SCHOOL OF ECONOMICS AND MANAGEMENT

Lund University

Derivatives and deregulation:

Bank risk in the wake of the Economic Growth, Regulatory Relief, and Consumer Protection Act

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Bachelor's thesis 2024

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Acknowledgements

I would like to begin by expressing my sincere gratitude to the people and organizations who have made this thesis possible. First and foremost my supervisor Dr. Talina Sondershaus for her guidance, insights and support during the entirety of the work on this subject, it has truly been of immense importance for the quality of this research project. Secondly I would like to give thanks to Benjamin Swedberg, Head of Trade Finance at SEB, who has been of great help in terms of market insights and discussion of potential data sources and variables which has helped shape the direction of the project, particularly in the early stages.

Abstract

This project aims to research to which extent the 2018 rollback of the Dodd-Frank Act has affected the derivative trading patterns of medium-sized banks in the U.S. and whether any conclusions can be drawn regarding changes in their risk profiles in regards to derivative markets given the hypothesis that institutions subject to regulation change would increase their risk exposure. To this end, trading data on three derivative categories, Interest Rate, Foreign Exchange and Credit, acquired from financial reports published by the U.S. Federal Financial Institutions Examination Council (FFIEC) has been analyzed through regression models with fixed effects over a time period of 2015-2020. The findings of this report do provide evidence in support for the hypothesis and suggest a positive relationship between the EGRRCPA and increased risk for Category IV financial institutions.

Keywords: Dodd-Frank, Derivatives, Financial regulations, Banks, Trading, Regression Analysis, Panel Data, Difference-In-Difference Analysis

Acronyms

DFA	Dodd-Frank Act
EGRRCPA	Economic Growth, Regulatory Relief & Consumer Protection Act
SLR	Supplementary Leverage Ratio
EPS	Enhanced Prudential Standards
OTC	Over-The-Counter
SIFI	Systemically Important Financial Institution
LCR	Liquidity Coverage Ratio
DiD	Difference-in-Difference
FFIEC	Federal Financial Institutions Examination Council
NPL	Non Performing Loans
OLS	Ordinary Least Squares

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Chapter 1: Introduction

1.1 Background

During the last 40 years, the growth of derivative markets has been one of the biggest changes in the financial industry. The trading of derivatives today plays a big part not only for the risk management of individual financial institutions, but also for the stability and efficiency of financial markets and industries on a wider scale. Financial institutions are key financial intermediaries, providing a way to hedge risk and extend planning horizons for other banks as well as corporations through derivative instruments. Derivative contracts are however also a popular instrument for speculating in the future value of underlying assets for the banks own profit, as they provide leverage (Hull, 2021). This leverage comes at a price, as in accordance with classic economic theory, increased returns come at the price of increased risk, something that became painfully obvious in 2008.

In the wake of the 2008 financial crisis, derivatives received a large amount of criticism for their role in how a U.S. housing market crash could turn into a global economic crisis (Hull, 2021). As a result of this, in 2010, the Dodd-Frank Wall Street Reform and Consumer Protection Act (hereby referred to as the DFA) was implemented, which aimed to increase transparency and reduce risk in the financial sector (Dodd-Frank Wall Street Reform and Consumer Protection Act, 2010). The new regulations included the introduction of clearinghouses for Over-The-Counter derivatives, meaning bespoke derivative contracts negotiated between two parties (as opposed to standardized exchange-traded derivatives) has to be cleared through a central clearinghouse, in order to increase transparency and decrease counterparty risk (Skeel 2011, 5). Secondly, the DFA implemented measures to identify financial institutions deemed to be systemically important, i.e. organizations which bankruptcy would trigger widespread economic consequences, at the time of the implementation of this law, the threshold for a systemically important financial institution (SIFI) was set at $50bn (Joo 2019, 568). This threshold is what decides if a banking organization or bank holding company is required to adhere to the so called Enhanced Prudential Standards (EPS), as well as whether or not they have to partake in annual stress-tests designed to evaluate the banks' ability to withstand adverse financial conditions (Joo 2019, 568). The EPS is a set of requirements aimed to increase the financial institutions ability to withstand adverse conditions, for instance through Supplementary Leverage Ratio (SLR), as defined by the ratio of the institutions Tier 1 Capital and its total leverage exposure (SWFI 2021). The EPS also requires the SIFI's to maintain a countercyclical capital buffer, as well as stricter rules for liquidity risk management and monthly liquidity stress tests (The Federal Reserve 2019).

