The Impact of female leadership and ownership on firm performance in EU countries

Econometrics – Final Project

at the

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with

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as part of the

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Executive Summary

Purpose: The purpose of this paper is to examine whether having a female top manager or female owner has a positive effect on firm's sales performance in ten EU countries. **Design/methodology:** cross-sectional regression analysis run in full sample and family firm's sample. Dependent variable is firm's sales performance. The explanatory variables are female top-manager and female owner within a firm. Data is taken from BEEPS database. **Findings:** We found that the representation of female top executives and female owner is negatively related to firm's sales performance. **Research limitations/implications**: availability of only cross-sectional data, only measurement indicator of firm performance, which is sales. Recent pandemic effect is not included in our analysis. **Originality/value:** We are looking at both impact of female leadership and female ownership within a corporate world on corporate performance. We are focusing on less developped European countries and there is little empirical evidence for this group of countries.

Keywords: Gender diversity, Female representation, female top management, sales performance, EU.

1. Introduction

One of the biggest reasons whether firm performs well or not is highly related to the firm's executive's role. The Corporate governance literature argues that board diversity is potentially positively related to firm performance. Liu et al (2014) study the effect of board gender diversity on firm performance in China's listed firms and found a positive relationship between gender diversity and firm performance. Similarly, Cristian et al (2012) examines whether female representation in top management in US firms had a positive effect. They found that it improves firm performance based on the innovation intensity of a firm. However, Darmadi et al (2007) examines the relationship between gender diversity on the management board and financial performance of Indonesian listed companies and he found out that the representation of female top executives was negatively related to return on assets and Tobin's *q*, suggesting that female representation is not associated with an improved level of performance.

In our paper we will examine whether having a female top manager or female owner has a positive effect on firm's performance in ten European countries. The research question is the impact of having female top manager or female owner on firm's sales performance. These analyses can be useful guidance for the European regulators who aim to improve gender equality and also CEO and senior management in European firms. The main contribution of our analysis that in this analysis we use a most recent data (2020). We are looking at both impact of leadership and ownership on firm's performance. We are focusing on less developped European countries and there is little empirical evidence for this group of countries.

2. Data

For this analysis we use cross-sectional data from Business Environment and Enterprise Performance Survey (BEEPS) database. This data is collected through surveys administered by European Bank for Reconstruction and Development in partnership with the World Bank. For analysis we use the latest survey collected in 2020 that covers last three years before the survey. BEEPS data includes key indicators related to business environment. We took information on the firm sales, female top management, female ownership, firm age, manager experience, firm size, product innovation, exports, sector of manufacturing fixed assets of firms in the following EU countries: Cyprus, Estonia, Greece, Italy, Latvia, Lithuania, Malta, Portugal, Slovakia, Slovenia. These independent variables are selected because in previous empirical studies (Liu

et al (2014), Nina Smith et al (2006), Cristian et al (2012), Darmadi et al (2007) researchers also used them.

Summary Statistics

Table (1) Summary statistics

	Mean	St.Dev	Min	Max
Dependent variable				
Sales	14.9	96.3	3.100	430.1
ln sales	14.6	1.9	8.0	22.0
Variables of interest				
Top manager female	0.2	0.4	0.0	1.0
Female owners	0.4	0.5	0.0	1.0
Control variables				
Manager experience	24.7	12.3	1.0	70.0
Product innovation	0.3	0.5	0.0	1.0
Firm age	27.4	19.2	3.0	204.0
Firm size	73.8	234.4	1.0	11.4
Fixed asset	1.5	0.5	1.0	2.0
ExportsDV	0.4	0.5	0.0	1.0
Lithuania	0.1	0.3	0	1
Malta	0.1	0.2	0	1
Portugal	0.2	0.4	0	1
Slovak_rep	0.1	0.3	0	1
Slovenia	0.1	0.3	0	1
Estonia	0.1	0.3	0	1
Greece	0.1	0.3	0	1
Cyprus	0.05	0.2	0	1
Italy	0.2	0.4	0	1
Latvia	0.1	0.3	0	1
Family_firms	0.7	0.5	0	1
Manufacturing	0.1	0.4	0	1
Retail	0.2	0.4	0	1
Other_services	0.2	0.4	0	1
Food	0.1	0.3	0	1
Garments	0.03	0.2	0	1
Metal_products	0.1	0.3	0	1
Machinery	0.1	0.3	0	1
Other_manufacturing	0.1	0.3	0	1
R_D	0.2	0.4	0.0	1.

