacity to fluctuating demand.

Mix Flexibility: Because of changes in client tastes and unforeseen patterns in consumption, businesses must find a means of meeting their customers' wants and satisfying them, or they will quickly shift to more competitive enterprises. Operational variation and a product mix may assist businesses in meeting the demands of various customers. In this context, MF is essential and crucial when a firm serves several areas of the market by delivering a collection of integrated goods. As a result, higher MF is required in circumstances of various market sectors, and vice versa (Suarez et al., 1996). Suarez et al. (1996) contend that MF is inextricably tied to the production system, since one of the approaches used to quantify MF is to assess the capability of the production system to deliver items at a certain moment. According to Suarez et al. (1996), MF has a beneficial impact on sales and profit. MF also assists businesses in providing the products needed to fulfill the wants and preferences of their clients (Sáenz et al., 2018; Pohludka and Štverková, 2019).

Product Development Flexibility: PDF plays a vital part in meeting consumers' wants, since it helps enterprises to provide new salable goods that correspond with changes in customer demand, so improving the company's performance and increasing its competitiveness (Lai et al., 2022). In this regard, Cottrell and Nault (2004) discovered that launching new goods improves corporate performance by increasing product

variety, whereas reliance on current offerings reduces company performance. With fast technology improvements and changes in client tastes, providing new products has become vital for many sectors; therefore, launching new items may provide organizations with major competitiveness (Suarez et al., 1996; Štverková and Pohludka, 2018).

Environmental Uncertainty: Based on the management literature, both micro and macro business environments are sources of risk and instability considering the differences between sectors (Sebestova et al., 2020 & Virglerova et al., 2020), which have direct or indirect interaction with the organization and which directly influence its business strategy. Furthermore, many scholars have approached uncertainty using different definitions. Uncertainty is viewed, for example, as a consequence of presumably environmental disturbances, the interactive nature of factors affecting the activity of an organization and its complexity (Galbraith, 1974; Mohammed, et al., 2021). The results of research conducted by Virglerova et al. (2017) confirm that companies consider the uncertainty associated with financial resources. The awareness depends on numerous factors and one of the most complicated to predict is informal economy influence, particularly, its impact on labor market uncertainty (Mishchuk et al., 2018; Remeikiene & Gaspareniene, 2021). Therefore, firms must find a mechanism to deal with environmental change, otherwise it will affect their efficiency and competitiveness (Metzker et al., 2021).

Demand and Supply Uncertainty: In terms of uncertainties such as variations and variances in demand, flexibility has been quantified and examined. Goyal and Netessine (2011) stated that manufacturing flexibility allows businesses to mitigate the negative consequences of a demand-supply mismatch by rearranging production in an appropriate manner in response to demand.

On the other hand, SU, as a form of uncertainty, has various detrimental implications on company performance, particularly financial performance as expressed by costs and earnings. Begen (2016) mentioned that (a) the negative effects of SU are more expensive than that of DU, (b) lowering SU is more lucrative than reducing DU, and (c) because of SU, enterprises would produce less, leading to DU and negatively affecting consumer satisfaction.

Operational flexibility and companies' performance: OF has been recognized as a characteristic of thriving organizations by Scherrer-Rathje et al. (2014) and is one of the factors that lead to good performance and enable companies to achieve a competitive advantage (Sáenz et al., 2018; Akram et al., 2022; Khalid, 2021). It is regarded as one of the most significant forms of organizational flexibility, and it relates to the company's capacity to rearrange existing resources to offer a diverse range of goods in order to adapt and respond to uncertainties and market changes, thus achieving exceptionally better performance (Slack, 2005), reaching the level of competitiveness and being one of the main leaders in the market. Moreover, supply chain flexibility as a form of operational flexibility can help companies to improve their performance and gain a competitive advantage (Seebacher, G., & Winkler, H., 2015), maintain a stable market position due to the development of B2B tools (Hu et al., 2019), and ensure the high quality of a company's logistics as well (Yu, K. et al., 2017; Kulkarni & Frankas, 2018). Here we must highlight the importance of OF as a dynamic ability that enables the company to reach a certain level of competitiveness (Ojha et al., 2020).

Based on the above discussion the following hypotheses are intended to be tested:

H1: The performance of the Hungarian food industry is influenced positively by operational flexibility.

H1a: The performance of the Hungarian food industry is influenced positively by mix flexibility.

H1b: The performance of the Hungarian food industry is influenced positively by volume flexibility.

H1c: The performance of the Hungarian food industry is influenced positively by product development flexibility.