However, the landscape for derivative trading has undergone significant changes in recent years, largely as a consequence of further regulation change. Most notably, and the subject of study for this research project, is the 'Economic Growth, Regulatory Relief, and Consumer Protection Act' (hereby referred to as the EGRRCPA) signed into law by President Trump in 2018 (Joo 2019, 568). The EGRRCPA raised the SIFI threshold from the previous $50bn to $250bn, leading to a significant reduction in the number of banks required to adhere to the EPS as well as partake in the annual regulatory stress testing implemented in 2010 (Joo, 2019). The 2018 EGRRCPA is effectively a rollback of the 2010 DFA, repealing many of the measures put in place in 2010. This regulation change presents an opportunity and a question; to examine the effect of regulation change on banks' derivative trading strategies and risk profiles of banks in the $50-$250Bn bracket, called Category IV firms (The Federal Reserve 2019). This is not only relevant for gaining an understanding of the implications of regulatory change on banks' behavior but also contributes to the discourse of optimal regulation of derivative trading in the banking sector.

1.2 Significance of the study

First off, balancing the objectives of financial stability and economic efficiency is crucial, therefore the study of implications of previous policy changes are of utmost importance in order to make well informed future regulatory decisions. Secondly, equal to the importance for policy makers, the insights of how regulatory change affects banks' risk profiles can be of value to both the risk management divisions of the financial institutions as well as the regulatory bodies of the federal government tasked with overseeing the banking sector. Thirdly, by offering empirical evidence from the pre- and post-EGRRCPA era, this study contributes to the academic literature on the effects of financial regulation and policy making. Furthermore it aims to fill an identified gap in existing academic literature, where many studies focus on the increased/decreased cost as a result of regulatory change, or risk on a more general level. This study dives deep into the impact on derivative trading patterns, an area not studied as extensively, despite being one of the key focus areas for the DFA.

Chapter 2: Hypothesis and literature review

The hypothesis of this research project is that relaxed risk management regulation in terms of exemption from the EPS and reduced frequency of both liquidity stress-testing as well as general supervisory stress-testing will lead to Category IV financial institutions exhibiting altered trading patterns in the OTC derivative markets, illustrated by a more pronounced risk profile.

This hypothesis is backed up by both theoretical and empirical literature. Even when derivatives are used exclusively for the purpose of hedging risk, their use may increase bank risk, and pose a potential threat to the stability of the bank (Instefjord, 2005). The increase in bank risk as a consequence of increased use of derivatives is proved further by other empirical studies (Huan and Parbonetti, 2019). The importance then of a robust framework for management and supervision of liquidity risks for financial institutions in order for the institution to have the ability to withstand adverse conditions, taking this risk into account is a widely accepted concept. The use of stress-testing, maintenance of adequate levels of liquidity "through a cushion of unencumbered high-quality liquid assets" regulated by a firm liquidity coverage ratio (LCR) are important measures to achieve this goal (Ruozi and Ferrari, 2013), all measures that were removed or relaxed in the 2018 EGRRCPA (Joo, 2019). This narrative is developed further in other literature. An empirical study on the impact of the introduction of the 2010 bill on the risk taking behavior of financial institutions by Akhigbe et al. (2015) provides evidence that a significant decline in firm specific risk followed the introduction of the Dodd-Frank Act, *especially* for firms that altered their capital ratios, an important part of the EPS which once again was in part deregulated for category IV institutions during the 2018 rollback.

Given these theoretical and empirical arguments in favor of stricter regulation, one can wonder what arguments can be made to the contrary. Popular arguments include that the costs associated with the regulatory burden the DFA imposed on smaller banks is disproportionate, and that the $50Bn threshold was set too low in 2010, something even former congressman Barney Frank (that is Frank as in Dodd-Frank) agrees with (Joo, 2019). The impact on costs as a result of regulation is something studied further by Le and Santos (2023), where empirical evidence is provided of an increase in non-interest expenses as a result of the Dodd-Frank Act, and a subsequent decrease following the 2018 rollback. This ties back to the policy implications described in the previous background chapter 1.2, i. e. the importance of balance in financial regulation between regulatory burden and financial efficiency.

Chapter 3: Methodology and Data

3.1 Research design

Founded in the empirical and theoretical framework described in the previous chapter, this quantitative research project aims to investigate the relationship between risk taking behavior and regulatory change through regression analysis. A Difference-in-Difference analysis was performed on a panel data set described further in the following subchapters.

