The Impact of a Financial Transaction Tax on Market Liquidity and Market Volatility

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Abstract:

In this study, we analyse the impact of the introduction of the Spanish securities transaction tax on the market quality parameters of market liquidity and market volatility. This is an area of social sciences which provides an interesting argument. To present the impact of the tax, we employ a difference in differences regression to value the difference between our control group (DAX 30) and the treatment group (IBEX 35) and isolate other possible external variables that may also impact the market quality parameters simultaneously. We also run a propensity score matching to ensure our calculations are robust. We conclude that the introduction of a securities transaction tax on Spanish equities has dampened the values of our market quality parameters of liquidity and volatility.

Acknowledgements

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1. Introduction

Securities transaction taxes (STT) are taxes which are imposed on the trading of financial devices, such as stocks, futures and options (Wang, N. and Li, D., 2012). The potential of a securities transaction tax is an area of economic analysis which has been at the forefront of many discussions since the global financial crisis in 2008. Whether a tax on financial transactions has the intended impact of reducing volatility and enabling an economic environment which flourishes with growth is the centre of a highly controversial topic. Those who encourage the introduction of the tax claim that a STT will reduce the presence of speculative market activity, which is also known as 'noise traders', and allow high levels of market volatility to cool down (Stiglitz (1989). On the contrary, those who oppose the imposition of such a tax on the stock market strongly argue that a tax on financial transactions may instead hinder market performance as investors may be prompt to tax avoidance through diversifying their investment portfolio and through investing in other financial opportunities that suit their tax preferences. Accordingly, reducing participation levels while simultaneously creating greater levels of volatility (Swchert and Seguin (1993). Primitively, a STT was proposed to avoid the high levels of speculative activity within markets and re-establish market forces' natural flow when determining prices (Lee, Y., Singleton, R. and Globerman, S., 2017).

The concept of financial transaction taxes can be traced back to 1936. After the stock market crash in 1929 and The Great Depression, the well-renowned economist John Maynard Keynes noticed the growing levels of price fluctuations in US markets, most predominately in the New York Stock Exchange, compared to that of markets in London. Keynes claimed that the high levels of volatility in the New York Stock Exchange were due to the lack of taxes on the purchase of securities, thus, allowing an easier process for inexperienced investors to join the stock exchange and creating a market where prices are driven by optimism and speculation. Another scenario in which a financial transaction tax left its mark on history was the proposition of the Tobin Tax by James Tobin in 1971. In 1971, the change to a flexible exchange rate from a fixed exchange rate led to a rise in short term speculation as there were high levels of funds moving between several economies at the time. To curb short term speculation and eliminate issues surrounding the movement of a high volume of funds, Tobin proposed a tax that is levied on spot currency conversions.

Will a tax on financial transactions help negate speculation-based trading and thus allow a more stable economy? Instead, will such a tax hurt market liquidity and encourage a volatile market environment?

2. Literature Review

Aforementioned, the concept of a STT was first introduced by James Tobin, arguing that a tax on financial transactions would deter novice and optimistic traders and thus, allow the growing levels of speculation in the foreign exchange to decline. Tobin metaphorically described the tax as 'throwing sand in the wheels of our excessively efficient international markets' (Tobin, 1978). Although the tax was initially thought to solve problems surrounding trades that took place on the foreign exchange, the 'Tobin Tax' has since been adjusted and appropriated by other economic institutions to achieve government objectives. Consequently, following the upsurge in the discussion and implementation of STT since James Tobin, several theoretical and empirical studies have been released analysing the success and or failure of introducing STT. The outcomes of the most popular studies are discussed below in the following subsections.

2.1 In favour of the proposal a STT

Much like Keynes and Tobin, Summers and Summers (1989) and Stiglitz (1989) express their desire for STT to take place within markets. Summers and Summers explore the desirability of introducing a US Securities Transfer Excise Tax (STET) directed at minimising the level of short-term speculation within US stock markets. Summers determine that strong arguments can be prepared to support a STET as the tax would, with all things being equal, have the positive impact of limiting instability resulting from excess speculation. Stiglitz's results further support the findings of Summers and Summers. Stiglitz argues that if rates of volatility do not rise, then a STT has no lasting negative impact on markets. He further highlights that because of the lack of noise traders as a result of the STT, liquidity levels are likely to see sustainable periods of improvement.

2.2 Against the proposal of a STT

On the other hand, many studies also reflect a certain level of wariness when discussing the possibility of the tax. Habermeier and Kirilenko (2003) demonstrate a clear level of concern when exploring this concept in depth. They claim that a STT 'throws sand' not into the wheels of excessively efficient international markets but instead into the engine of financial markets. Their results demonstrate the tax has a dampening effect on price discovery, volatility and liquidity and, therefore, arrive at the conclusion that the tax leads to the fall in the efficiency of markets.