H2: Uncertainty moderates the association between operational flexibility and Hungarian food industry performance.

3. METHODOLOGY

The aim of the study is to examine the relationship between OF and company performance. In order to establish this, the moderating effect of environmental uncertainty is also used for testing the aforementioned hypotheses.

To meet the study's aims, primary data were gathered using a questionnaire developed from the relevant literature mentioned under literature review, and it was distributed to food sector enterprises in Hungary.

In total, Hungary has 2,223 food enterprises in this field, of which 301 enterprises (production managers participated in the survey) were questioned by phone by applying the structured questionnaire, which is CCA. The respondent rate equals 13% compared to the total. Sampling was started at the end of 2019 but most of it was done in the first half of 2020. Only those enterprises with 5 or more employees were included in the sample. A random sample technique was used to determine the sample size.

For testing the hypotheses of the study, descriptive statistics, Liner (OLS) regression and moderation analyses are applied (Hayes, 2013).

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. Test of Reliability

The Cronbach Alpha is a statistical test to measure internal consistency. In the study, it was used to measure the reliability homogeneity of variables. Table 1 presents the result of the reliability by Cronbach Alpha. Based on the outcomes, the Cronbach Alpha range of variables is between 0.695-0.89.

Table 1

Test of Reliability and Loadings

No.	Variable	Cronbach's
1	DU	0.695
2	SU	0.800
3	MF	0.890
4	VF	0.839
5	PDF	0.869
6	FP	0.826
7	CS	0.803
8	OP	0.795

Source: Based on Author's Calculation (2021)

4.2. Result of descriptive statistics

Descriptive statistics is used to show the observation number, mean, standard deviation, minimum and maximum number of variables.

Table 2

Descriptive Analysis

Variables	Min.	Max.	Mean	Std. Deviation	N
DU	1	4.71	2.66	0.697	301
SU	1	4.50	2.04	0.734	301
MF	1	5	3.65	0.999	301
VF	1	5	3.52	0.815	301
PDF	3	5	3.43	0.789	301
FP	1.38	5	3.42	0.792	301
CS	2.29	5	4.09	0.498	301
OP	1	5	3.73	.747	301

Source: Author's Calculation (2021)

4.3. Correlation analysis

As statistical analyses, correlation analyses are used to elaborate the correlation degree between the used variables of the study.

Table 3 displays the correlation matrix between variables. It has been found that between the variables correlation is moderate or low, yet the p-value is significant at .005 and .010 levels. On the other hand, it has also been indicated that the independent variables (MF, VF, PDF) and dependent variable (CP) are correlated with each other.

In more detail, MF is linked to company performance significantly and positively ($R = 0.534$, $P<0.01$).

VF is linked to company performance significantly and positively ($R = 0.621$, $P<0.01$).

PDF is linked to company performance significantly and positively ($R = 0.604$, $P<0.01$).

On the other hand, the results indicated that uncertainty is strongly adversely linked with companies' performance ($R = 0.143$, $P < 0.05$).

It is a logical result because uncertainty will lead to poor performance, but it is a weak correlation because the descriptive analysis showed that the target companies do not face uncertainty in supply or demand, and their performance ranges between good and very good, and uncertainty can be a special accidental case rather than a critical condition for some target companies. This may indicate the positive impact of flexibility as an operational managerial capability on corporate performance, regardless of uncertainty.

Table 3

Correlations Matrix

	UN	MF	VF	NPF	Performance
UN	1				
MF	-.016	1			
VF	-.056	.603**	1		
PDF	-.010	.657**		1	
Performance	-.143*	.534**	.621**	.604**	1

** $P < 0.01$, * $P< 0.05$

Source: Based on statistical analysis by SPSS (2021)

4.4. Test of normality

Based on the following equation, linear regression indicates the expected conditional values of the ou tcome. Y = β0 + β1X. The value of Y will be determined by the value of X.

However, before using the regression model, a normality test must be done to guarantee that the vari ables are distributed normally. The assumption of normality is that the underlying residuals are regularly distributed, or nearly so. The normality test can be conducted in different ways, one of them by applying Kolmogorov/Shapiro text. Table (4) shows that the values of **Sig.** are greater than 0.05, which means the data follow the normal distribution.

Moreover, based on the diagram in Appendix 1, all values are grouped around the diameter, which means that the data is normally distributed, and the figure in Appendix 1 also shows that the histogram represents a normal distribution.

Table (5) shows the DurbinWatson statistic, a test used in statistics to determine the existence of autocorrelation in regression residuals. Since the value of DurbinWatson is almost 2, it means that the residuals are symmetrical, random and do not have autocorrelation.

