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Capital structure of publicly traded companies in the US and the EU during and after COVID-19

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ABSTRACT

In this research paper, adjustments in the capital structure of publicly listed companies in the US and the EU during the pandemic and after the pandemic are explored. Capital structure is explained through 3 main leverage ratios: overall liability leverage ratio, long-term debt leverage ratio, and current liability leverage ratio. The effect of the pandemic and post pandemic era is analysed using the fixed effects regression and 6 core control variables inspired by the Frank and Goyal (2009) paper. Financial information on companies was taken quarterly from 2016Q1 – 2024Q1. Every core factor, which was used as control variable, was found to be significant in explaining the leverage ratios during the sample period, just like in Frank and Goyal (2009) paper. The period of the COVID-19 pandemic was found to have significantly increased leverage ratios of both US and EU companies. Furthermore, the post pandemic period was found to have significantly increased leverage ratios in the US. Meanwhile in the EU it did not, and even significantly decreased the long-term debt leverage ratio. Finally, results show that the Ukrainian War period had significant negative effect on all leverage ratios of EU firms relative to that of US firms (difference-in-difference), compared to the pandemic period.

Keywords: Capital Structure Factors, COVID-19, Pandemic, Interest Rates, Ukraine War

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CHAPTER 1 Introduction

In 2009, Frank and Goyal (2009) tested and uncovered the factors that influence capital structure decisions of publicly traded firms in the US. They identified six fundamental factors that consistently influence market leverage ratio of companies – industry median leverage, market-to-book ratio, tangibility, profits, firm size, and expected inflation. Additionally, the paper brought some theoretical implications, such as the alignment of the six core factors with the trade-off theory, which balances the tax benefits of debt against potential bankruptcy costs. Furthermore, the research also provided empirical support for pecking order theory, market timing theory and agency cost theory. This study emphasizes the complexity of capital structure decisions by showing that no single theory can fully explain the empirical regularities observed. Thus, an integrated approach which considers multiple factors is essential for a thorough understanding of firm capital structure decisions.

To protect the economies and tackle the negative effects that came with the COVID-19 pandemic on the 11th of March 2020, most central banks initiated monetary policies that injected liquidity to the market. The FED from the USA, lowered the interest rates and started a heavy quantitative easing program (Haas et al., 2020). Although the ECB kept the already 0% interest rates, it initiated a Pandemic Emergency Purchase Programme, which provided further liquidity (European Central Bank, 2020). They also relaxed eligibility and collateral criteria for their operations and introduced new longer-term refinancing operations. This not only allowed banks to borrow money more easily, but also provided more affordable long-term lending to banks (European Central Bank, 2020). As the cost of debt decreased significantly, unavoidable changes probably happened in the capital structure of firms pre and during COVID-19 in the EU and the US. Not even 2 years later, a completely new period started. As the pandemic slowly died down, inflation in the US started spiralling out of control to 7.5% on January 2022, which was the biggest 12-month increase in inflation since 1982 (Bureau of Labor Statistics 2022). Similar happened in the EU, as inflation jumped to 5.6% on January 2022 (Eurostat 2024). Thus, both the FED by 0.25% (Congressional Research Service [CRS], 2022) and the ECB by 0.5% (European Central Bank, 2024) raised their interest rates first time in March 2022 to try and slow down the quick growth of inflation. The last hike of the FED was on July 2023 and the last hike from the ECB was September 2023. The effective interest rates stayed the same until 2024Q1. During those interest rate hikes and until this day, the firms struggled with a completely different set of circumstances and the rising debt costs.

Thus, two different periods (liquidity injection in the pandemic, and interest rate tightening after the pandemic) most likely had great impact on the capital structure choices. Therefore, this paper investigates the changes in the capital structure of publicly traded companies during these two distinct periods, in the USA and the EU. The implications and results of this paper are primarily useful as a measurement of policy effects, as there is currently not a lot of research that explored the impact of these government and central bank policies on firm leverage ratio and their current consequences.

Additionally, there is one big difference between what was happening in the EU and the US starting with the year of 2022, and that is the Russian invasion of Ukraine. As both EU and US stand firmly with Ukraine, the war has had an undeniably greater impact on the EU economies than on the US economy, namely trough food, energy prices, and the general fear of having a close-by war (Deng et al., 2022). Thus, there is a possible difference in the change of leverage ratios of EU firms and US firms during the period of the Ukrainian War (2022Q1 – now).

Hence, this paper has three main research questions to be examined (overall leverage, long-term debt ratio, current liability ratio), split up between three periods. The period of Q1 2016 until Q1 2020 is taken as a fundamental period of what we consider pre-pandemic levels. First research question is to explore the relationship between the changes in the capital structure of EU and US publicly traded firms and its determinants during the period from Q2 2020 until Q1 2022 (the COVID-19 high liquidity periods). Second, exploring the relationship between the changes in the capital structure of EU and US publicly traded firms and its determinants during the period from Q2 2022 until Q1 2024 (the rising interest rate post pandemic period). Finally, a comparison of changes in EU company leverage ratios and US company leverage ratios will be done to find out whether the Ukrainian War had significantly higher impact on the capital structure decisions of EU companies, relative to those in the US, compared to pandemic periods. Companies that are taken in the sample are all publicly traded and active from Q1 2016 until Q1 2024, which means that they are all relatively big and have been present in the economy for the past decade.

The paper is structured in the following way. Firstly, the three main research questions were brought in the introduction section. Secondly, a literature review of relevant papers is presented, and hypotheses are formed. Thirdly, the methodology and data descriptions are explained. After, results of the three main research questions are elaborated. In the final section, the findings and paper's possible limitations are discussed and summarized.

CHAPTER 2 Theoretical Framework

2.1 Fundamental capital structure knowledge

To thoroughly understand the impact of economic policies during and after COVID-19 on capital structure decisions, it is necessary to understand the fundamental drivers of leverage ratios and the concept of capital structure. Starting with Miller (1958), in an efficient and fully integrated market, companies do not care whether they fund their operations with equity or debt, as costs are identical. However, in the real world, the market is not perfectly efficient. Furthermore, Myers (1984) provided concept and partial empirical proof to two theories about capital structure. First, the Static Trade-off Theory says that firms aim to balance debt tax benefits against the financial distress costs to determine their optimal capital structure. Empirically it turned out that capital-intensive industries do indeed have higher debt ratios, due to the reason of larger investments. Second, the Pecking Order Theory says that firms prioritize financing sources based on the principle of least resistance, thus in this order of preference, internal funds, debt, and equity as last. Empirically it turned out to be that firms indeed predominantly use internal funds and debt, while equity being a less common source. Later, Harris and Raviv (1991) provided an overview analysis of multiple capital structure theories in that time, excluding those based on tax considerations. They found 4 drivers: Agency Costs (connected to conflicts between managers and shareholders regarding debt), Asymmetric Information (connected to who makes decisions on the firm's capital structure), Product-Input Market Interactions (connected to the firm's position in the market), and Corporate Control Considerations (connected to buyouts and M&A). From the more empirical side, one of the first relevant papers which defined and tested multiple factors was Titman and Wessels (1988). While testing only manufacturing firms, the analysis showed that only factors of uniqueness, size, and profitability showed significant results. Finally, testing all types of US firms Frank and Goyal (2009) empirically identified the following six factors (while testing many other) and their influence on leverage ratios: industry median leverage – positive influence, expected inflation – positive influence, total assets – positive influence, asset tangibility – positive influence, market-to-book ratio – negative influence, and profitability – negative influence. As Frank and Goyal (2009) is considered a breakthrough paper, and relevant for this topic, in this paper the same 6 core factors are used as controls while measuring effects for pandemic, post pandemic and Ukrainian war periods.