2.3 Empirical Literature review

While theoretical research is based on making connections between existing empirical studies to make advancements in a theoretical view, empirical research is based on gathering findings through completing experiments and observations.

Umlauf (1993) observed the impact of a financial transaction tax on the behaviour of equity returns in the Swedish stock market. The study focused on the equity returns that took place from the 1980 to 1987 period. This exploration of the Swedish STT was of an interesting viewpoint as the tax was imposed for political reasons rather than to alter trading patterns that took place within financial markets. The results of the study show that volatility remained constant however, price levels and rate of turnover of stocks did decrease in volatility. Furthermore, once the rate of tax saw a rise to 2% in the year 1986, Umlauf's observations depict high levels of trading moving abroad, most evidently to London, where the tax rates were more favoured to traders at the time.

Pomeranets and Weaver (2011) investigate the change in market quality when 9 altercations of the New York State STT between 1932 and 1981 and a further 3 modifications to the Federal STT from the years 1932 and 1966. The research collected from the observations demonstrates a positive correlation between an increase in the STT and the market quality parameters of stock volatility, bid-ask spread and market volume. Pomeranets and Weaver round up their analysis by stating that the STT, overall, damages the quality of the market.

Phylasktis and Aristidou (2007) focus their study specifically on the effect of STT on volatility. The study provides a unique point of view as the results of the tests provide doubt on the findings of previous studies in this field. The data collected highlights that the impact of the STT on volatility is dependent on whether the market is in a state of ‘bear’ or ‘bull’. Moreover, the findings of the paper display that the effects of the tax are more prominent in stocks which are high in volume and during times in which the market is a ‘bull’ period. However, instead of the tax to stabilise volatility, as supporters of the tax advertise, volatility rates experienced greater levels.

2.4 Theoretical Literature Review

McCulloch and Pacillo’s (2011) review attempt to synthesise all of the previous theoretical literature available on the impact of STTs on varying levels of volatility in stock markets. In general, the study demonstrates that most papers conclude that a STT stabilises volatility as it limits the number of noise traders that participate in markets. McCulloch and Pacillo (2011) also highlight that the size of the given tax should be deeply considered. If the relative size of the tax is deemed to be too large, the fall in the levels of market activity and market liquidity may result in a rise in volatility, rather than the said decrease.

Matheson (2011) attempts to review past evidence that has been given in this field of research, specifically, analysing whether the evidence supports the said purpose of a STT and the possible impact that may leave on economies. Matheson claims that the imposition of the tax will cause greater harm than good. He forecasts prices of securities and the volume of trades will take a hit in the short run, he then further claims that this may lead to firms increasing their price levels as a response to the imposition of the tax-reducing profit levels. This may then result in a slower rate of development for economies.

Schwert and Seigun (1993) provide a contrary point of view depicted by Matheson (2011). Unlike the arguments put forward by Matheson (2011), Schwert and Seigun (1993) suggest that the introduction of a STT is of a greater benefit than detrimental. However, they also do put light on the possible negative aspects of the tax as they conclude that regulators of the tax are made aware of the possible negative outcomes as the tax is yet to be suggested for the US treasury market.

Kupiec (1996) provides an intriguing framework for the field of STT analysis. Within the analysis of the paper, the evidence offered presents the partial equilibrium argument to be misleading and incorrect. Results depict that although a STT may alleviate volatility levels for the price of assets that are deemed to be risky, the fall in the volatility levels for prices of risky assets is followed by a decrease in the price of those assets as investors account for the future tax liability that is associated with owning assets of a risky nature. Overall, Kupiec's final remarks, from exploring the impacts of the tax, state that although volatility may decrease slightly as a result of the tax, the reduction in the price of that asset provides a greater loss to investors involved within those risky assets. Consequently, the volatility of assets with risky returns rises with the insertion of a STT.

2.5 Methodological problems with previous studies

Concerning the previous results derived from empirical studies, many studies fall victim to methodological problems and experience endogeneity complications. The majority of preceding studies explore a scenario in which a STT was put into action during periods in which the economy was suffering from several economic problems. As a result, as the government was attempting to solve high volatility through a STT, they were also attempting to solve many other economic problems and, therefore, implemented other government intervention schemes simultaneously. Other studies fail to separate the pure natural effect of the STT from other government intervention schemes and other macroeconomic variables.

Our study attempts to avoid falling into similar problems by applying a difference differences approach. To separate the impact of the tax from other factors, our study compares the differential effect of the STT on treatment and control groups.

Umlauf (1993) and Pomeranets and Weaver's (2011) exploration of STT both use a difference in differences approach to mitigate problems surrounding endogeneity. Umlauf presents a control group that consists of the New York Stock Exchange and the London Stock Exchange and a treatment group that consists of the Swedish All-share equity index. On the other hand, in terms of methodology, Pomeranets and Weaver compile the stocks traded on the New York Stock Exchange and form that data to be the treatment group whilst the data collected upon the stocks traded on Nasdaq to be the control group.