Table 4

Tests of normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Performance	.050	301	.065	.984	301	.082

a. Lilliefors Significance Correction

Source: Based on statistical analysis by SPSS (2021)

Table 5

Model summary [b]

Model	R	R Square		Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.281 [a]	.079		.076	.55705	1.986

a. Predictors: (Constant), OF

b. Dependent Variable: PERFORMANCE

Source: statistical analysis by SPSS (2021)

4.5. Regression analysis

The causal association between variables was investigated using LR analysis, in order to test the hypotheses and sub-hypotheses.

Table 6

LR results of several flexibility dimensions and total performance

	DV
	Performance
IV	Model 1
Constant	1.877***
MF	0.044 (.079)
VF	0.265 *** (0.386)
PDF	0.230*** (0.338)
R	0.697
Adjusted R^2	0.481 (48.1%)

** P < 0.01, * P< 0.05

Source: Based on statistical analysis by SPSS (2021)

Note: The numbers in brackets represent the values of the standardized Beta coefficient for each variable (β), with this symbol we can actually compare the variables to see which had the strongest relationship with the dependent variable (Everitt, B. S.; Skrondal, A., 2010), whereas the numbers marked with (***) fall back to Beta based on the un-standardized coefficient (B), which was used to write the regression equation.

Based on the findings as presented in Table 6, OF has a positive effect on company performance and accounts for 48.1% of performance variance.

Referring to the result of the empirical testing, the first core hypotheses ***"The performance of the Hungarian food industry is influenced positively by operational flexibility" is accepted.***

On the other hand, it has been also found that flexibility does not have influence on CP. Based on this, H1a: ***"The performance of the Hungarian food industry is influenced positively by mix flexibility***" is rejected.

Furthermore, flexibility affects companies CP positively and this effect is equal to 38.6%. Referring to this finding, H1b ***"The performance of the Hungarian food industry is influenced positively by volume flexibility"*** is accepted.

Finally, yet importantly, new product flexibility affects company performance in a positive way. This effect is equal to 33.8%. Thus, H1b "***The performance of the Hungarian food industry is influenced positively by product development flexibility***" is accepted.

Based on the LR results, regression equation is as follows:

Y= 1.877 + 0.265X1 + 0.230X2

X1: VF, X2: PDF, Y: companies' performance.

• VF improves the performance of food industry companies in Hungary, with the highest impact of 38.6%.

• PDF VF improves the performance of food industry companies in Hungary, ranking second in terms of impact on performance (33.8%).

Table 7

LR Results of several flexibility dimensions and several performance dimensions

	DV		
	Performance		
IV	Model 1		
	FP	CS	OP
Constant	1.649***	2.941***	1.043***
MF	0.003 (0.004)	0.047 (0.093)	0.038** (0.188)
VF	0.444** (0.457)	0.188*** (0.307)	0.162*** (0.177)
NPDF	0.06 (0.062)	0.094** (0.155)	0.537*** (0.591)
R	0.497	0.483	0.787
Adjusted R^2	0.239	0.225	0.615

*p < .05; **p < .01; ***p < .001

Source: Based on statistical analysis by SPSS (2021)

Table 8

LR Results of (OF) variable and several performance dimensions

		DV	
		Performance	
IV		Model 1	
	FP	CS	OP
Constant	1.825***	3.002***	1.132***
OF	0.455*** (0.434)	0.309*** (0.469)	0.740*** (0.749)
R	0.434	0.469	0.749
Adjusted R^2	.186	0.217	0.559

*p < .05; **p < .01; ***p < .001

Source: Based on statistical analysis by SPSS (2021)

Table 8 shows that total OF has a positive effect on all performance dimensions (FP, OP, and CS).

4.3. Moderation analysis

Moderation Analysis was performed using SPSS 25 and the PROCESS (Hayes, 2013) developed by Andrew Hayes to assess the second main hypothesis related to moderation.

Table 9

LR Results of (OF) and Performance

	DV
	Performance
IV	Model 1
Constant	1.132 ***
OF	0.740 *** (0.749)
R	0.749
R^2	0.559

*p < .05; **p < .01; ***p < .001

Source: Based on statistical analysis by SPSS (2021)

Based on Table 9, OF is positively related to company performance. The relationship is significant, and OF explains 55.9% of the variance of company performance.