In *Table (1)* we see variable description and summary statistics. Our full sample consists of 4819 observations and 130 variables, but we limited summary and description of variables only to those that are included in our model. Sales is a dependent variable. The average sales of firms are about 15 million euros. The standard deviation of sales is equal to 96 million euros. There is a very large dispersion around the mean of this variable and for this reason we will transform

sales into logarithmic value. Regarding the variable(s) of interest, 40% of firms have female owners and 20% of firms have female top managers.

3. Research Methodology

Since we have a continuous dependent variable, our data is cross sectional and because if four OLS assumptions are met the OLS is BLUE, we will use an OLS estimator to run the following multiple linear regression model.

Equation (1)

$$\boldsymbol{ln\_Sales_i} = \beta_0 + \beta_1\, TM\_Female_i + \beta_2\, Firm\_age_i + \beta_3\, Manager\_exp_i + \beta 4\, Firm\_size_i + \beta 5\, ExportsDV_i + \beta 6\, Fixed\_asset_i + \beta 7\, Product\_innovation_i + \beta 8\, Sectoral\_DM_i + \beta 9\, Country\_DM_i + \varepsilon_i$$

Equation (2)

$$\boldsymbol{ln\_Sales_i} = \beta_0 + \beta_1\, Female\_Owner_i + \beta_2\, Firm\_age_i + \beta_3\, Manager\_exp_i + \beta 4\, Firm\_size_i + \beta 5\, ExportsDV_i + \beta 6\, Fixed\_asset_i + \beta 7\, Product\_innovation_i + \beta 8\, Sectoral\_DM_i + \beta 9\, Country\_DM_i + \varepsilon_i$$

The *Equation (1)* above is the main model. Dependent variable $\boldsymbol{ln\_Sales_i}$ is estimated in monetary units €. The ***i*** stands for each observation in sample from 1 to ***n.*** We regress $\boldsymbol{ln\_Sales_i}$ on *Female Top Manager* and we have other control variables such us *Firm age, Manager Experience, Firm size, Firm exports, Fixed asset, Product innovation, Sectorial dummies,* and *Country dummies* plus an error term ε_i at the end.

In the second model, instead of female top managers we use *Female ownership* as the variable of interest. While the first and second models are estimated on the full sample, the third and fourth models are estimated only on family firms.

4. Analysis

Testing dependent variable whether it follows a normal distribution: we can plot histogram of *ln_sales* and in Figure (1) we can see that it has a normal distribution. Further, we run our regression models with conventional standard errors. We get results shown in (*Table2).* The results of the regression estimate coefficients are most likely to be incorrect because having a homoskedasticity in error terms is rarely true in economics.

Test for heteroskedasticity we run Breusch–Pagan test for heteroskedasticity. Our null hypothesis is H_0: *error terms are homoscedastic*. Ha: *error terms are not homoscedastic*. The results (*Appendix Table 3)* for all models shows a very small *p-value*. So, we reject the null and we apply a robust standard error to the regression model.