2.2 Pandemic period hypothesis formation

The pandemic period had 2 main parts. First one being the initial shock of the pandemic where the US and the EU went into a sudden lockdown, and thus economies had a sudden negative shock. Second part of the pandemic period came very quickly as a reaction from the government with lower interest rates and very strong fiscal policies. From a perspective of the initial shock, Schularick et al. (2020) provided an analysis of the starting pandemic market impacts. EU banks lost about 40% of their market value in Q1 and Q2 of 2020 and had much lower loan loss reserves than their US counterparts, thus highlighting the greater vulnerability of the European banks to prolonged economic stress. At the beginning, hit by significant capital shortfalls, both US and European banks could not hand out more credit to the firms in the economy. Varghese and Haque (2021) measured an immediate but a temporary 5.3% drop from pre pandemic average level of 19.6% in leverage (net debt to asset ratio) in the US, only in the beginning of 2020Q1.

As the second part of pandemic started, Li et al. (2020) noticed that the increase in liquidity demands was concentrated in the largest banks mostly, which as well served the largest companies. They observed a very strong lending growth during the last weeks of Q2 2020, with very large banks having much higher increase in C&I loans compared to the much smaller banks. Unlike the 2008 crisis, the COVID-19 liquidity demands were met, and the main reason would be the strong inflow of liquidity from the FED (Li et al. 2020)). Furthermore, in periods of high inflation, the real value of money erodes, and thus tax savings that are present interest payments become more valuable in real terms. As a result, tax advantages of holding debt become more significant. Thus, during high inflation, firms will seek to increase the amount of debt they are holding (Taggart 1985). From the perspective of cost of debt, Barry et al. (2008) provide evidence that firms are more likely to acquire debt when current interest rates are lower than historical averages. Both are consistent with the market timing theory proposed by Frank and Goyal (2009), which claims that all company directors look at current conditions in equity and debt markets. And even says that if market conditions look unusually favourable, funds are sometimes raised even if the company does not have the actual need for the funds. Since the US had freshly low interest rates and much higher inflation expectations by the end of 2020, Halling et al. (2020) explained and predicted the surge in the corporate bond issuance during the pandemic. Following this logic, Baines and Hager (2021) observe that larger companies have been consistently getting more leveraged, meanwhile small companies have seen a sharp deleveraging alongside increasing debt servicing costs, in the decade before COVID-19, while controlling for other variables. Unlike Baines and Hager (2021), in this paper only publicly traded companies are studied. All companies in the data sample can be considered big compared to an average size of all companies in the economy, thus it is predicted that due to higher expected inflation, low interest rates and strong fiscal policies, the leverage ratio has significantly changed during the pandemic period:

H_a: *The pandemic period significantly changed the leverage ratios of companies*

2.3 *Post pandemic period hypothesis formation*

An important theory for the post pandemic period, which was discussed by Frank and Goyal (2009), is the trade-off theory. It suggests that firms try and balance the perfect amount of debt in their firm, following the benefits of tax shield, while carefully avoiding financial distress and bankruptcy costs. In line with this, Varghese and Haque (2021) mentioned two factors, while discussing the impact during the COVID-19 pandemic. First factor was worsening growth in corporate cash flow that increased asset risk and thus prompted firms to reduce their leverage. Second factor the paper mentioned was the rollover of long-term debt, as firms showed a preference to rollover their existing long-term debt rather than acquiring new one. These factors however are in the end more implied for the post pandemic, as it was proved that fiscal policies stimulated the economy quite strongly during the pandemic. Since this post pandemic period of high interest rates is still quite new, there is not a lot of research present on this topic. Thus, this paper is trying to dive deep in exploring what would be so far unexplored effects in our modern-day time. Following the trade-off theory, during the post pandemic period, there were high interest rates present, and expected inflation was getting lower, while stimulating fiscal policies stopped. Thus, it can be said that the post pandemic period differed quite significantly with its economic circumstances compared to the pandemic period. Therefore, a hypothesis is formed:

H_a: ***The post pandemic period significantly changed leverage ratios of companies since pandemic***

2.4 *Ukrainian War period hypothesis formation*

Finally, there was one more crucial event that escalated specifically on the European continent, and it was the Ukrainian War. No influential paper such as Frank and Goyal (2009) or Miller (1958), ever touched upon or tried to explain the possible effects of a close-by war on capital structure decisions of companies. Even without the war, the investors in both US and the EU were dealing with quite unique circumstances, such as the post pandemic economy, surging inflation, rising interest rates, and new monetary and fiscal policies of central banks. The war in Ukraine just added another negative factor in EU economies to worry about. Deng et al. (2022) tried to uncover the effects on EU stock returns from a more energy perspective, after the war broke out. Since the start of the war, they argued, it was obvious EU economies could not anymore depend on cheap Russian gas. Besides bringing fear of a close-by war, the war thus also brought worries around energy supply to the whole of the EU. Rising energy prices also brought rising inflation with it. Thus, stocks that were strongly exposed to energy policy changes tended to underperform in the EU. Consequently, companies that rely on inflation data during their conference calls with analysts, as well resulted in a much lower stock return. From a bank perspective, Martins et al. (2023), using an event study, explored the stock return impact on the largest 100 European banks after the start of the Ukrainian

War. They observed a negative and significant stock reaction in the banks. These results are indeed consistent with investor sentiment and the asset pricing perspective that come from expectations and fear. Bringing main European bank stocks down potentially decreases banks' liquidity, and thus, they might be more reluctant to give out new loans to companies. Following the logic in the relevant research, the effects of Ukrainian War were more influential on European stocks and banks, and thus hypothesis is formed:

H_a: ***The Ukrainian War significantly changed leverage ratios of European companies relative to US companies, since the pandemic period ended.***

CHAPTER 3 Methodology & Data

Quarterly financial data was taken from the Wharton Research Database System, using Compustat. Only companies that have been active from 2016Q1 to 2024Q1 are taken. Thus, the sample does not contain companies that closed during the sample period. Companies are taken only from the US (9,132 companies) and the EU (3,098 companies). They are also organized and marked by industries that they are classified in (SIC code). All companies that were considered non classified in terms of active industry, were dropped. Since Compustat did not have data on market capitalization of each EU firm, market capitalization data was taken from Orbis Database System and merged with Compustat data using ISIN number of each firm and the related quarter. Finally, data on 12-month expected inflation was taken from Survey of Professional Forecasters (Federal Reserve Bank of Philadelphia) and Survey of Professional Forecasters (European Central Bank).

