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SPECIAL TOPICS IN BUSINESS ECONOMICS

Third assigment

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1 Introduction

In this study, we will construct an econometric model with the goal of identifying variables that statistically influence the profitability of companies. Profitability will be measured using Tobin's Q as the dependent variable. In addition, to achieve a more robust estimation of the coefficients of the dependent variable, we will employ statistical measures and charts. This will ensure the reliability of our estimations. In the second stage, taking into account the relevant literature, we will reevaluate our initial regression using an instrumental variable. The OC (Concentration Ratio-Herfindahl-Hirschman Index) will be used as the instrumental variable. Finally, we are required to address the heterogeneity arising from the differentiation between the regions.

2 Question (1)

2.1 Data Description

In this article, we utilize variables from various companies and sectors across four European countries (France, Germany, Spain, and Italy) during the period 2010-2016. Our sample consists of $4,826$ company observations across all years, with an average of approximately 689 unique companies per year. With 16 main sections, over half of the companies sample belong to Manufacturing and Professional, Scientific, and Technical Activities sections. In the continuation of our analysis, we will use the following variables: $Tobins\_Q\_$, PM, $Size$, $Leverage$, and $Growth\_sales$. $Tobins\_Q\_$ is a measure calculated as the natural logarithm of the market value of assets divided by the book value of total assets. It is used to assess a business's profitability. In simple terms, the metric suggests that higher profits are associated with a larger difference between the market value and the accounting value of an asset. PM, which stands for profit margin, represents the percentage of a company's revenue that it retains as profit. $Size$ is the natural logarithm of total assets, placing a company into a size category based on the value of its assets. $Leverage$ is the ratio of Total long-term debt to total assets, indicating the borrowing of funds for investments or projects. $Growth\_sales$ represents the growth rate of sales, indicating the percentage increase in sales for each company within a specific time frame.

2.2 Descriptive Statistics

Table 1: Summary Statistics

	Obs	Mean	Std. Dev.	Min	Max
Tobins_Q_	4826	0.835	0.681	0.005	3.640
PM	4826	2.080	14.887	-99.817	36.300
Size	4826	19.466	2.388	12.457	26.739
Leverage	4826	0.156	0.148	0.000	0.811
Growth_sales	4826	0.048	0.209	-1.000	0.640

Comment: This particular table was generated using Stata statistical software

Table 1 provides descriptive statistics for the variables of interest that will be used in the upcoming study. The average of $Tobins\_Q\_$ for all the examined years across businesses and all sectors is 0.835. The initial observation suggests that, on average, businesses exhibit a lower market value in comparison to the book value of their assets, potentially indicating undervaluation in the market. The average PM is 2.080. This means that, on average, 2.080% of the revenue earned represents profit. The average $Size$ of a company in our sample is 19.466. This corresponds to the average value of total assets for the firms in the sample. The average $Leverage$ is 0.156, which means that, on average, 15.6% of the

firm's assets are represented by long-term debt. A lower leverage ratio generally suggests lower financial risk, indicating that the company relies less on borrowed funds. The average *Growth_sales* is 0.048, indicating that, on average, the firms in our sample increase their sales by 4.8% annually.

We employed a boxplot for each analyzed variable to identify potential outliers. Following this, values surpassing $3(Q_3 - Q_1) + Q_3$ (outliers), where Q_1 denotes the first quartile and Q_3 represents the third quartile, were removed from all variables except for *Size*, which had no outliers. The outlier values were then substituted with the mean of each respective variable. In the variable *Tobins_Q_*, approximately 3% were extreme values and were replaced with the mean of the respective variable. For *PM*, it was about 6%, for *Leverage* approximately 0.7%, and finally, for *Growth_sales*, it was around 4.8%. Last but not least, we checked the distribution of the above variables using the Skewness-Kurtosis test of normality. For all the variables under examination, the null hypothesis of normal distribution was rejected, as the Prob>chi2 was less than 0.01. This indicates that we reject the null hypothesis of normal distribution in all cases. The data transformations to address extreme values, as well as the distribution of the variables under examination, will play a role in the estimations that need to be considered.