Regression results with robust standard errors

Table (4) Regression results with robust standard errors

	Dependent variable **ln_Sales**			
	results for full sample		results for family firms	
	(1)	(2)	(3)	(4)
Constant	14.322***	14.259***	14.150***	14.074***
	(0.152)	(0.151)	(0.170)	(0.170)
top manager female	-0.218***		-0.210***	
	(0.057)		(0.061)	
female owner		-0.120***		-0.036
		(0.045)		(0.049)
firm age	0.010***	0.011***	0.011***	0.011***
	(0.001)	(0.001)	(0.001)	(0.001)
manager experience	0.006***	0.007***	0.004*	0.005**
	(0.002)	(0.002)	(0.002)	(0.002)
firm size	0.005***	0.005***	0.006***	0.006***
	(0.0001)	(0.0001)	(0.0002)	(0.0002)
exportsDV	1.025***	1.027***	0.910***	0.922***
	(0.050)	(0.049)	(0.055)	(0.055)
fixed asset	-0.591***	-0.590***	-0.536***	-0.535***
	(0.048)	(0.048)	(0.053)	(0.053)
product innovation	0.154***	0.141***	0.128**	0.127**
	(0.050)	(0.050)	(0.055)	(0.055)
	(0.123)	(0.122)	(0.135)	(0.135)
Sectorial dummies	*yes*	*yes*	*yes*	*yes*
Country dummies	*yes*	*yes*	*yes*	*yes*
Observations	4,491	4,440	3,121	3,116
R2	0.435	0.439	0.471	0.469
Adjusted R2	0.432	0.436	0.467	0.465
Residual Std. Error	1.435	1.420	1.321	1.324
	(df = 4467)	(df = 4416)	(df = 3097)	(df = 3092)
F Statistics	149.500***	150.269***	119.769***	118.668***
	(df = 23; 4467)	(df = 23; 4416)	(df = 23; 3097)	(df = 23; 3092)

Note: *p<0.1; **p<0.05; ***p<0.01

Due to space limit , results for sectoral and country dummies are not shown. It is included in R code results.

Results in *Table (4)* shows that the impact of having female top managers on sales is negative and statistically significant at 1%. Firms that have female top managers have 20.1% lower sales compared to the firms that do not have a female top manager, other things being equal. The impact of having female owner on sales is negative and statistically significant at 1% only for model 1 but statistically insignificant in model 4. Firms that have female owners have 12% lower sales compared to firms that do not have female owners, other things being equal. The

firm age has a positive effect on firm's sales and statistically significant at 1%, other things being equal. When firm age increase by 1 year, the firm sales increases by 1 %. The top manager's experience also shows a positive effect on sales at 1% significance level in model 1 and model 2 and if manager gains one more year of experience, the firm sales increases between 0.6% and 0.7%. In model 3 and model 4 it is statistically significant only at 5% and 10%. In model 4, on more year of experience would increase sales about 0.4 %. The firm size, export and product innovation also show positive effect on sales, and they are all statistically significant at 1% except innovation impact in model 3 and model 4 where it is significant at 5%. Fixed asset shows a negative effect on sales at 1% significance level for all four models.

Test for multicollinearity in *Table (5)* we show variance inflation factor, for each variable in the model, and because VIF is below 5, the multicollinearity is not an issue in our models.

Normality test: to test the OLS assumption of normality in error terms, we plot the residuals as well as we conduct three tests: Shapiro-Wilk, Cramer-von Mises and Anderson-Darling. As results (*Table6)* in the appendix shows, all three tests reject the Null of normality in error terms. However, we have a large sample and following the Central Limit Theorem, OLS estimators should follow a normal distribution and therefore our results are valid.

5. Discussion

In this analysis we examined the impact of having female top manager and female owner on firm's sales performance in ten EU countries. Similar to Darmadi et al (2007) we also found a negative effect on firm sales if top manager is a female or if the owner is female. However, having female owner was slightly better (-12%) than female top manager (-21%). Perhaps there is a good reason that we got a similar result to Indonesia for our ten EU countries given the fact that these countries do not necessarily have a strong economy whereas two other mentioned studies in this paper on China and US found a positive effect and they both have a strong economy. And for that reason, we could conclude that the effect of having female top manager or female owner on firm performance perhaps vary depending on the economic power and type of a country.

Limitations: first limitation is that we have only cross-sectional data. With panel data we would be able to catch the impact over time. We only have one measure of firm performance and that is sales. Future studies could use other indicators linked to corporate social responsibility. The third limitation is that this data does not include pandemic. Future studies should include pandemic because it could also lead to an interesting outcome.