Relationship between Operational Flexibility and Performance by the Moderating Effect of Uncertainty: The moderating effect of uncertainty on the link between OF and the performance of food sector enterprises in Hungary is shown in Table 10

Table 10

Results of moderated regression analysis (uncertainty as criterion)

	ß	R	R^2	T	P
Constant	2.565 [1.68, 3.44]			5.710	0.000
OF	0.406 [-0.167, 0.646]	0.687	0.472	3.33	0.0009
Uncertainty	-0.2442 [-0.6174,0.1290]			-1.287	0.1989
OF * Un	0.0400 [-0.0617, 14.17]		0.0011	0.774	0.4394

*p < .01, **p < .05, ***p < .001

Source: Based on statistical analysis by SPSS (2021)

Table 10 shows that all P values are not significant: P > 0.000, P > 0.05, and there is a (0) value between the lower and upper value for each of the following ranges [-0.1669, 0.645], [-0.6174, 0.1290], [-0.0617, 14.17]. As a result, it can be concluded that uncertainty has no bearing on the relationship between OF and company success, rejecting the second main premise that "***Uncertainty moderates the association between operational flexibility and Hungarian food industry performance".***

5. DISCUSSION AND CONCLUSION

This study discussed OP from a product flexibility perspective. The aim of the study was to prove that flexibility can be used as a dual mechanism, while depending on the business environment in which the company operates, due to it being one of the dynamic capabilities that companies have to improve their performance or to reduce environmental uncertainty.

Based on the aim of this study, in terms of flexibility, it has been determined that the Hungarian business environment looks stable. In the case of Iran, the Iranian business environment being considered one of the most turbulent of business environments, it has been found that pharmaceutical companies in Iran used flexibility to reduce the negative effects of uncertainty on their performance (Yousuf, 2021). However, the relationship between OF and the performance of the Hungarian food industry clearly differs from the Iranian business environment. Furthermore, flexibility positively affects the performance of the Hungarian food industry. The results obtained from empirical testing match with Sáenz et al. (2018), who considered OF as a characteristic of successful companies and affecting CS positively.

On the other hand, Lafou, M., et al. (2016) have indicated that product flexibility improves performance, as it is a production diversification technique. But this does not match fully with Chod and Rudi's (2005) research, which shows that MF and PDF do not affect financial performance, and only VF affects financial performance positively. This is a logical result since flexibility is a costly choice.

As a conclusion, in stable business environments like the Hungarian business environment, it is observed that OF can be useful as a one-way mechanism in order to enhance a company's performance. The reason is that it can be used as a dual mechanism in case of an uncertain business environment, such

as Iran, where OF is used as a mechanism in order to reduce the negative effects of uncertainty and enhance companies' performance at the same time.

Besides, companies find themselves under pressure, such as being between the competitiveness 'anvil' and the cost 'hammer' of adopting flexibility as an operational technique, while enhancing performance and finding competitive advantage. The advantages of flexibility must reach the point of equilibrium between flexibility costs and good performance, in other words, how far these companies can move forward adapting new options and being flexible in operations while at the same time incurring costs of changing production plans in response to changes in customer needs. Moreover, proactive steps of competitors in the market are also another component to consider, because flexibility as an option is costly. Altering a production plan from one to another based on changes in consumer behavior and market circumstances can be risky and even cost companies the opportunity and ability to survive in the market.

For target companies, OF should seem a definite strategy, since it is just a managerial mechanism at the operational level under strategic-level supervision. Just as 'one hand cannot clap alone', one single technology will not be a solution, and target companies can use several management techniques for ensuring better performance and competitiveness, for example, market orientation, good financial management and effective operational management techniques. Furthermore, target companies can use different approaches like system flexibility, supply chain flexibility or aggregate flexibility, which can positively reflect on their performance and enable them to obtain competitive advantage.

Additionally, companies should work on all levels in order to develop their organizational performance in general, as system flexibility alone is not enough to enhance performance (Camison and Lopez, 2010). Companies should also consider the role of big data analysis using organizational information systems to enhance the effectiveness of operational flexibility (Yu, W., et al., 2021). Likewise, Hungarian food companies will not be able to compete with low prices for imported products until they invest in technological development, which needs state funding.

For future lines of research, flexibility can be checked from different perspectives and can be directly linked to competitiveness and dynamic capabilities. This will allow comparing the impact of flexibility on competitiveness based on the size of companies, particularly since flexibility as an option can be costly for large companies as changing from one option or plan to another may be uncertain. It should also be considered that more resources are required where more costs appear, and thus the losses are higher in the case of failure of the adopted choice. However, it will be easier and safer for small businesses or entrepreneurs to apply, since their options are comparatively modest and protective compared to the proactive approach of the major players in the market, which can incur greater risks.