To define the 3 periods of interests, dummy variables are constructed. First, PREPANDEMIC is a dummy variable of 1 if the period is from and including 2016Q1 until and including 2020Q1, otherwise 0. Second, PANDEMIC is a dummy variable of 1 if the period is from and including 2020Q2 until and including 2021Q4, otherwise 0. Third, POSTPANDEMIC is a dummy variable of 1 if the period is from and including 2022Q1 until and including 2024Q1. Also, a dummy variable EUWAR of 1 if the period is 2022Q1 – 2024Q1 and if a company is in the EU, otherwise 0. Besides the 3 periods of interests, all other variables are exact same as in the Frank and Goyal (2009), unless it was impossible to obtain certain type of data, then they were approximated in the best way possible (see Appendix A). Thus, the main variable of interest is the leverage ratio and is measured as a ratio of total liabilities over MVA, following similar logic as Frank and Goyal (2009). Furthermore, besides the main leverage ratio, there are 2 more leverage ratios tested in this paper (Table 1). All control variables match the 6 core factors established in the Frank and Goyal (2009) and those are: industry median leverage, expected inflation, log of assets, asset tangibility, market-to-book ratio, and profitability (Table 1). Almost every variable was transformed using natural logarithm, just like in Frank and Goyal (2009). This partially solved the skewness or the non-normality of the data, but it also reduced the effect of unnaturally big/small values, which could be considered outliers. If a variable had a minimum amount of 0, +0.0000001 was added to all the values before transforming the variable into a logarithm.

Table 1 Description and definition of all variables used in the model

Variable	Name	Formula
Leverage ratio	LEVERAGE	$\ln\left(\frac{Total\ Liabilities}{MVA}\right)$
Short-term	LEVERAGES	$\ln\left(\frac{Total\ Current\ Liabilities}{MVA}\right)$
Long-term	LEVERAGEL	$\ln\left(\frac{Total\ Longterm\ Debt}{MVA}\right)$
(Pre/Post) Pandemic	PREPANDEMIC PANDEMIC POSTPANDEMIC	1 if Q1 2016 – Q1 2020, otherwise 0 1 if Q2 2020 – Q1 2022, otherwise 0 1 if Q2 2022 – Q1 2024, otherwise 0
Market-to-Book ratio	MTB	$\ln\left(\frac{MVA}{Total\ Assets}\right)$
Profitability	PROFIT	$\frac{Operating\ Income\ before\ Depreciation}{Total\ Assets}$
Industry Median Leverage	IND	$\ln\left(Median\ Industry\ LEVERAGE(S/L)\right)$
Expected inflation	INF	Median Expected 12-month Inflation
Total Assets	ASSETS	$\ln\left(Total\ Assets\right)$
Tangibility	TANG	$\ln\left(\frac{Net\ PP\&E}{Total\ Assets}\right)$
European Union	EU	1 if company is in the European Union
War	WAR	1 if Q1 2022 – Q1 2024, otherwise 0
Europe War	EUWAR	1 if $EU \times WAR = 1$, otherwise 0

Note: Market Value of Assets (MVA) = Market Capitalization + Total Liabilities

Furthermore, since the data is organized in a panel form, the approach is to test the Random Effects Model over the Fixed effects model using the Hausman test. Fixed effects regression proves to be statistically significant over the Random Effects Model (see Appendix B). Additionally, the White test showed heteroskedasticity present in the fixed effects regression and the Wooldridge test showed autocorrelation of errors present (see Appendix B). Both were solved by clustering errors within the panel (within the gvkey for each firm). Finally, FE regression models are described in the following way:

Sample period used for this model is from 2016Q1 until 2022Q1.

$$LEVERAGE(L \therefore S)_{i,t} = \beta_0 + \beta_1 PANDEMIC_{i,t} + \beta_2 MTB_{i,t} + \beta_3 PROFIT_{i,t} + \beta_4 IND_{i,t} + \beta_5 INF_{i,t} + \beta_6 ASSETS_{i,t} + \beta_7 TANG_{i,t} + \epsilon_{i,t}$$

Sample period used for this model is from 2020Q2 until 2024Q1.

$$LEVERAGE(L \therefore S)_{i,t} = \beta_0 + \beta_1 POSTPANDEMIC_{i,t} + \beta_2 MTB_{i,t} + \beta_3 PROFIT_{i,t} + \beta_4 IND_{i,t} + \beta_5 INF_{i,t} + \beta_6 ASSETS_{i,t} + \beta_7 TANG_{i,t} + \epsilon_{i,t}$$

Sample period used for this model is from 2020Q2 until 2024Q1.

$$LEVERAGE(L \therefore S)_{i,t} = \beta_0 + \beta_1 EU_{i,t} + \beta_2 WAR_{i,t} + \beta_3 EUWAR_{i,t} + \beta_4 MTB_{i,t} + \beta_5 PROFIT_{i,t} + \beta_6 IND_{i,t} + \beta_7 INF_{i,t} + \beta_8 ASSETS_{i,t} + \beta_9 TANG_{i,t} + \epsilon_{i,t}$$

Table 2 Summary of variable descriptives

Variable	Observations	Mean	Std. Dev	Min	Max
LEVERAGE	191,913	-1.2353	1.3327	-25.3284	-0.0001
(no log)	191,913	0.4361	0.2875	0	0.9999
LEVERAGES	149,495	-2.1911	1.373	-25.3284	1.3701
(no log)	149,495	0.186	0.1733	0	3.9359
LEVERAGEL	184,589	-4.8175	6.99	-25.3284	0.9163
(no log)	184,589	0.1538	0.1701	0	2.5
MTB	191,910	0.5786	1.0217	-4.8911	14.3873
(no log)	191,910	103.3878	7752.662	0.0075	1,771,500
PROFIT	187,980	-0.2984	52.8884	-15,600.80	15,382.33
INDLEV	306,629	-0.746	0.5231	-1.9647	-0.1415
(no log)	306,629	0.537	0.2455	0.1402	0.8681
INDLEVS	288,252	-2.2295	0.4521	-3.7885	-0.7165
(no log)	288,252	0.1204	0.0647	0.0226	0.4885
INDLEVL	306,629	-2.5106	0.5916	-25.3284	-1.213
(no log)	306,629	0.0948	0.0574	0	0.2973
INF	306,496	3.1468	2.7855	-3.5	10.5
ASSETS	217,618	6.0978	2.924	-7.824	15.2809
(no log)	217,618	13,450.04	108,917.90	0.0004	4,329,380
TANG	200,488	-3.3542	4.7884	-25.3284	0.4564
(no log)	200,488	0.209	0.2392	0	1.5784

Note: Summary statistics of each variable are presented. First line of each variable contains statistics of its logarithm form. Second line (no log) contains statistics of its original form (without logarithm form). If a variable is not transformed using logarithm, there is no second line for it, such as PROFIT or INF.