2.3 Regression results

Table 2: OLS Regression

VARIABLES	COEFFICIENTS
PM	0.005***
	(0.001)
Size	-0.039***
	(0.004)
Leverage	-0.837***
	(0.070)
Growth_sales	0.312***
	(0.054)
Constant	1.693***
	(0.085)
Observations	4,826
R-squared	0.081

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Based on Table 2, we will present our empirical results regarding the influence of variables of interest on our dependent variable *Tobins_Q_*. Additionally, we will assess the extent to which our empirical findings align with the existing literature, specifically, how variables interact with our dependent variable. We used a basic model, the pooled Ordinary Least Squares (OLS), and incorporated robust standard errors to handle heteroscedasticity. This

means that the variability of the disturbance term isn't the same for all x_i but varies, which is a more realistic assumption. In this manner, we prevent potential biases from influencing our estimates. Using the F-TEST for the linear regression model, where Prob > F is significantly smaller than 0.01, at a 1% significance level, we can confidently state that the model has been well-specified. Therefore, we reject the reduced model, indicating that the added variables have substance and are not zero in the population. It's worth noting that all coefficients in our sample are statistically significant at a 1% significance level. Last but not least, the R-squared indicates that only 8.1% of the variability in our dependent variable is explained by the model. However, it is often considered a less reliable measure and is not widely used.

The variable PM appears to positively impact the firm's profitability because the net profit margins maintained by a business over time create the potential for higher performances in future periods. This could arise due to high expectations from the firm's good performance or the possibility of improvements driven by earnings. The variable $Size$ negatively influences $Tobins\_Q\_$, as larger businesses are often seen as being in a more mature stage of their life cycle. In such stages, expectations for significant growth or innovation tend to be lower, potentially leading to a negative impact on the business value. The variable $Leverage$ has a negative impact on $Tobins\_Q\_$ because as the risk increases, the expected returns of a business are likely to decrease. On the other hand, $Leverage$ can act as a control mechanism within each company by reducing profit diversion, potentially leading to a positive relationship with $Tobins\_Q\_$. The variable $Growth\_sales$ has a positive impact on $Tobins\_Q\_$ because if growth is a significant factor in increasing future returns from an investment, then an increase in $Growth\_sales$ will positively affect $Tobins\_Q\_$. Also Companies with faster growth rates compared to others tend to have higher value, hence the positive relationship.

Regarding both the interpretation of the regression results and the management in terms of what we expected and the explanation of the sign, we relied on the following two articles: "Multiple Large Shareholders and Firm Value" and "Firm Size and the Effect of R&D on Tobin's Q" where the results regarding the direction of influence seems to be consistent. Additionally, our sample consists of 16 distinct sections. However, 64.9% of the businesses belong to the Manufacturing and Professional, Scientific, and Technical Activities sections. According to the information provided, our estimates are significantly composed of businesses within these sections, given their specific characteristics, attributed to the distinct distribution of various businesses across sectors. If there were a different proportion of businesses in the sectors, the results could vary.

3 Question (2)

Considering the literature, our primary goal is to identify a suitable instrumental variable, denoted as z. This variable should be associated with the variable x ($Ownership\_Concentration$) and should not be correlated with the error term u, ensuring an unbiased estimator. In other words, the only predictive information that the variable z will provide for y will be through its indirect correlation with our variable of interest, x. There seems to be a relationship between the mean ownership share of the top three largest shareholders and the severity of corruption(CPI), as indicated by a study titled "Corruption and Corporate Finance Patterns: An International Perspective" authored by Julan Du from the Chinese University of Hong Kong. The study suggests a strong positive correlation between these factors. Emphasizing that corruption degrades corporate governance, as individuals such as firm managers involved in such practices seek to relax financial regulations, aiming for easier access to corrupt behaviors. It also leaves shareholders who hold small stakes in the company vulnerable to exploitation by shareholders with large stakes and corporate executives. Such behaviors are observed in countries where government entities have high levels of corruption. Additionally, in their analysis, they use instrumental variables to address potential issues such as endogeneity. This involves handling situations where an independent variable (x) is related to the disturbance term (u).