6. Bibliography

Salim Darmadi, Do Women in Top Management Affect Firm Performance? Evidence from Indonesia, 2010

Cristian et al. Does female representation in top management improve firm performance? A panel data investigation,2012

Liu et al. Do women directors improve firm performance in China?, 2014

Nina Smith et al. Do women in top management affect firm performance? A panel study of 2,500 Danish firms, 2006

Data source

BEEPS, Data 2018-2020

A. Appendix – Supplements

Table (2) Regression results without robust standard errors

	Dependent variable **ln_Sales**			
	results for full sample		results for family firms	
	(1)	(2)	(3)	(4)
Constant	14.322***	14.259***	14.150***	14.074***
	(0.152)	(0.151)	(0.170)	(0.170)
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	(0.050)	(0.049)	(0.055)	(0.055)
fixed asset	-0.591***	-0.590***	-0.536***	-0.535***
	(0.048)	(0.048)	(0.053)	(0.053)
product innovation	0.154***	0.141***	0.128**	0.127**
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Observations	4,491	4,440	3,121	3,116
R2	0.435	0.439	0.471	0.469
Adjusted R2	0.432	0.436	0.467	0.465
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	(df = 4467)	(df = 4416)	(df = 3097)	(df = 3092)
F Statistics	149.500***	150.269***	119.769***	118.668***
	(df = 23; 4467)	(df = 23; 4416)	(df = 23; 3097)	(df = 23; 3092)

Note: *p<0.1; **p<0.05; ***p<0.01

Due to space limit , results for sectoral and country dummies are not shown. It is included in R code results.

Figure (1) histogram of the **dependent variable**

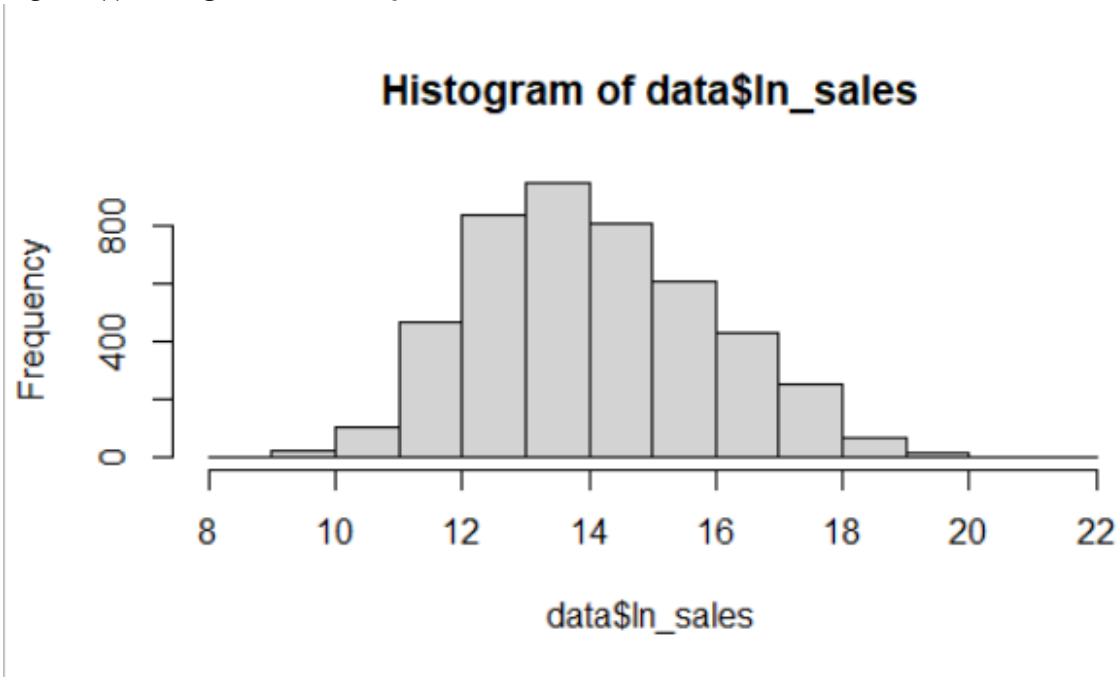


Table (3) Breusch-Pegan test for heteroskedasticity

Studentized Breusch-Pegan test		
Data: model 1		
BP=1054.3	df= 23	p-value <2.2e-16
Data: model 2		
BP=989.12	df = 23	p-value <2.2e-16
Data: model 3		
BP=941.78	df= 23	p-value< 2.2e-16
Data: model 4		
BP= 950.33	df= 23	p-value < 2.2e-16