Movements in average leverage ratios in the US and the EU are presented in Figure 1, Figure 2, and Figure 3 respectively.

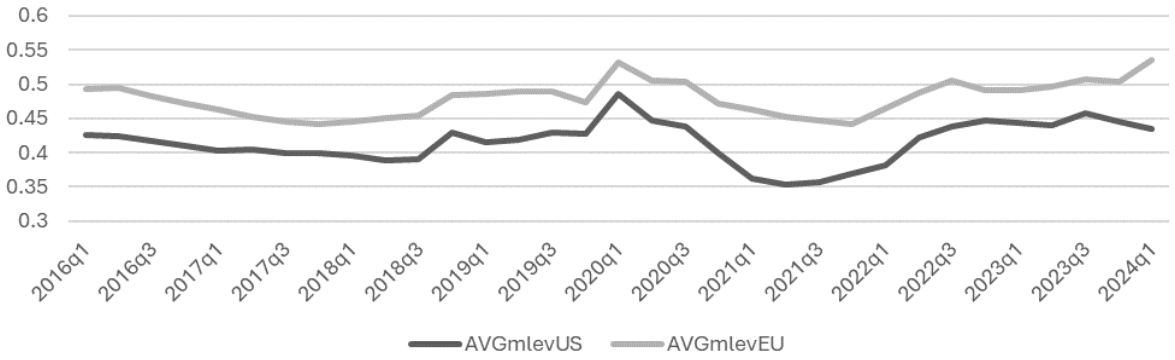

Figure 1. Movements in average overall leverage ratio (no log) over time in US and EU

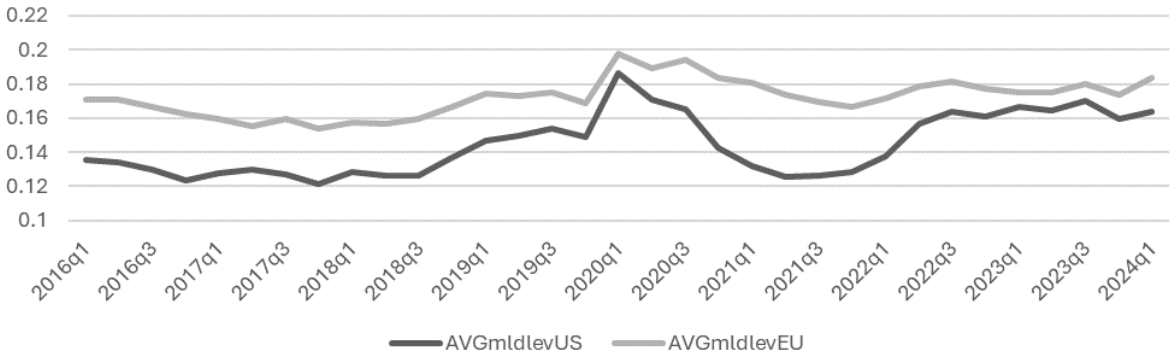

Figure 2. Movements in average long-run debt leverage ratio over time (no log) in US and EU

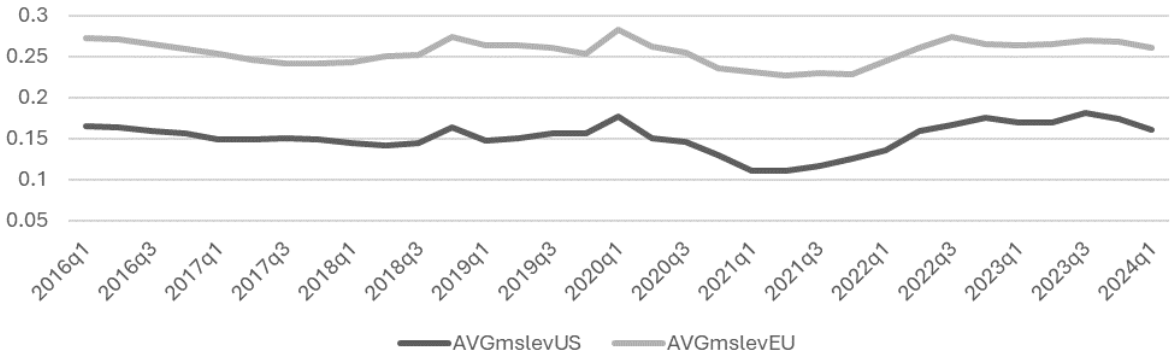

Figure 3. Movements in average current liability leverage ratio over time (no log) in US and EU

Table 2 provides data summarizing descriptives of all variables used, and their respective values before logarithm transformations. The main leverage ratio (LEVERAGE – no log) is 0.44 with a high standard deviation of 0.29. Thus, an average level of liability in the firm is 44% of its total market value of assets. We see in Table 1 the minimum overall leverage ratio is 0, thus there are companies in the sample without any liability, and the highest liability ratio is 0.99, which means that company has the same amount of liability as market value of assets (market capitalization + total liability). Looking at the movements of average overall leverage ratio in Figure 1, we can see a slight downward trend in overall leverage until 2018Q3. From 2018Q3 until 2020Q1 the ratio started to raise. During the pandemic period, the ratio fell sharply, but then started to rise in 2022. Finally, we see no obvious trend from 2022 onwards. The current liability ratio has a mean of 18.6% of total market value of assets (standard deviation 0.17), with minimum at 0 and maximum at 3.94 (potential outlier, yet not enough arguments to drop the observation). Looking at Figure 3, we see the same pattern as in movements in Figure 1. The long-term debt ratio has a mean of 0.15 (standard deviation of 0.1701), which tells us that on average in this sample companies have 15% of their total asset market value in long-term debt. The long-term debt ratio has a minimum at 0, and a maximum at 2.5 (potential outlier, yet not enough argumentation to drop the observation). Looking at Figure 2, long-run debt leverage ratio behaves very similarly in its movements over time to the overall leverage ratio.