3. Understanding the Spanish Securities Transaction Tax

To highlight the specific Spanish STT and to demonstrate the differences to former STTs that have been applied to other economies, the following section will outline the specifics of the tax in detail. Following rigorous debates and discussions among Spanish authorities, the Spanish STT was put into action on the 16th of January 2021 at a rate of 0.2%. Although the STT is often described to be similar to that introduced in Italy and France, this type of STT has its exemptions and does not apply to all securities that participate in Spanish stock markets.

The respective Spanish STT has to be issued by a Spanish entity which has a market capitalisation that is greater than EUR 1,000 million as of the 1st of December for the previous taxable year. Acquisitions of the shares must be traded on regulated markets, the location of the market is not considered, thus, shares traded on Spanish markets and foreign markets apply to the tax. The Spanish tax governors will publish a list of companies that exceed the said Euro 1,000 million before the 31st of December for each year. Acquisitions of specific interest of depositary receipt including ADRs and ADS are accounted for within the tax. However, the laws surrounding the tax highlight clear boundaries to which shares and scenarios are not within the scope of the tax. The acquisitions of shares that are targeted at the issuance of depositary receipts, the acquisition of depositary receipts that are used in the process of exchanging for the supply of Spanish shares and transactions which are made to cancel depositary receipts are all situations in which the law of the STT is not applicable and is thus understood to be out of scope from the law. The tax also does not apply to all and provides a clear outline of those who are not out of the boundaries of the tax and thus do not have t comply with paying the tax. The numerous exemptions and scenarios in which one does not pay such a tax are summarised below. In the case of the primary market, the issuance of shares, Initial Public offerings (IPOs), instrumental acquisitions, and stabilisation agreements are all examples of where the tax cannot, currently, be enforced. For the secondary market, an acquisition from the purchase (or loan) transaction by central counterparties (CCP), a liquidity agreement and acquisitions that are executed during the faze in which marking activities take place are all examples of which a STT cannot be performed in secondary markets. The tax is also unable to reach other areas in the financial markets that are not considered to be a part of the primary and secondary markets. Intragroup transactions, restructured transactions, securities financing, collateral transactions and resolution measures are further areas of the financial field in which the tax fails to reach.

4. Research Design

4.1 The Data set and Sample.

Our sample will consist of all the stocks that are included in the IBEX 35. The IBEX 35 stocks will be analysed in depth over 12 months, 6 months before the tax was introduced and 6 months after the tax was introduced (16-Jun-2020 – 16-Jan-2021 & 16-Jan-2021 – 16-Jun-2021). Our analysis has been limited to 6 months before the introduction of the tax and 6 months after the tax to limit the impacts of other taxes on our sample that may have also been made valid during this period. The data I have collected is daily data, therefore the panel is made up of 254 days, and 35 firms. This generates total observations to reach 8890 (254*35). The treatment group that is considered within this study is the German index DAX 30. This group will be analysed over the same 12-month period as the IBEX 35.

4.2 Methodology – The Difference in Differences approach

The employment of the Difference in Differences approach has become a revolutionary tool within empirical research for social sciences for observing the impact of crucial events and changes that take place. Imbens and Wooldridge (2008) present a simple breakdown of the DiD approach. They explore the outcome of an event for two different groups in two different periods. The groups are split into a control group and a treatment group. For those members in the control group, they are not exposed to the considered event, these members are usually those who are measured to be participating in the first period (T1), where the event or change in any laws, for example, is yet to take place. On the other hand, the treatment group, in most cases, coincides with the second period (T2). This is a point in time where participants are exposed to any changing factors in their environment that may change action and behaviour. The two groups are then compared and contrasted, concerning their points in time, to conclude how a new event, such as a new tax, has affected the participants. This use of the DiD approach as an analysis tool allows for the opportunity for an event to be explored in greater detail. This method can be further implemented into a panel set-up where many groups (controlled and treated) can exist and be examined over multiple events. As a result, this allows robustness checks of our model to take place to further support and solidify our econometric findings.

To explore the possible impact of the STT on the market quality parameters, which in this study will be market liquidity and market volatility, we will employ the following regression equation as our econometric framework:

$$V_{it} = \alpha_0 + \alpha_1 D_i + \alpha_2 D_t + \alpha 3STT_{it} + \epsilon_{it};$$

V_{it} represents the measure of market liquidity or market volatility of a firm at a specific time, t. D_i portrays the firm dummy variable and D_t acts as the dummy variable for a time within this model. The D_i dummy associates the value 1 if the data is considered the treatment group and 0 if the data is thought to be the control. The previous line of logic follows the dummy variable for a time, this enables the observation to follow any changes that take place from before the tax was imposed and after the tax was imposed. The coefficient within this regression that is of most significance is the α3 coefficient.