We will use another variable, Return on Assets (ROA), as an instrument for evaluating Ownership Concentration, based on the recommendation of the literature article 'Portfolio Concentration and Firm Performance' by Anders Ekholm and Benjamin Maur. In this study, a positive relationship was found between the Herfindahl Index of ownership concentration (HFI) and ROA under various assumptions related to Portfolio Concentration. The HFI is calculated by assessing an investor's holdings relative to the total company shares, similar to our definition where higher ownership implies an increased index. ROA is defined as earnings before interest and taxes divided by average total assets, providing information similar to our own definition. The article checked for any potential nonlinear relationship between these variables, but the findings were statistically insignificant, reinforcing the understanding of a linear relationship. The article argues that portfolio concentration (AWI) is highly significant for smaller shareholders, assuming a positive correlation between the concentration of the portfolio and the future performance of the company. Portfolio concentration refers to how many shares an investor holds in a company, with higher concentration indicating a large portion of the investor's shares invested in that specific company. This significance is attributed to smaller shareholders having limited information capabilities, making the concentration of the portfolio in a company a crucial motivation for active participation in the company's proceedings. Additionally, the size of ownership in the company plays a significant role, providing extra motivation for acquiring information about the respective company. The average portfolio concentration of shareholders shows a significant relationship with performance, especially when compared to larger shareholders, where this relationship decreases noticeably. As a result, there is no significant force for information acquisition as individual units(small shareholders), and investors are compelled to follow market mechanisms as the primary means to improve their position. In more general terms, this relationship suggests an increase in concentration in a company when investors anticipate higher future returns for the shares of that particular company. This is seen as a

profitability strategy where investors can exploit favorable conditions.

Before utilizing instruments for the variable $Ownership_Concentration$, we conducted a check for extreme values and examined the distribution of variables, as outlined in section 2. For all variables, we performed a normality test using Skewness/Kurtosis tests. In every case, we rejected the null hypothesis of normal distribution. Additionally, only for the variable $ROA\_before\_$, we encountered an issue with extreme values, which we addressed by replacing them with the mean value of 6.43% for the sample. According to the article "On solving endogeneity with invalid instruments: an application to investment equations," many studies aim to enhance the accuracy of Tobin's q calculation when investigating the relationship between investment and liquidity. To mitigate measurement errors in Tobin's q, researchers use estimators that correct for these errors, such as the IV two-stage least squares estimator. For this reason, we will also use this estimator in our analysis. We will use the First-Stage F Statistic, which, according to the article "A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments," concludes that the F-statistic, based on this specific methodology, should be large, specifically above 10, for a reliable estimation using the two-stage least squares method. Using both variables as instruments, the F-statistic is 7.89, which is less than 10, suggesting that these variables are not valid instruments for $Ownership_Concentration$. Conversely, when using only the variable CPI as an instrument, we obtain an F-statistic equal to 15.57, which is greater than 10, indicating that this variable is a valid instrument for $Ownership\_Concentration$. Therefore, we will use only the variable CPI.

Table 3: 2nd-Stage Results

VARIABLES	COEFFICIENTS
Ownership_Concetration	0.492***
	(0.158)
PM	0.005***
	(0.002)
Size	-0.101***
	(0.037)
Leverage	0.156
	(0.286)
Growth_sales	0.000
	(0.002)
Constant	-0.084
	(1.449)
Observations	4,682
R-squared	-0.234

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Observing Table 3, we observe a statistically significant positive relationship at a significance level of 1% between $Ownership\_Concentration$ and $Tobins\_Q\_$. This could be happening because a company with a high $Tobins\_Q\_$ may indicate high returns for a

shareholder, thereby providing an incentive to acquire a larger share of the stock. Additionally, there is considerable variability in the coefficients compared to Table 2, indicating low robustness in the estimates.