The market-to-book ratio has a mean of 103.39 (standard deviation of 7753), this tells us that the market value of assets usually trades at 100 times of its book value. The minimum market-to-book ratio is 0.0075, and the maximum is 1,771,500. Following the same logic as Frank and Goyal (2009), market-to-book ratio was transformed by simply taking a logarithm. The profitability ratio has an average of -0.30 with a high standard deviation of 53. This tells us that the average ratio of operating income before depreciation over assets is negative in the sample. The profit variable has a minimum of -15,601 and a maximum of 15,382. Expected inflation has a mean of 3.15 over the next 12 months with a standard deviation of 2.79. The minimum is -3.50 and the maximum is 10.50. Total assets have a mean of 13,450 in millions (standard deviation 108,918), with a minimum of only 0.0004 in millions and a maximum of 4,329,380 in millions. Finally, the tangibility has a mean of 0.21 which tells us that net PP&E represent 21% of total assets on average in this sample of companies. Tangibility also has a standard deviation of 0.24, with a minimum at 0 and a maximum at 1.58.

CHAPTER 4 Results & Discussion

The results are displayed in the following order. First, for all 3 time periods together, results for FE regression of 6 core factors on the leverage ratios in each region are displayed, with their influence and significance explained. Next, results for pandemic period effects on overall leverage ratio (LEVERAGE), long-term debt leverage ratio (LEVERAGEL), and current liability leverage ratio (LEVERAGES) are shown, for both regions. Second, results for post-pandemic period effects on overall leverage ratio (LEVERAGE), long-term debt leverage ratio (LEVERAGEL), and current liability leverage ratio (LEVERAGES) are shown, for both countries. Finally, same three leverage ratios are tested and results for the third main hypothesis are displayed, thus regarding the Ukrainian War.

4.1 6-core factors

Table 3. FE Regression results on leverage ratios and their 6 core factors in the US

Variable	LEVERAGE	LEVERAGEL	LEVERAGES
MTB	-0.7234***	-0.1699	-0.7578***
	(0.0204)	(0.1088)	(0.0197)
IND	0.5053***	1.9012***	0.4591***
	(0.0235)	(0.2848)	(0.0267)
TANG	0.0351***	0.4044***	0.0378***
	(0.0049)	(0.0266)	(0.0049)
INF	0.0168***	0.1383***	0.0204***
	(0.0013)	(0.0087)	(0.0013)
PROFIT	-0.0001**	0.0004	-0.0002**
	(0.0002)	(0.0003)	(0.0001)
ASSETS	-0.3070***	1.4133***	-0.4724***
	(0.0278)	(0.1018)	(0.0273)
CONSTANT	1.6690***	-8.4856***	2.0809***
	(0.1669)	(1.0078)	(0.1440)

*Notes: p-value<0.01 ***; p-value<0.05 **; p-value<0.1 *, observations: 119,890; 119,228; 98,205, overall R2: 0.07; 0.29; 0.07*

Table 4. FE Regression results on leverage ratios and their 6 core factors in the EU

Variable	LEVERAGE	LEVERAGEL	LEVERAGES
MTB	-0.8764***	-0.8696***	-0.8336***
	(0.0223)	(0.0580)	(0.0226)
IND	0.2297***	0.8094***	0.2359***
	(0.0282)	(0.0867)	(0.0313)
TANG	0.0441***	0.3025***	0.0342*
	(0.0132)	(0.0634)	(0.0187)
INF	0.0070***	0.0016	0.0114***
	(0.0017)	(0.0042)	(0.0021)
PROFIT	-1.1604***	-2.0861***	-0.7986***
	(0.2301)	(0.6394)	(0.1963)
ASSETS	0.0441**	0.2759***	-0.0262
	(0.0215)	(0.0590)	(0.0243)
CONSTANT	-0.6554***	-1.4674***	-0.7924***
	(0.1297)	(0.3935)	(0.1400)

*Notes: p-value<0.01 ***; p-value<0.05 **; p-value<0.1 *, observations: 47,137; 43,731; 47,030. overall R2: 0.50; 0.16; 0.32*

Looking at Table 3 and Table 4, we see that almost all coefficients of the market-to-book ratio are negative and statistically significant for leverage ratios in the publicly traded companies in both the US and the EU. More specifically in the US, if the MTB ratio increases by 1%, the overall leverage ratio drops by 0.72%, and the current liability ratio drops by 0.76%, on average (5% significance). On the other hand, the MTB coefficient explaining the LEVERAGEL is not significant. Meanwhile in the EU on average, the overall leverage ratio drops by 0.88%, the long-term debt ratio drops by 0.87% and the current liability ratio drops by 0.83%, if MTB rises by 1%. This result fully matches the empirical results obtained by Frank and Goyal (2009), which proved that a higher MTB ratio implies more cash and investing source from the stock market and thus less need of acquiring a loan.

From industry perspective, we see that the coefficient of the median level of leverage ratios for the industry is positive and statistically significant for all leverage ratios in both the US and the EU. For the US, if the industry median raises by 1% the overall leverage ratio rises by 0.51%, the long-term debt ratio rises by 1.90% and the current liability ratio rises by 0.46%, on average (5%

significance). Meanwhile in the EU on average, the overall leverage ratio rises by 0.23%, the long-term debt ratio rises by 0.81% and the current liability ratio rises by 0.24%. The similarity in the size of the effects is truly noticeable and comparable between the US and the EU. This also fully matches the empirical results obtained by Frank and Goyal (2009), who proved that if a company operates in a more leveraged industry, it will also most likely have higher leverage. Furthermore, we also see that the industry has a much higher coefficient for long-term leverage than for overall leverage or current liability ratio. This could be because industries that are much more leveraged, are usually more leveraged with long-term debt, rather than any other debt, such as the oil or the manufacturing industry, due to their big and expensive assets.

Results in Table 3 and Table 4 tell us that the coefficient of tangibility is positive and statistically significant for all leverage ratios in the publicly traded companies in both the US and the EU. In the US, if tangibility rises by 1%, the overall leverage ratio rises by 0.03%, the long-term debt ratio rises by 0.40% and the current liability ratio rises by 0.04%, on average (1% significance). In the EU, the overall ratio rises by 0.04%, the long-term debt by 0.30% (1% significance) and the current liability ratio by 0.03% (10% significance). The similarity in the coefficients is truly noticeable between the US and the EU. This as well fully matches the results obtained by Frank and Goyal (2009), as previously argued, the higher the need for physical assets, especially PP&E, the more likely a long-term loan is needed to hold these highly valuable assets. Thus, this could be a reason why all leverage increases with tangibility, but more specifically why long-term debt increases even higher than other leverage ratios.

Observing results for expected inflation, we see that the coefficient is positive and statistically significant for all leverage ratios in the publicly traded companies in the US, meanwhile in the EU it is only for overall leverage and current liability ratio. In the US, if expected inflation rises by 1%, the overall leverage ratio rises by 1.7%, the long-term debt ratio by 13.8% and the current liability ratio by 2.0% (1% significance). Meanwhile in the EU, the overall leverage ratio rises by 0.7%, the current liability ratio rises by 1.1%, while the long-term debt coefficient is insignificant. This matches the empirical results by Frank and Goyal (2009), as argued, the higher the expected inflation, the lower the real value of money, and thus the tax advantages of holding debt become higher, making debt more attractive.