The anatomy of the tax enables the DiD methodology to work well in this case of observation. As the tax is only applicable to certain firms (firms with a market capitalisation of over EUR 1,000 million), we can construct valid control and treatment groups. The dummy variable that regards time encapsulates all other external changes that take place and impact the control and treatment group at the time of the STT being introduced. If financial markets were to experience a large shock event, such as a sudden financial crisis, the time dummy variable will capture this event within our study. Firm dummy variables capture constant differences between enterprises throughout time. As a result, before the STT, the DiD technique allowed for disparities in market behaviour between large and small enterprises to be considered. However, the DiD methodology assumes parrel trends, thus, the model claims that such differences in trends will remain constant if the tax was not imposed. This can be considered to be an unrealistic assumption as the trend growth rates between a large Spanish firm, to which the tax is likely to be applicable, and a smaller Spanish firm, to which the tax is likely not to be set are likely to have different variables that impact their growth rate trends.

We employ the German-based index DAX 30 as the control group and compare that to the IBEX 35, which is our treatment group. Both the DAX 30 and the IBEX 35 share financial qualities which represent both indexes to be identical in nature. The DAX 30 and the IBEX 35 share a 3 months correlation of 0.78, this demonstrates a highly positive correlation between the two indices and further highlights the similarity in movements in their markets, regarding their rates of return. The DAX 30 currently trades at approximately -0.06 of potential returns per risk while the DAX index has a score of -0.09, this demonstrates that the two indexes have similar risk associations. Spain and Germany are within the European boundary and are therefore within a close distance to one another. Consequently, they both share a high level of dependency on the performance of European markets. In addition, the close geographical distance between the two economies possibly highlights the similarity in culture and behaviour. Traders from both economies are likely to share a similar tolerance to such economic events and thus react similarly. The high level of similarity between the two groups that are being assessed allows for the impact of the tax to be made evident. If the two groups were drastically different, comparing the results of the DiD regression from each country would not be reasonable.

The high level of similarity between the two indexes contributes to greater reliability in the interpretation of our empirical results. As both the control group and the treatment group almost mirrored each other within financial markets pre the imposition of the Spanish STT, the impact of the tax post the tax will be able to stand out greater. This will allow us to isolate the impacts of the tax on the Spanish financial market and analyse the true effects this left on market liquidity and market volatility.

To create an observation which is reliable within the process of comparing, we split our sample into two subsample periods, T1 and T2. This method of subsampling sanctions the ability for us to assign the impact of the STT to the considered market quality parameters of liquidity and volatility. We have recognised that there is a possibility that our control group, the DAX 30, could be polluted with biasness. To avoid such a scenario from taking place in our investigation, we provide the outcomes before the tax and after the tax.

4.3 The Methods for measuring Market Liquidity and Market Volatility

4.3.1 Market Liquidity

The notion of market liquidity is very complex. There are multiple methods to calculate the liquidity of a market, a set method is not established therefore we come across other studies of liquidity that implement different methods of calculation. Diaz and Escribano (2020) explore the role of liquidity in financial markets and the authors of the review express those measurements of liquidity are complex in nature; they are mostly unique to each set of scenarios; there is no concrete understanding within the field of economics to determine what exact calculations determine liquidity.

Previous studies of liquidity, in general, adopt a similar approach. The activity levels of traders in the market, the cost of the said transaction and measures that affect price are those which a considered. In this study, we will employ variables that reflect such aspects of the liquidity of the financial markets for our control groups and treatment groups.

First, to observe liquidity, we will concentrate on the traded volume of a share and multiply that by the closing price for each trading day. This will generate a trading value.

- The Trading Value ($V_{i,t}$) = the number of shares traded on each trading day i on day t * the closing price ($P_{i,t}$) of each trading day.

The second area of consideration in this study when analysing liquidity is the turnover ratio. The turnover ratio is generated through the percentage turnover rate for each given day.

- The Turnover Ratio (T_{it}) = the % change in the given turnover ratio in the considered data.

The final variable which we consider in our study is the liquidity ratio. To apply the liquidity ratio to our analysis, we adopt the inverse of Amihud's illiquidity ratio, $V_{i,t}/|R_{i,t}$. The number of shares traded for a particular stock (i) on a given day (t) is represented by the Vi,t component of the ratio. The absolute stock return for stock (i) on day (t) is |Ri,t|. For a 1 per cent price fluctuation, the liquidity ratio is represented in millions and multiplied by 10^5 (Wu, C.H. and Wang, T.Y., 2020).

- AMIHUD, = 1/ |r | /VOLUME – The inverse illiquidity ratio

4.3.2 Market volatility

Much like the concept of market liquidity, market volatility is an area of study which has no set methods of measurement. It provides multi-faceted views on which methods to adopt when observing volatility. However, within the majority of studies, volatility is considered as the standard deviation of the given prices for each trading day, t.