3.2 Data sources

The data sets used in this research project mainly comprises data from the quarterly Report of Condition and Income (Call Report) financial institutions are required to file each quarter year with The Federal Financial Institutions Examination Council. These data sets include vast amounts of information on all aspects of the reporting institutions financial welfare. In addition to the firm specific data acquired from Call Reports, macroeconomic data has been sourced from FRED, the Federal Reserve Economic Database.

3.3 Delimitations

As the regulation change in question only applied to financial institutions active on U.S. markets, the study was limited to research the behavior of American banks. Two groups of three banks each were included in this research project, selected on the basis of total consolidated assets. The treatment group, i. e. Category IV financial institutions with total consolidated assets within the $50-$250Bn bracket, represented the banks who experienced regulatory relief. These three financial institutions included BMO Harris, Key Bank and Fifth Third Bank. The control group comprised financial institutions whose total consolidated assets exceeded $250Bn and were subsequently unaffected by the regulatory change. The control group initially comprised JPMorgan Chase Bank, Bank of America and Wells Fargo. However, repeated violations of the parallel trends assumptions during estimation prompted a graphical illustration of the variables, where it became apparent that the trading patterns of JPM significantly set it apart from the norm over the entirety of the observation period (Figure (1)). While interesting in itself, and perhaps an area for future research, it is beyond the scope of this study and the exclusion of the bank was crucial for the suitability of the model. As a consequence of this the control group henceforth consisted of the Bank of America and Wells Fargo, while the treatment group remained unchanged.

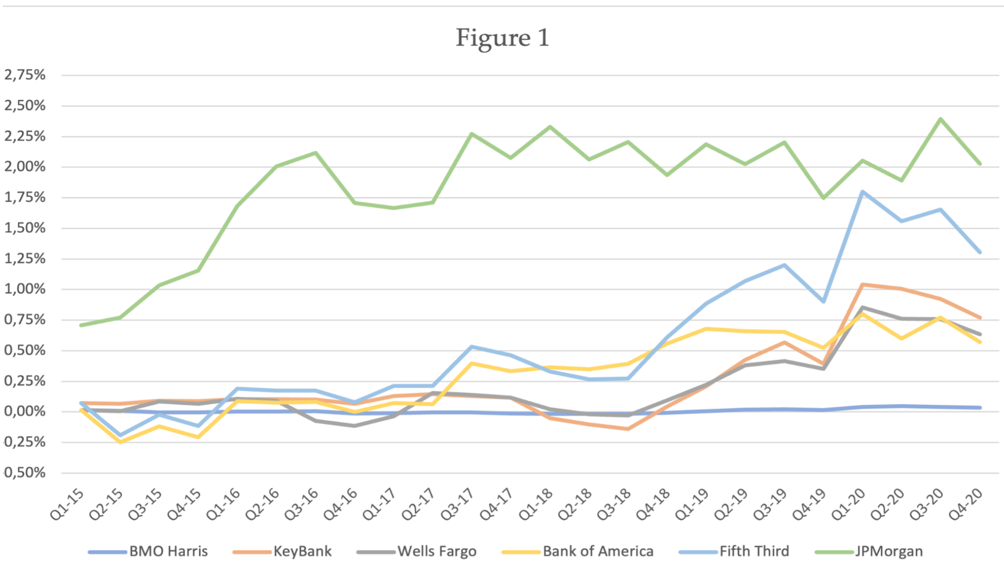

Figure 1: Risk Proxy Aggregate Data Plot. This graph shows the actual values of the response variable Risk Proxy Aggregate in order to illustrate the tendencies of JPMorgan that sets it apart from the other institutions.

The dataset runs from the first quarter of 2015 to the last quarter of 2020, providing two equal length time periods pre- and post the regulation change, with 24 quarterly data points for each variable in total. The research was also delimited to the study of three derivative types, Interest Rate, Foreign Exchange and Credit Derivatives. This delimitation was based on the extent to which the studied financial institutions utilized different derivative types, indicated by the data from the Call Reports. While the institutions in the control group provided extensive data on their use of all derivatives, including commodity derivatives and equity derivatives, the data on these two contract types for the institutions in the treatment group was incomplete at best, non-existent at worst, prompting their exemption from the study.