Looking at Table 3 and Table 4, we see that the profitability of a company is negative and significant only for overall leverage and current liability ratio in the US, meanwhile in the EU it is negative and significant for all leverage ratios. Looking at the US, if profitability ratio rises by 1 unit, the overall leverage ratio will decrease by 0.01% and the current liability ratio by 0.02% on average with 1% significance. While in the EU, the overall ratio drops by 116%, the long-term debt ratio by 209% and the current debt ratio by 80%. This matches the empirical results obtained by Frank and Goyal (2009), as they argued that if a company is more profitable, it also has more cash at their disposal to reinvest into the firm, and thus less need for external sources, such as debt.

Finally, seeing the effect of company size, we can see that the coefficient of logarithm assets is always statistically significant, negative for overall ratio and current ratio, but positive for long-term debt ratio in the US. For the EU, it is positive and significant for overall leverage and long-term debt ratio, meanwhile for current debt ratio it is not significant. For the US, if total assets rise by 1%, the overall leverage ratio will drop by 0.31%, the long-term debt ratio rises by 1.41%, and the current liability ratio will drop by 0.47%, on average with 1% significance. Meanwhile in the EU, the overall ratio will rise by 0.04% and the long-term debt ratio will rise by 0.28%. Regarding long-term debt ratio in US and EU coefficients, this matches the empirical results obtained by Frank and Goyal (2009), where they argue that the higher the assets, usually more leverage is needed to withhold them. Meanwhile, the negative coefficients do not match the results of the Frank and Goyal (2009) paper.

4.2 Pandemic period effects

Table 5. FE Regression Results of the pandemic period on leverage ratio of US companies

Variable	LEVERAGE	LEVERAGEL	LEVERAGES
PANDEMIC	0.1682***	2.4029***	0.1541***
	(0.0138)	(0.1024)	(0.0143)
MTB	-0.7150***	-0.0708	-0.7612***
	(0.0219)	(0.1264)	(0.0219)
IND	0.3397***	1.4179***	0.2483***
	(0.0283)	(0.2659)	(0.0335)
TANG	0.0312***	0.3383***	0.0328***
	(0.0056)	(0.0294)	(0.0056)
INF	0.0106***	0.0109	0.0158***
	(0.0009)	(0.0087)	(0.0011)
PROFIT	-0.0001**	0.0007***	-0.0002**
	(0.0001)	(0.0002)	(0.0001)
ASSETS	-0.3687***	1.1874***	-0.5191***
	(0.0353)	(0.1246)	(0.0378)
CONSTANT	1.8013***	-9.4821***	1.7866***
	(0.2091)	(1.0626)	(0.1902)

*Notes: p-value<0.01 ***; p-value<0.05 **; p-value<0.1 *, observations: 86,224; 85,769; 70,263. overall R2: 0.02; 0.29; 0.04*

In Table 5 we can see that for US publicly traded companies the overall leverage ratio has significantly increased during the pandemic. Meaning that during the pandemic period, the overall leverage ratio has increased by 16.82% on average, with 1% significance. Thus, we reject the null hypothesis that the pandemic period did not significantly change the overall leverage ratio of publicly traded companies in the US. Furthermore, we also observe a significant impact of the pandemic period on the long-term debt ratio of publicly traded firms in the US. More specifically, during the pandemic period, the long-term debt ratio has increased by 240% on average, with 1% significance. Thus, we reject the null hypothesis that the pandemic period did not significantly change the long-term debt leverage ratio of publicly traded firms in the US. Additionally, if we look at the current liability ratio, we also see a significant change. During the pandemic period, the current liability ratio has increased by 15.41% on average, with 1% significance. Thus, we reject the null hypothesis that the pandemic period did not change the current liability leverage ratio of publicly traded firms in the US.

Table 6. FE regression results of the pandemic period on leverage ratios of EU companies

Variable	LEVERAGE	LEVERAGEL	LEVERAGES
PANDEMIC	0.0573***	0.1457***	0.0011
	(0.0085)	(0.0236)	(0.0119)
MTB	-0.8742***	-0.8830***	-0.8380***
	(0.0239)	(0.0699)	(0.0239)
IND	0.2822***	0.8487***	0.2133***
	(0.0349)	(0.1137)	(0.0326)
TANG	0.0447***	0.2804***	0.0334
	(0.0119)	(0.0732)	(0.0210)
INF	0.0156***	0.0318**	0.0228***
	(0.0039)	(0.0132)	(0.0044)
PROFIT	-0.9707***	-2.4034**	-0.6056***
	(0.2566)	(0.9367)	(0.2139)
ASSETS	0.0194	0.2533***	-0.0392
	(0.0251)	(0.0780)	(0.0328)
CONSTANT	-0.4975***	-1.3753**	-0.7635***
	(0.1500)	(0.5153)	(0.1804)

*Notes: p-value<0.01 ***; p-value<0.05 **; p-value<0.1 *, observations: 35,369; 32,392; 35,285. Overall R2: 0.52; 0.17; 0.32*

From Table 6 we can see that for EU publicly traded companies the overall leverage ratio has significantly increased during the pandemic. Meaning that in the pandemic period, the overall leverage/liability ratio has increased by 5.7% on average, with 1% significance, compared to the pre-pandemic. Thus, we reject the null hypothesis that the pandemic period did not significantly change the overall leverage ratio of publicly traded companies in the EU. Furthermore, we also observe a significant impact of the pandemic period on the long-term debt ratio of publicly traded firms in the EU. During the pandemic period, the long-term debt ratio has increased by 14.57% on average, with 1% significance. Thus, we reject the null hypothesis that the pandemic period did not significantly change the long-term debt ratio of publicly traded firms in the EU. Finally, if we look at the current liability leverage ratio, we do not see a significant change. More specifically, the coefficient on a dummy variable for the pandemic period is not statistically significant. We therefore do not reject the null hypothesis, which states that the pandemic period did not significantly change the current liability ratio of publicly traded firms in the EU.

These results can be potentially explained by the extremely high liquidity in the market during the pandemic period, which came from low interest rates and effective fiscal policies. These conditions thus rose inflation and made debt cheap, thus more attractive to attain, especially long-term debt (Baines and Hager, 2021). Therefore, we get a significant increase in leverage ratios during the pandemic in both the EU and the US.