Table (5) VIF test results

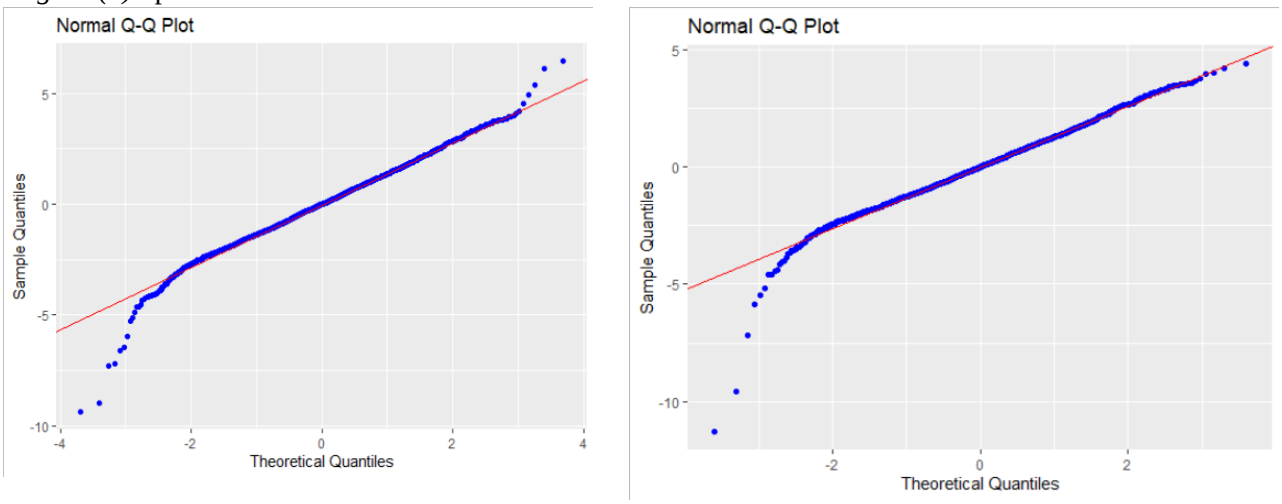
Variance inflation factor
test for multicollinearity

top_manager_female	firm_age	manager_experience	firm_size
1.069516	1.293110	1.273047	1.111891
exportsDV	fixed_asset	product_innovation	manufacturing
1.326447	1.272742	1.192363	3.115546
retail	other_services	food	garments
2.833421	2.979225	1.620200	1.360798
metal_products	machinery	Cyprus	Estonia
1.572977	1.565911	1.559258	1.813182
Greece	Italy	Latvia	Lithuania
3.007378	3.655670	1.735997	1.852866
Malta	Portugal	Slovak_rep	
1.655141	4.337278	2.839885	

Table (6) Normality test results

Model	Test	Statistic	p- value
M1	Shapiro-Wilk	0.99	0.0000
	Cramer-von Mises	289.2614	0.0000
	Anderson-Darling	1.693	2e-04
M2	Shapiro-Wilk	0.9909	0.0000
	Cramer-von Mises	286.1333	0.0000
	Anderson-Darling	1.534	6e-04
M3	Shapiro-Wilk	0.9821	0.0000
	Cramer-von Mises	203.3176	0.0000
	Anderson-Darling	1.5977	4e-04
M4	Shapiro-Wilk	0.982	0.0000
	Cramer-von Mises	202.4111	0.0000
	Anderson-Darling	1.6247	4e-04