3.4 Variables

The response variable chosen to illustrate the risk profile of the studied banks is a risk proxy variable constructed from call report data, consisting of the ratio of net fair value of derivative positions over total consolidated assets. The net fair value provides insight into the financial position and risk exposure of the reporting bank as its definition is the amount the reporting bank would pay or receive if it were to settle or close out its derivative position at the observation date, i.e. it represents the reporting financial institutions reliance on derivatives, and takes into account the hedging strategies employed by the institution. Expressing the risk proxy as a ratio provides a better understanding of the value in relation to the size of the institution, compared to using solely the net fair value. In addition to the aggregate ratio, regressions were performed on the ratio of three separate derivative categories in order to increase the robustness of the test results. The three categories of derivatives studied are interest rate derivatives, foreign exchange derivatives and credit derivatives. The variables are defined as follows:

- Risk Proxy Aggregate
- Risk Proxy Interest Rate Derivatives
- Risk Proxy Foreign Exchange Derivatives
- Risk Proxy Credit Derivatives

Bank level control variables for each financial institution were lagged values of the conventional CAMELS variables as defined by Krause, Sondershaus and Tonzer (2016, Appendix A). The CAMELS are a set of measures of bank performance and are well established within the financial sector and used by a wide array of regulatory bodies to rate banks. While the rating system used by regulators produces a score from 1 to 5, 1 being the best and 5 being the worst, in this study the variables were used to control for bank-specific effects on the response variable. The definitions were as follows:

- Capital - Defined as the ratio of total equity capital and total consolidated assets
- Asset Quality - Defined as the ratio of non-performing loans (NPL) and total loans
- Management Quality - Defined as the ratio of non-interest expense and non-interest income
- Earnings - Defined as the ratio of non-interest income and total assets
- Liquidity - Defined as the ratio of liquid assets and total assets
- Size - Defined as the natural logarithm of total consolidated assets

Macroeconomic control variables were chosen to capture the effect of macroeconomic trends on the banks' derivative trading, and are as follows:

- Inflation - defined as percentage change in the consumer price index
- GDP - defined as the percentage change in the U.S. Gross Domestic Product

The purpose of including bank level control variables (CAMELS) and macroeconomic control variables (Inflation and GDP) is to isolate the effect of the regulation change from other bank-specific or macroeconomic factors that could impact the banks derivative trading behavior.

3.5 Data restructuring and transformation

The FFIEC Call Reports are incredibly large and cover all aspects of the reporting institutions financial state. Each quarterly report consists of a collection of 47 data schedules, each with its own reporting purpose, ranging from Off-Balance Sheet Items (Schedule RC-L) to Quarterly Declaration of Income and Expenses (Schedule RC-K). Each of these schedules contains approximately 500,000 data points. The time frame of this study was six years, this led to a total of 24 quarters, 25 including Q4 of 2014 for the lagged values of the CAMEL variables. Certain parts of the data collected for the variables were extracted using the Excel Power Query function and Python scripts to automate the extraction process, while others were extracted manually. An example of this was the Asset Quality variable, as the NPL-part of the variable was not summarized in the reports, but rather consisted of 66 different data categories (multiplied by 24 quarters and six banks equalling 9504 data points) of past due and nonaccrual loans each having to be extracted and summed from every quarterly report manually.

The extracted and transformed data was subsequently structured in a panel data format with cross-sectional units over time with fixed time- and unit-specific effects. A Time_ID variable was added in the form of year and quarter, for example 151 being the code for Q1 of 2015, 152 representing Q2 of 2015 and so on. A Bank_ID variable was also added, where each bank was referred to by their individual IDRSSD, a unique numerical identifier issued to all financial institutions by U.S. regulatory bodies, for example the IDRSSD for BMO Harris is 75633, and for Wells Fargo the IDRSSD is 451965. Additionally, a dummy variable 'RegChange' for the 2018 regulation change was created, taking on the value of 1 from Q1 of 2018, and 0 before. For the DiD analysis a binary interactive variable 'BankSize' for the regulation change dummy was created, taking on the value of 1 if the corresponding bank was affected by the regulation change, i.e. the Category IV financial institutions, and 0 if not. The two variables 'BankSize' and 'RegChange' are interacted in the model to estimate results for the Difference-in-Difference analysis.