4.3 Post pandemic period effects

Table 7. FE regression results of post pandemic period effects on leverage ratios in the US

Variable	LEVERAGE	LEVERAGEL	LEVERAGES
POSTPANDEMIC	0.1055***	0.0521	0.1718***
	(0.0130)	(0.0637)	(0.0144)
MTB	-0.8226***	-0.6929***	-0.8154***
	(0.0279)	(0.1023)	(0.0280)
IND	0.2763***	0.8103***	0.2027***
	(0.0447)	(0.1309)	(0.0499)
TANG	0.0313***	0.5039***	0.0398***
	(0.0049)	(0.0355)	(0.0063)
INF	0.0021*	-0.0020	0.0047***
	(0.0011)	(0.0060)	(0.0012)
PROFIT	-0.0001**	0.0003*	-0.0002**
	(0.0001)	(0.0002)	(0.0001)
ASSETS	-0.4524***	0.0924	-0.5891***
	(0.0706)	(0.1205)	(0.0710)
CONSTANT	2.4102***	-0.8577	2.2222***
	(0.4226)	(0.7909)	(0.3534)

*Notes: p-value<0.01 ***; p-value<0.05 **; p-value<0.1 *, observations: 64,650; 64,255; 53,445. overall R2: 0.01; 0.27; 0.05*

From Table 7 we can see that for the US publicly traded companies the overall leverage ratio has significantly increased during the post pandemic period, compared to the pandemic period. Meaning that in the post pandemic period, the overall leverage ratio has increased by 10.55% on average, with 1% significance, from the pandemic period. Therefore, we reject the null hypothesis, which states that the post pandemic period did not significantly change the overall leverage ratio of publicly traded companies in the US, compared to the pandemic period. Furthermore, we do not see any significant effect of the post pandemic period on long-term debt leverage ratio, compared to the pandemic period. Thus, we do not reject the null hypothesis that the post pandemic period did not significantly change the long-term debt ratio of publicly traded firms in the US, compared to the pandemic period. Finally, if we look at the current liability ratio, we see a significant change. More specifically, in the post pandemic period, the current liability ratio has increased by 17.18% on average, with 1% significance, compared to the pandemic period. We reject the null hypothesis that the post pandemic period did not change the current liability ratio of publicly traded firms in the US, compared to the pandemic period.

Table 8. FE regression results of post pandemic period effects on leverage ratios in the EU

Variable	LEVERAGE	LEVERAGEL	LEVERAGES
POSTPANDEMIC	0.0020	-0.0649***	0.0094
	(0.0085)	(0.0223)	(0.0129)
MTB	-0.9399***	-1.0565***	-0.7998***
	(0.0253)	(0.0448)	(0.0263)
IND	0.0988***	0.1549***	0.2457***
	(0.0285)	(0.0494)	(0.0417)
TANG	0.0077	0.2477***	0.0375*
	(0.0152)	(0.0611)	(0.0193)
INF	0.0023*	-0.0026	0.0092***
	(0.0013)	(0.0040)	(0.0022)
PROFIT	-1.1019***	-1.0384***	-0.7331***
	(0.2306)	(0.3224)	(0.2209)
ASSETS	0.0132	0.0832	0.0202
	(0.0352)	(0.0701)	(0.0382)
CONSTANT	-0.6064***	-1.5981***	-1.0630***
	(0.2011)	(0.3898)	(0.2053)

*Notes: p-value<0.01 ***; p-value<0.05 **; p-value<0.1 *, observations: 24,121; 23,138; 24,070. overall R2: 0.47; 0.22; 0.34*

Looking at Table 8, we can see that for EU publicly traded companies the overall leverage ratio has not significantly increased during the post pandemic period, compared to the pandemic period. Therefore, we do not reject the null hypothesis that the post pandemic period did not significantly change the overall leverage ratio of publicly traded companies in the EU, compared to the pandemic period. Furthermore, we see a significant effect of post pandemic period on long-term debt leverage ratio, compared to the pandemic period. Specifically, in the post pandemic period, the long-run debt leverage ratio has decreased by 6.5% on average with 1% significance, compared to the pandemic period. The null hypothesis, which states that the post pandemic period did not significantly change the long-term debt ratio of publicly traded firms in the EU compared to the pandemic period, is rejected. Additionally, if we look at the current liability ratio, there is no significant change. Thus, we do not reject the null hypothesis that during the post pandemic period the current liability ratio of publicly traded firms in the EU did not change.

Since inflation expectations were extremely high in the US in the post-pandemic period, yet interest rates were rising, this potentially made US companies attain short-term debt rather than signing long-term debt contracts with unfavourable rates. EU companies did not attain more overall liability, and they decreased their long-term debt, and the reason might be because of investors' fears or economic impacts due to the close-by Ukrainian War, which is explored in the next sub-section.

4.4 Ukrainian War period effects

Table 9. FE Regression DiD results for the effect of Ukrainian War on the EU.

Variable	LEVERAGE	LEVERAGEL	LEVERAGES
EU	0 (omitted)	0 (omitted)	0 (omitted)
WAR	0.1102*** (0.0117)	0.1453** (0.0625)	0.1689*** (0.0129)
EUWAR	-0.0331*** (0.0108)	-0.1386** (0.0599)	-0.0446*** (0.0120)
MTB	-0.8204*** (0.0254)	-0.7175*** (0.0943)	-0.7988*** (0.0250)
IND	0.2771*** (0.0377)	0.6537*** (0.1138)	0.2335*** (0.0418)
TANG	0.0297*** (0.0048)	0.5009*** (0.0351)	0.0386*** (0.0062)
INF	-0.0005 (0.0010)	-0.0082 (0.0056)	0.0013 (0.0011)
PROFIT	-0.0001** (0.0001)	0.0003* (0.0002)	-0.0002** (0.0001)
ASSETS	-0.4143*** (0.0629)	0.0776 (0.1105)	-0.5337*** (0.0628)
CONSTANT	2.1153*** (0.3713)	-0.9371 (0.6924)	1.9991*** (0.3209)

*Notes: p-value<0.01 ***; p-value<0.05 **; p-value<0.1 *, observations: 88,771; 87,393; 77,515. overall R2: 0.03; 0.29; 0.07*

We can see that the coefficient for EUWAR is negative and significant for all leverage ratios. More specifically, if a company is in the EU, the Ukrainian War dropped its overall leverage ratio by 3.3%, its long-run debt leverage ratio by 13.86%, and its current liability ratio by 4.5%, on average with 5% significance, relative to the US companies. Thus, we reject all 3 null hypotheses related to the Ukrainian War having no significant effect on EU leverage ratios, relative to the US. Furthermore, the WAR coefficient is always positive and significant with 5%, meaning that on average leverage ratios have risen during the Ukrainian War period (looking at US and EU companies as one big group). This is most likely the case since US firms represent two thirds of all firms in the sample. And as previously mentioned, the post pandemic period (which differs in only 1 quarter to Ukrainian War period) significantly increased leverage ratios of US firms.

Like mentioned in the previous sub-section, we can see that the Ukrainian War can potentially explain why EU companies did not attain more overall or current leverage, and significantly reduced their long-term debt leverage. This could be due to the general fear in the market when having a close-by war happening, but also due to the economic impact the Ukrainian War had on EU economies through, for example, food and energy prices (Deng et al., 2022).