Figure (2) plot of the residuals to test for normal distribution



B. Appendix – R Code

```
#download our data that we prepared

data=read.csv ("data.csv", header= TRUE, sep=";")
#-----------------------Summary Statistics-------------------------------
-------------------------------------------------

# Bellow, we have the summary statistics of the variables of interest

stargazer (data, type="text", title="Descriptive statistics", digits=1,
out="table1.txt")

#----------------------------------------test if our dependent variable is
normally distributed--------------------# plot dependent variable
hist(data$ln_sales)
#----------------------First, we run our 4 models with conventional
standard errors-----------------------------

m1<- lm (ln_sales~top_manager_female+firm_age +manager_experience
+firm_size+exportsDV+fixed_asset+product_innovation +manufacturing +
retail+other_services+food + garments+ metal_products+machinery+
Cyprus+Estonia+Greece+Italy+Latvia+ Lithuania+ Malta+Portugal+Slovak_rep,
data=data)

m2<- lm (ln_sales~female_owners+firm_age +manager_experience
+firm_size+exportsDV+fixed_asset+product_innovation +manufacturing +
retail+other_services+food + garments+ metal_products+machinery+
Cyprus+Estonia+Greece+Italy+Latvia+ Lithuania+ Malta+Portugal+Slovak_rep,
data=data)

# Create family data

family<-data[data$family_firms==1,]

m3<-lm (ln_sales~top_manager_female+firm_age +manager_experience
+firm_size+exportsDV+fixed_asset+product_innovation +manufacturing +
retail+other_services+food + garments+ metal_products+machinery+
Cyprus+Estonia+Greece+Italy+Latvia+ Lithuania+ Malta+Portugal+Slovak_rep,
data=family)
```

```
m4<-lm (ln_sales~female_owners+firm_age +manager_experience+firm_size+
exportsDV+fixed_asset+product_innovation+manufacturing+retail+other_service
s+food+garments+metal_products+machinery+Cyprus+Estonia+Greece+Italy+Latvia
+Lithuania+Malta+Portugal+Slovak_rep,data=family)


# with help of stargazer library, we can have a nice output of the results
stargazer (m1, m2, m3, m4, type="text",

          dep.var. labels=c ("log Sales"),

          covariate. Labels=c ("top manager female", "female owner","firm
age","manager experience","firm size","exportsDV","fixed asset","product
innovation","manufacturing","retail","other
services","food","garments","metal
products","machinery","Cyprus","Estonia","Greece","Italy","Latvia","Lithuan
ia","Malta","Portugal","Slovak rep"), out="4_modelss.txt")

# The interpretations of the regression models can be found in the pdf file

# -------------------variance inflation factor, test for multicollinearity-
-----------------------------------------------

m1<- lm (ln_sales~top_manager_female+firm_age +manager_experience
+firm_size+exportsDV+fixed_asset+product_innovation +manufacturing +
retail+other_services+food + garments+ metal_products+machinery+
Cyprus+Estonia+Greece+Italy+Latvia+ Lithuania+ Malta+Portugal+Slovak_rep,
data=data)
vif(m1)

# plot dependent variable
hist(data$ln_sales)
#---------------------------------- We run a Breusch–Pagan test for
heteroskedasticity---------------------------
bptest(m1) # p-value < 2.2e-16, we reject the Null
bptest(m2) # p-value < 2.2e-16, we reject the Null
bptest(m3) # p-value < 2.2e-16, we reject the Null
bptest(m4) # p-value < 2.2e-16, we reject the Null

#----------------------------------We will use robust standard errors for
each model ----------------------------coeftest(m1, vcov = vcovHC(m1,
type="HC1"))
coeftest(m2, vcov = vcovHC(m2, type="HC1"))
coeftest(m3, vcov = vcovHC(m3, type="HC1"))
coeftest(m4, vcov = vcovHC(m4, type="HC1"))
#----------------------------------we look at the results with robust
standard errors------------------------------

model1=coeftest (m1, vcov = vcovHC (m1, type="HC1"))
model2=coeftest (m2, vcov = vcovHC (m2, type="HC1"))
model3=coeftest (m3, vcov = vcovHC (m3, type="HC1"))
model4=coeftest (m4, vcov = vcovHC(m4, type="HC1"))

stargazer (model1, model2, model3, model4, type="text",
```

```
          dep.var.labels=c("Sales"),

          covariate. Labels=c ("top manager female", "female owner","firm
age","manager experience","firm size","exportsDV","fixed asset","product
innovation","manufacturing","retail","other
services","food","garments","metal
products","machinery","Cyprus","Estonia","Greece","Italy","Latvia","Lithuan
ia","Malta","Portugal","Slovak rep"), out="models with robust standard
errors.txt")




# ---------------------------------plot the residuals----------------------
-------------------------------------------------------

ols_plot_resid_qq(m1)
ols_plot_resid_qq(m2)
ols_plot_resid_qq(m3)
ols_plot_resid_qq(m4)


#---------------------------------test for normality ----------------------
-------------------------------------------------------

ols_test_normality(m1)
ols_test_normality(m2)
ols_test_normality(m3)
ols_test_normality(m4)
```

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