3.6 Model specification and assumptions

Given the definitions and transformations described in 3.4 and 3.5, the regression model is specified as follows:

$$Y_{it} = \beta_0 + \beta_1(RegChange_t * BankSize_i) + \beta_2 RegChange_t + \beta_3 Y_{it-1} + \beta_4 Capital_{it} + \beta_5 AssetQuality_{it} + \beta_6 ManagementQuality_{it} + \beta_7 Earnings_{it} + \beta_8 Liquidity + \beta_9 Size_{it} + \beta_{10} Inflation_t + \beta_{11} GDP_t + \epsilon_{it}$$

Where β_1 is the key DiD estimator, capturing the differential impact of the regulation change on the treatment group relative to the control group. The error term is

$\epsilon_{it} = \alpha_i + \gamma_t + \mu_{it}$ where α_i and γ_t represents bank- and time specific fixed effects, respectively, and μ_{it} is the new idiosyncratic error term picking up randomness over time.

Apart from the usual Gauss-Markov assumptions of panel data OLS, namely homoscedasticity of variances ($Var(\epsilon_{it}|x_{i\,t}) = \sigma^2\ \forall\ i,\ t$), exogeneity of the error term ($E(\epsilon_{it}|x_{i\,t}) = 0$) meaning the conditional expectation of the error term given *x* equals 0 and no autocorrelation ($Cov(\epsilon_{i,\,t}|\epsilon_{i,\,s}) = 0\ \forall t \neq s$), the Difference-in-Difference approach carries with it its own critical assumption of parallel trends. The assumption states that in the absence of regulatory change, the two groups would exhibit the same tendencies over time i.e. they would share a common trend.

Making sure the data does not violate these assumptions was crucial in order to draw valid inference and to not induce a spurious regression. The use of robust standard errors when running the estimations helped alleviate concerns of potential heteroskedasticity in the error terms, and the use of fixed effects mitigated certain types of potential endogeneity, particularly those arising from omitted variables. After trial estimations of the model, the Rho- and Durbin-Watson values indicated high levels of positive autocorrelation in the models data and residuals. To alleviate this problem lagged values of the response variable (Y_{it-1}) was included in the estimation as an independent variable, which successfully solved the initial model's violation of the autocorrelation assumption. Not doing this step would possibly have led to underestimated standard errors and inflated R^2-values, which would have led to the risk of misinterpreting the significance of the coefficients.

3.7 Parallel Trend Tests

For parallel trends, there is no standardized test to control for this, instead separate regressions were run, with a new variable interacting each quarter with the treatment indicator ‘BankSize’. The fixed effects model was specified as follows:

$$Y_{it} = \beta_0 + \sum_{t=Q1-2015,\, t\neq Q4-2017}^{Q4-2020} \beta_1(1 * BankSize_i) + \epsilon_{it}$$

Subsequently, if β_1 is consistently statistically different from zero in the pre-treatment period, this would suggest the presence of differing trends in the pre-treatment period and thus a violation of the parallel trends assumption.

The results from these regressions are illustrated in the coefficient plots below (Figure 2). The results suggested that while there were anomalies at certain observations, given the context and incredibly small magnitude of the coefficients, they were not sufficient to suggest that the parallel trend assumption was violated. The overall pattern, considering all pre-treatment quarters suggested that the assumption was not violated. The change in trading patterns was most apparent for the aggregated risk proxy as well as the risk proxy for interest rate derivatives. By observing the coefficient plots in figure 1A and 1B, there is a most noticeable change after Q1 of 2018, where the coefficients increase, signaling an increase in the risk proxy following the regulation change. This serves as preliminary evidence to support the hypothesis, although not sufficient for any generalizing conclusions.