According to the article "Differences in Governance Practices between U.S. and Foreign Firms: Measurement, Causes, and Consequences," country characteristics play a significant role in explaining why foreign companies invest less in governance compared to American companies. The level of investor protection in each country is a critical factor influencing controlling shareholders' expectations of benefits and costs from an investment, as well as their approach to governance. Additionally, the connection between a firm's internal governance investment and its value is likely influenced by the laws and regulations prevailing in each country, as mentioned earlier. This is why specific countries exhibit distinct governance characteristics. Moreover, the culture and customs governing each country are likely to impact how a company is managed. In summary, the article emphasizes the diversity in governance practices across countries. Lastly, due to the variability across countries in Tobin's Q, which may arise from industry and country characteristics,industry and country fixed effects are used to address such forms of heterogeneity in the statistical model. For these reasons, we will also employ this statistical model to address endogeneity that may arise from the aforementioned factors. It's worth considering that when using the fixed-effects statistical model, what we are doing is removing the average value from all variables in the model. As a result, variables that are constant over time are eliminated, and we cannot observe them.

Table 4: 2nd-Stage with industry and country fixed effects Results.

VARIABLES	COEFFICIENTS
Ownership_Concetration	-.788
	(.636)
PM	0.006**
	(0.002)
Size	-0.108**
	(0.043)
Leverage	0.456*
	(0.267)
Growth_sales	0.004
	(0.003)
Constant	8.236*
	(4.875)
Observations	4,682
R-squared	-0.234

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

For the results [1], we employed two-stage least squares (TSLS) with industry and country

[1]The results were generated using the following command in Stata:'ivreg2 $Tobins\_Q\_$ ($Ownership\_Concetration = CPI$) PM $Size$ $Leverage$ $Growth\_sales$ $i.NACEcode$ $i.Country$,robust', To account for industry sources of heterogeneity, we used $i.NACEcode$, and to account for country sources of heterogeneity, we used $i.Country$. The command 'encode $CountryISOcode$, generate($Country$)' was

fixed effects. Looking at Table 4, firstly, we can observe that the instrument we used does not have a statistically significant impact. Moreover, the direction of the impact is negative, contradicting what has been established in the existing literature so far. The variables that maintained their statistical significance regardless of the regression model and showed resilience are the variables PM and $Size$. Furthermore, they retained their sign of influence concerning the dependent variable $Tobins\_Q$. Lastly, the variables $Leverage$ and $Growth\_sales$ exhibited significant variations in terms of their statistical significance and the variability of their coefficients compared to the regressions conducted using a variety of statistical techniques.

used to generate the variable $Country$.

4 Conclusion

The goal of this analysis was to identify variables that impact the variable $Tobins\_Q\_$, essentially finding variables that significantly influence firms' profitability. Various techniques were employed, such as instruments to address endogeneity, i.e., correlations with the disturbance term from independent variables. Fixed effects were used to account for variations arising from heterogeneity across countries and industries. Initially, the instrument used had favorable specifications with a high F-statistic and a statistically significant coefficient within the framework of TSLS analysis. However, after incorporating fixed effects, it did not exhibit statistical significance at any acceptable level. This suggests that the initial statistical significance might have arisen from the heterogeneity across countries and industries. Finally, variables PM (profit margin) and $Size$ (Natural logarithm of total assets) demonstrated significant resilience, reinforcing the findings of the respective economic literature. It would be interesting to conduct further research to determine the suitability of the specific instrument, providing additional tests and control variables known from theory to influence our dependent variable.

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