Previous studies of volatility in general, adopt a similar approach. The return levels of each trade per day, how each stock varies in price per day and the distance between that the highest price and the lowest price per day are all areas of exploration which is considered in our study of volatility. In our revision of market volatility, we assert different variables that capture and highlight the volatility of our control group and volatility group to the best of our ability

Our first area of concern is the absolute return rate for each stock. This is calculated by applying the 'ABS' (absolute) function on Microsoft excel. To further create a coherent calculation of absolute return, the closing price and opening price of each stock per day are applied to the excel function.

- Absolute return (excel function) = 'ABS(Closing price/Open – 1)'

The second variable we evaluate in our attempt to get a clear picture of volatility is conditional variance, which we calculate using the GARCH 1.1 approach. The ARCH (1) model is expanded with the GARCH (1.1) model. The ARCH model depicts the variation over a certain period. However, the magnitudes of the squared mistakes in previous q periods determine this. The ARCH (1) model investigates a model's mean and variance at the same time. Whereas the GARCH model imposes a geometric lag structure, therefore, the model contains a lagged term of the conditional variance. This method was generated by Bollerslev (1989) to resolve the issue surrounding negative estimates. The GARCH method is used within social sciences to forecast the possible rates of volatility that may take place as a result of previous prices.

- Conditional variance – proxied by the GARCH (1.1) model. The results of the conditional variance were generated through solving for squared lagged residual on excel by using past rates of return as a contributing variable within calculations.

The final metric we apply to our model to understand market volatility is the high to low range figure. Parkinson (1980) demonstrates that the price range is a superior volatility estimator to alternatives like the return-based estimator. Traders in financial markets use it regularly in technical analysis and to determine the range distance between prices in stock markets. Scenarios in which a stock has a large high to low range value is understood to represent qualities that portray high volatility.

- High to low range = Highest price of stock (i) at time (t).