Figure 2: Coefficient plots with confidence intervals

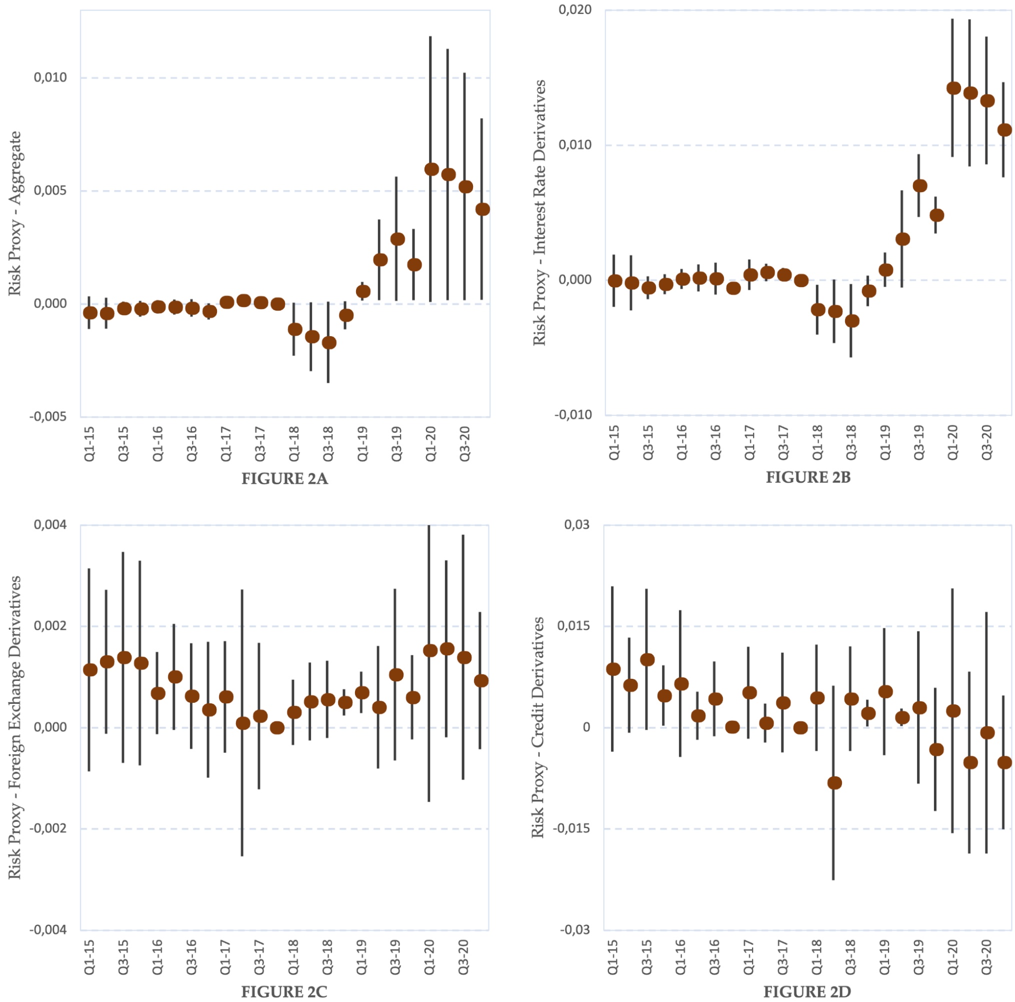

Figure 2: Coefficient plots. This figure shows the coefficients of the response variables plotted over time with confidence intervals at 90%.

	(I)	(II)	(III)	(IV)
	Risk Proxy Aggregate	Risk Proxy Interest Rate	Risk Proxy Foreign Exchange	Risk Proxy Credit
BankSizexRegChange	0.000656577** (0.000303669)	0.000640597 (0.000488633)	0.000393757** (0.0000930335)	0.0000280696 (0.00207032)
RegChange	–0.000405446 (0.000272288)	-0.000325274 (0.000286498)	-0.000146299* (0.0000834329)	-0.000882108 (0.000824379)
Capital	0.0332786*** (0.0115821)	0.0386643 (0.0374918)	0.00777231 (0.0120459)	-0.166645 (0.111719)
Asset Quality	–0.0214199*** (0.00684164)	0.0119845 (0.0113779)	-0.0100051 (0.00843460)	-0.0234035 (0.0952446)
Management Quality	–0.000374307 (0.000760546)	0.000447643 (0.000715887)	0.000485722 (0.000708593)	0.00310440 (0.00588997)
Earnings	0.0203893 (0.0149347)	-0.00816090 (0.0137256)	0.00598118 (0.0123538)	0.149292 (0.125999)
Liquidity	0.00104567 (0.00459275)	-0.0108410** (0.00448970)	0.00603402** (0.00237573)	0.00653853 (0.0269671)
Size	0.00220496 (0.00141430)	0.00581775 (0.00495934)	-0.000101197 (0.00111790)	-0.0168294** (0.00558841)
Inflation	–0.000443563 (0.000614052)	-0.00116086** (0.000492373)	-0.000301157 (0.000476918)	-0.00121163** (0.000433117)
GDP	-0.0000292189 (0.0000400969)	-0.000149792 (0.0000926239)	0.0000216935 (0.0000354620)	-0.000342954 (0.000194558)
Lagged Response Variable	0.830665*** (0.0681888)	0.877512*** (0.0920964)	0.505070*** (0.0582366)	0.0449065 (0.302048)
Observations	115	115	115	115
R2	0.765199	0.845460	0.369024	0.233402

TABLE 1: Main results. This table shows the results from the main regressions using time- and unit-specific fixed effects, robust standard errors and including 1 lag of the response variable as an estimator. *. **, *** represents significance at 10%, 5% and 1%, respectively.