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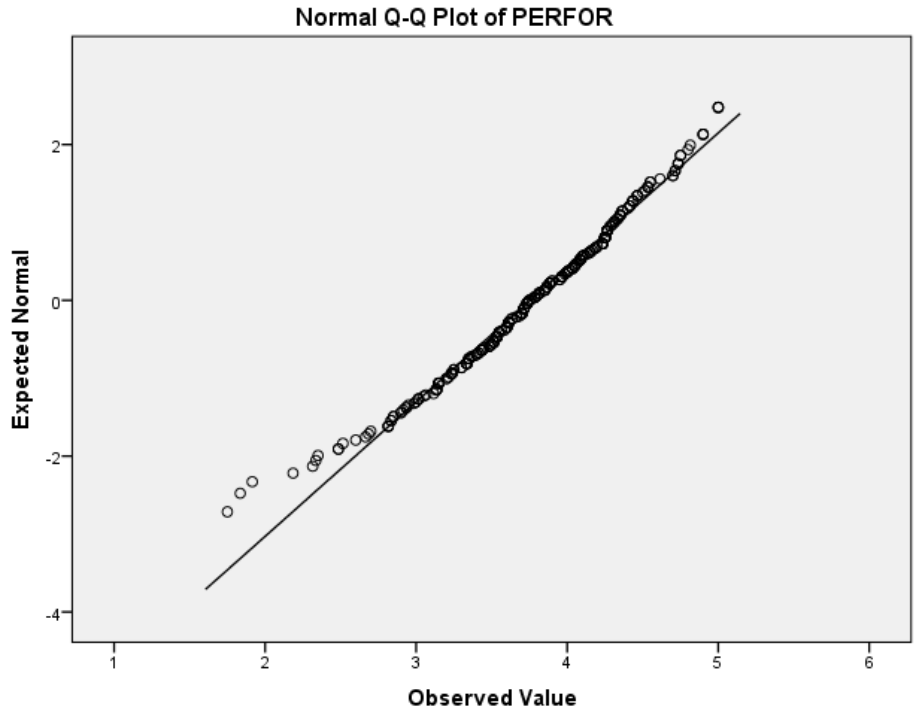
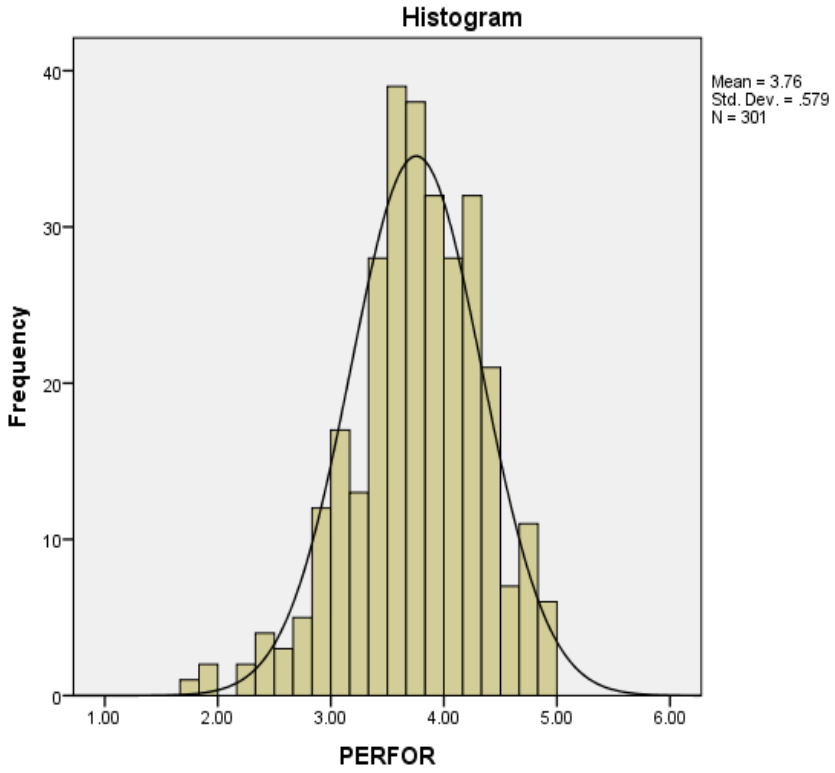
APPENDIX


Normal Q-Q Plot of PERFOR
Expected Normal
Observed Value
2
0
-2
-4
1
2
3
4
5
6


Histogram
Mean = 3.76
Std. Dev. = .579
N = 301
Frequency
PERFOR
40
30
20
10
0
1.00
2.00
3.00
4.00
5.00
6.00