5. Empirical Results

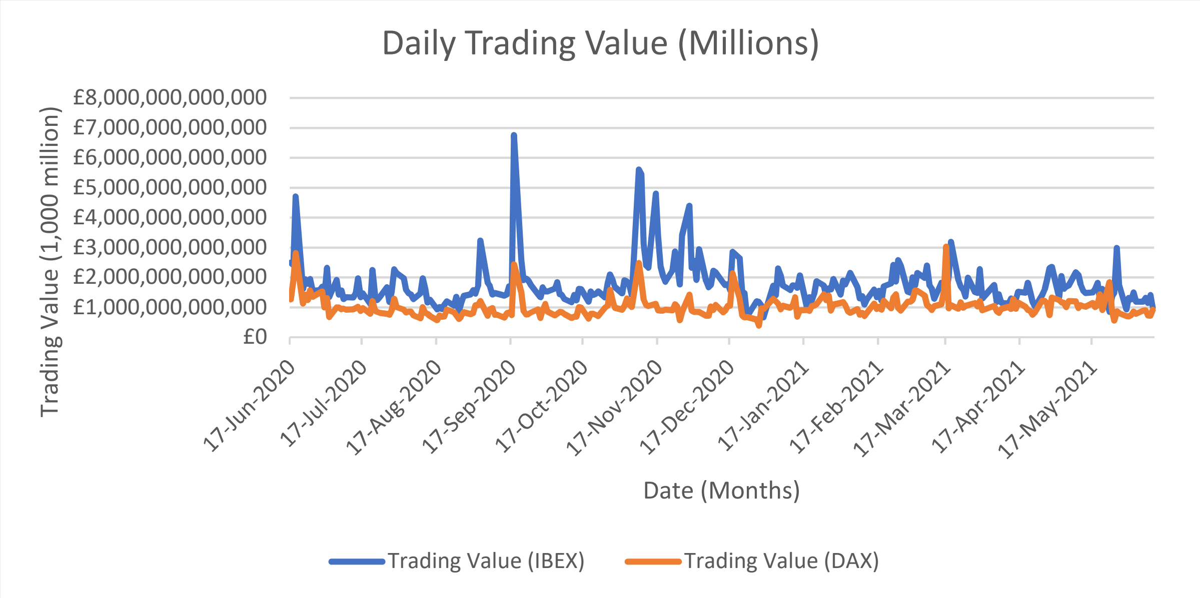
5.1 Graphical analysis

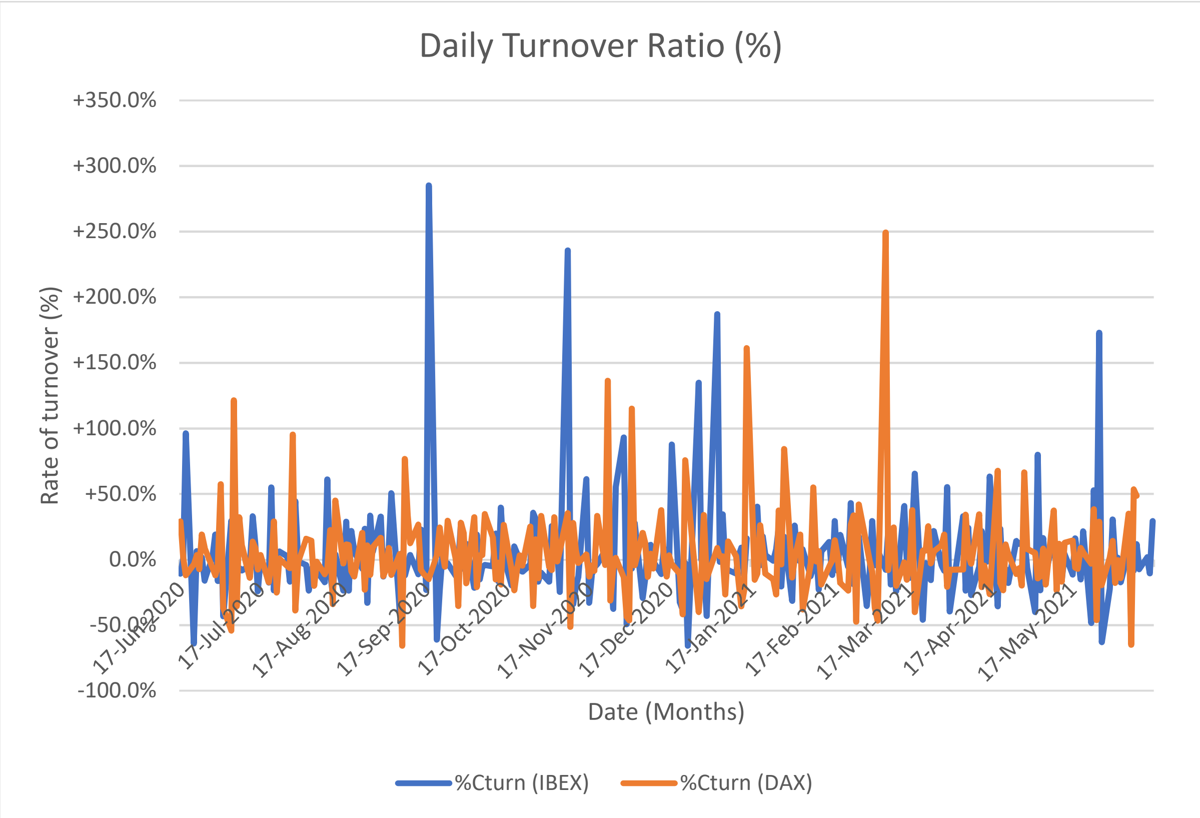
The following subsection represents the graphical trend of each variable which we consider a metric for liquidity and volatility. The graphs provide the visual impact that the STT had on the trends and patterns of our measurements.

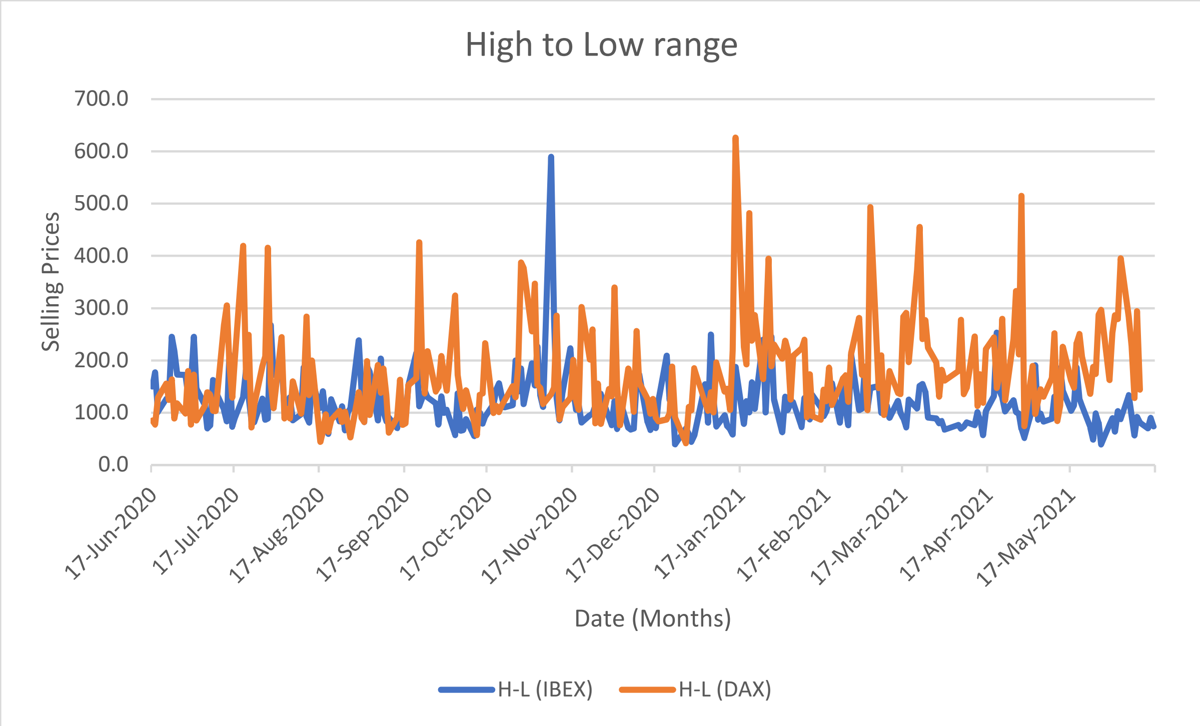
The overall pattern of the results of the trading value, turnover ratio and liquidity ratio is made evident in the graphs below (Figure 1). The graphs portray the difference between the control group of the DAX 30 and IBEX 35, in addition, the diagram emphasises the pre-and post-difference of implementing the tax on the varying groups. For the market liquidity measure of trading value, to an extent, there is a mirrored trend throughout the data as a similar pattern is obeyed throughout the time series. The IBEX 35 index peaks in September 2020, at 700 thousand million, which is ironically before the introduction of the tax. The turnover ratio trend exhibits aggressive fluctuations throughout the series, generally, the fluctuations are bounded between -50% and 100% on average. Before the introduction of the tax, in September 2020, the most visible difference in the rate of returns was made evident, as the IBEX 35 saw the rate of turnover reach 270% whilst the DAX saw a low rate of 10%