The main results of the Difference-in-Difference analysis provided evidence of a positive relationship between regulatory relief and an increase in risk. The coefficient for the DiD-estimator for the aggregate of all three derivative types (I) was estimated to be statistically significant at the 5% level. As neither the DiD-estimator nor the risk proxy are LOG-transformed, the coefficient is interpreted as a change in absolute value. This means that the net fair value of the aggregate of all three derivative types increased with [≈0.0657] percentage units relative to the total consolidated assets following the regulation change. Although not all derivative types exhibited the same significant relationship when estimated separately i.e. Foreign Exchange- and Credit Derivatives, the aggregate and Interest Rate Derivatives did. These results provide evidence in support of the hypothesis. In addition to the DiD-estimator, other statistically significant contributors to change in the risk proxies included both the bank level- and the macroeconomic control variables.

	N	Mean	Min	Median	Max	S. D.
Risk Proxy Aggregate	120	0,00114	-0,00271	0,00044	0,00999	0,00263
Risk Proxy Interest Rate	120	0,00205	-0,00306	0,00024	0,01955	0,00471
Risk Proxy Foreign Exchange	120	0,00070	-0,00264	0,00072	0,00387	0,00097
Risk Proxy Credit	120	-0,00502	-0,03081	-0,00157	0,00994	0,00803

Table 2: Summary Statistics. This table shows the summary statistics for the response variables.

Chapter 5: Discussion

As previously mentioned, the results of both the main regressions as well as the parallel trends regressions suggested a positive relationship between the regulation change and reliance on derivatives for Category IV financial institutions, indicating increased risk for the treatment group. The coefficient for the aggregate risk proxy [≈0.000657] in the context of the data set suggested a substantial increase, as the mean of the variable in the pre-treatment period for Category IV financial institutions was [≈0.00066]. This meant that the reliance on derivatives nearly doubled in relation to asset size for the treatment group. The results from the additional regressions on the separate derivative types, however, are not homogenous. While the coefficient for foreign exchange derivatives also suggested a positive relationship between the regulation change and the risk proxy, the coefficients for interest rate contracts and credit contracts did not.

While these findings do support the hypothesis, using the results to draw generalizing inference on the impact of the EGRRCPA requires carefulness. Given the heterogeneity of the coefficients for the DiD-estimators, as well as the small groups used in this study, the results may not accurately represent the entirety of the market. Furthermore, the inclusion of additional derivative types may have led to a broader understanding of the implications of the regulation change. However, as discussed in the chapter on delimitations, the data on the use of other derivative types by Category IV financial institutions was lacking in the Call Reports. The most obvious explanation would be that these institutions do not utilize other contract types, however, a different data source may have provided more extensive data.

The choice of response variable could also have been different. Other constructions of the risk proxy were considered, for example a ratio of gross notional values and total consolidated assets. This was exempted, as while the gross notional values may have provided insight into the scale of derivative trading, it does not take into account the hedging strategies and risk offset as well as the fair values do, and thus does not illustrate risk exposure as accurately. The net fair value posed its own problem though, as the interpretation of the coefficient can be difficult. A positive coefficient for the DiD-estimator generally indicated an increase in reliance on derivatives, as the vast majority of the net fair values in the data set were positive. However the net fair value *can* be negative as well, and in those cases a negative coefficient would have indicated an increase in reliance on derivatives. This problem could be alleviated by regressing the positive fair values and the negative fair values separately.

Chapter 6: Conclusions

In conclusion, the results of this research project did provide evidence in support of the hypothesis that the regulatory relief introduced through 'Economic Growth, Regulatory Relief, and Consumer Protection Act' in 2018, did in fact increase the risk exposure of Category IV financial institutions. However, in order to draw valid conclusions about the effectiveness of the regulation change and its impact on bank risk further studies would be wise. Further research on a larger number of financial institutions, additional derivative types and additional risk proxies would increase robustness and provide more conclusive evidence for or against the hypothesis.

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