Table 10. Overview of all hypotheses tested, and their respective results

Null Hypothesis	**Result**	**Leverage**
Pandemic period had no significant effect on the overall leverage ratio of US firms	Rejected	Increased
Pandemic period had no significant effect on the long-term debt leverage ratio of US firms	Rejected	Increased
Pandemic period had no significant effect on the current liability leverage ratio of US firms	Rejected	Increased
Post pandemic period had no significant effect on the overall leverage ratio of US firms, compared to pandemic period	Rejected	Increased
Post pandemic period had no significant effect on the long-term debt leverage ratio of US firms, compared to pandemic period	NOT rejected	/
Post pandemic period had no significant effect on the current liability leverage ratio of US firms, compared to pandemic period	Rejected	Increased
Pandemic period had no significant effect on the overall leverage ratio of EU firms	Rejected	Increased
Pandemic period had no significant effect on the long-term debt leverage ratio of EU firms	Rejected	Increased
Pandemic period had no significant effect on the current liability leverage ratio of EU firms	NOT rejected	/
Post pandemic period had no significant effect on the overall leverage ratio of EU firms, compared to pandemic period	NOT rejected	/
Post pandemic period had no significant effect on the long-term debt leverage ratio of EU firms, compared to pandemic period	Rejected	Decreased
Post pandemic period had no significant effect on the current liability leverage ratio of EU firms, compared to pandemic period	NOT rejected	/
Ukraine War period had no significant effect on the overall leverage ratio of EU firms relative to US firms, compared to pandemic period	Rejected	EU rel. decreased
Ukraine War period had no significant effect on the long-term debt leverage ratio of EU firms relative to US firms, compared to pandemic period	Rejected	EU rel. decreased
Ukraine War period had no significant effect on the current liability leverage ratio of EU firms relative to US firms, compared to pandemic period	Rejected	EU rel. decreased

The paper does have a few possible limitations. First, although the 6 core factors were inspired by the Frank and Goyal (2009) paper, a different approximation of the MVA had to be taken due to the limitations of Compustat data for EU companies. This might have impacted the way the 3 main dependent variables were calculated, but also the significance levels of MTB coefficients in regressions. Second, although most factors match the change and the significance researched by Frank and Goyal (2009), they are not all significant in every FE regression analysis, thus not being able to control for those effects. For example, in the regression analysis for long-term debt ratio of EU companies in the post pandemic period, both inflation and log of total assets are insignificant, thus in that specific FE regression only 4 out of original 6 factors are stable controls. It is possible that not all 6 original factors perfectly explain different types of leverage ratios, and thus this needs further verification and research. Lastly, this research only focuses on publicly listed companies, and therefore these results and effects can hardly be applied to other types of companies, such as start-ups or just any unlisted companies. It easily could be that these companies were hit much harder or much less than the big publicly traded corporations. For future research, it is important to include also non-publicly listed companies, as they make up a big contribution to the GDP of US and the EU economies.

CHAPTER 5 Conclusion

In this paper, impact of the pandemic period and the post pandemic period on the leverage ratios of US and EU publicly traded companies was studied using the 6 core factors from the Frank and Goyal (2009) paper. The sample time was split into 3 main periods: pre pandemic 2016Q1 – 2020Q1, pandemic 2020Q2 – 2022Q1, post pandemic 2022Q2 – 2024Q1. There were 3 main hypotheses, each answered for 3 main leverage ratios (overall leverage ratio, long-term debt leverage ratio and current liability leverage ratio) and 2 areas (the US and the EU).

All hypotheses were tested using fixed effects regression analysis with within panel clustered errors. The empirical results of this paper find that the pandemic period increased all 3 types of leverage ratios (overall leverage ratio, long-term debt leverage ratio, and current liabilities leverage ratio) significantly in US companies, compared to the pre pandemic period. Meanwhile, for EU companies, increased overall leverage ratio and long-term debt leverage ratio significantly (compared to the pre pandemic period), and current liabilities leverage ratio stayed the same (coefficient insignificant). The post pandemic period increased overall leverage ratio and current liabilities leverage ratio significantly in US companies, meanwhile decreased long-term debt leverage ratio significantly in EU companies, compared to the pandemic period. Regarding Ukrainian War, the results showed that the war had a negative effect on overall leverage ratio, current liabilities ratio, and long-term debt leverage ratio of EU companies relative to US companies, compared to the pandemic period (difference-in-difference).

Looking at the results, it appears that fiscal and monetary policies during the pandemic period successfully increased the leverage ratios of companies, which was achieved by raising liquidity levels in the economy (Baines and Hager, 2021), so that companies can push through the negative economic impacts of the COVID-19 pandemic. Furthermore, we can see that the post-pandemic effects differ quite a lot between the US and the EU. While in the US the overall leverage ratio has increased, the change in long-term debt leverage ratio has stopped, most likely due to the rise of interest rates by the FED, which made conditions to acquire long-term debt less favourable. Meanwhile, the leverage ratio slowdown was more extreme in the EU, which is most likely due to the fear and economic impacts that the Ukrainian War brought to the European continent (Deng et al. 2022).

Overall, although there are limitations present, this paper still mostly successfully quantified the impact of the pandemic period, post pandemic era, and the Ukrainian War on the leverage ratios of US and EU companies. This paper is thus useful in multiple ways. First, from a firm perspective, future conclusions can be drawn on how the industry might change depending on different external conditions that hit it, such as a war or a pandemic. More importantly, this paper is most useful for policy making, as it provides a full overview of what were the actual effects of these periods with different economic, political, and social circumstances.

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APPENDIX A Variable differences with Frank and Goyal (2009)

The only and main difference with Frank and Goyal (2009) was the definition of Market Value of Assets (MVA). In this paper it is defined as Market Capitalization plus Total liabilities. While in Frank and Goyal (2009) MVA = Market Capitalization + Short-term Debt + Long-term Debt + Preferred Liquidation Value – Deferred Taxes and Investment Tax Credit. These variables were unattainable in Compustat for the EU, thus Market Capitalization + Total Liabilities was taken as the closest approximation for MVA of US and EU companies in this paper.

APPENDIX B Additional tables

Table B.1 Hausman test

	Test statistic	P-value
Chi2 (6)	2580.13	0.0000

Note: Choose FE over RE regression model as p-value<0.05

Table B.2 White test

	Test statistic	P-value
F (40, 160195)	66.03	0.0000

Note: There is heteroskedasticity present, clustering errors is needed

Table B.3 Wooldridge test to test for autocorrelation

Variable	e
Le	0.6485***
	(0.0018)
constant	0.0072***
	(0.0009)

*Note: p-value<0.1 *, p-value<0.05 **, p-value<0.01 ***, observations: 157,208, R2: 0.44, if the coefficient was around 0, there would be no autocorrelation of errors present, otherwise there is autocorrelation of errors, thus clustering errors is needed*