turnover rate. However, some outliers exist, the most potent being during March 2021. During this period, the STT had been introduced, and whilst the German index, which is the control group, experience rates of turnover of approximately 250%, the Spanish index experienced negative rates of turnover. The liquidity ratio trend portrays a more consistent reaction to the tax compared to the other variables of measurements for liquidity. While other variables display a reaction to the tax, visually, we observe the constant fluctuation throughout the time series for the liquidity ratio. Although, on the 17th of February 2021, the IBEX 35 index demonstrates a liquidity ratio rate of 0.001% following the introduction of the STT.

The behaviour of the metrics that determine volatility in our model is presented in the graphs below (Figure 1). Much like the metrics for liquidity, the graphs signify the change in the trend of the DAX 30 and the IBEX 35 from six months before the STT was put into action and six months after. Figure 1 provides the absolute return in percentage form of the IBEX 35 and the DAX index across the duration series. Generally, the series unveiled mild fluctuations throughout. The lowest absolute return observed came from the IBEX measure, this was a rate of return of -8%, in around November 2020. This graph in figure 1 also illustrates the high to low range. The IBEX 35 peaked before the imposable of the tax, this being mid-November 2020 at approximately 600. Contrastingly, the Dax index peaked after the tax, this being at around mid-January 2021 at approximately 630. The conditional variance, estimated through the GARCH (1,1) model, depicts a stable trend for both groups of consideration. Nevertheless, an outlier in the trend is made evident in the IBEX index, where conditional variance hit a remarkable 3.5%. This peak period of the conditional variance for the IBEX stocks was also shadowed by the DAX 30 as the German-based index also hit a new peak in the time series. Interestingly, both peak periods only occurred momentarily as, by the following month, the variance of prices settle to a regular and sustainable level. This high variance in the price of both indexes may illustrate the traits of a volatile market, this may have been used as a supporting argument to support such an introduction of a tax to financial markets.






High to Low range
Selling Prices
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
17-Jun-2020
17-Jul-2020
17-Aug-2020
17-Sep-2020
17-Oct-2020
17-Nov-2020
17-Dec-2020
17-Jan-2021
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17-May-2021
Date (Months)
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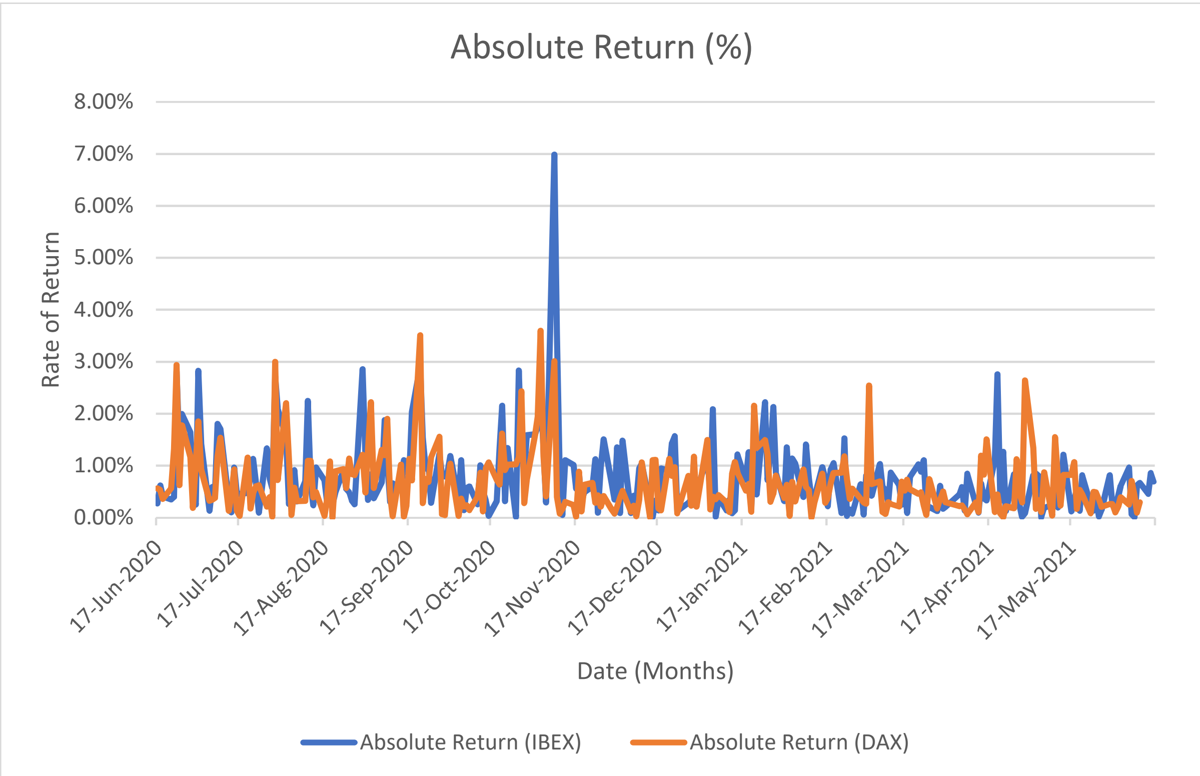
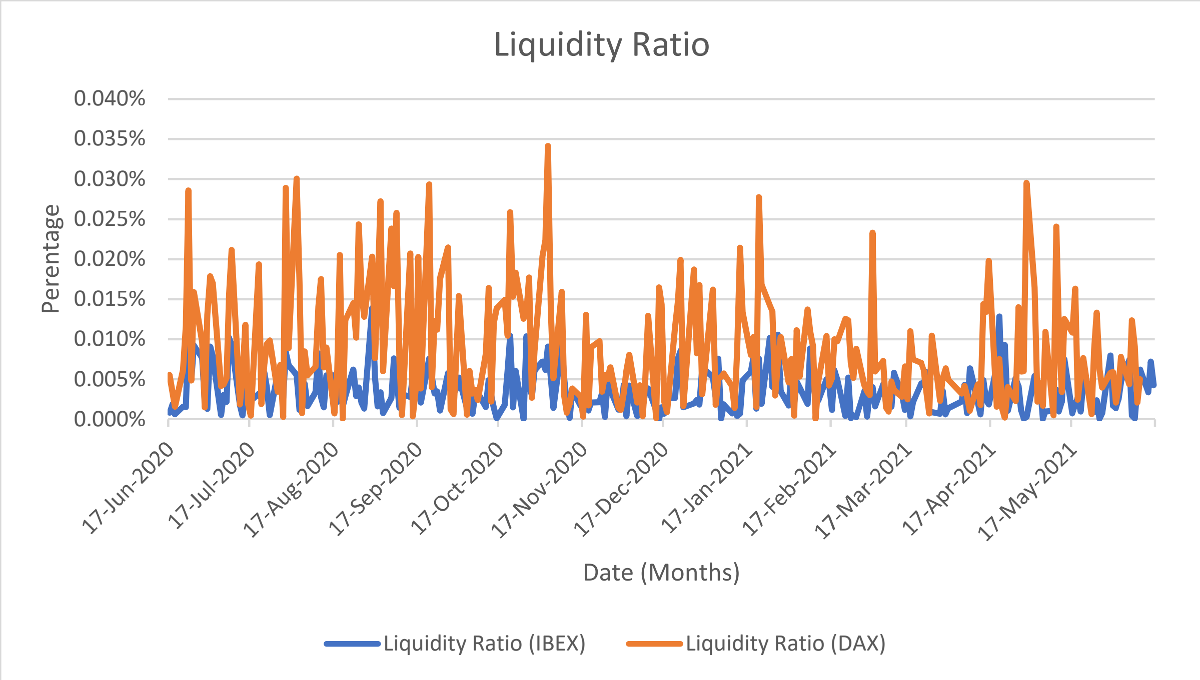
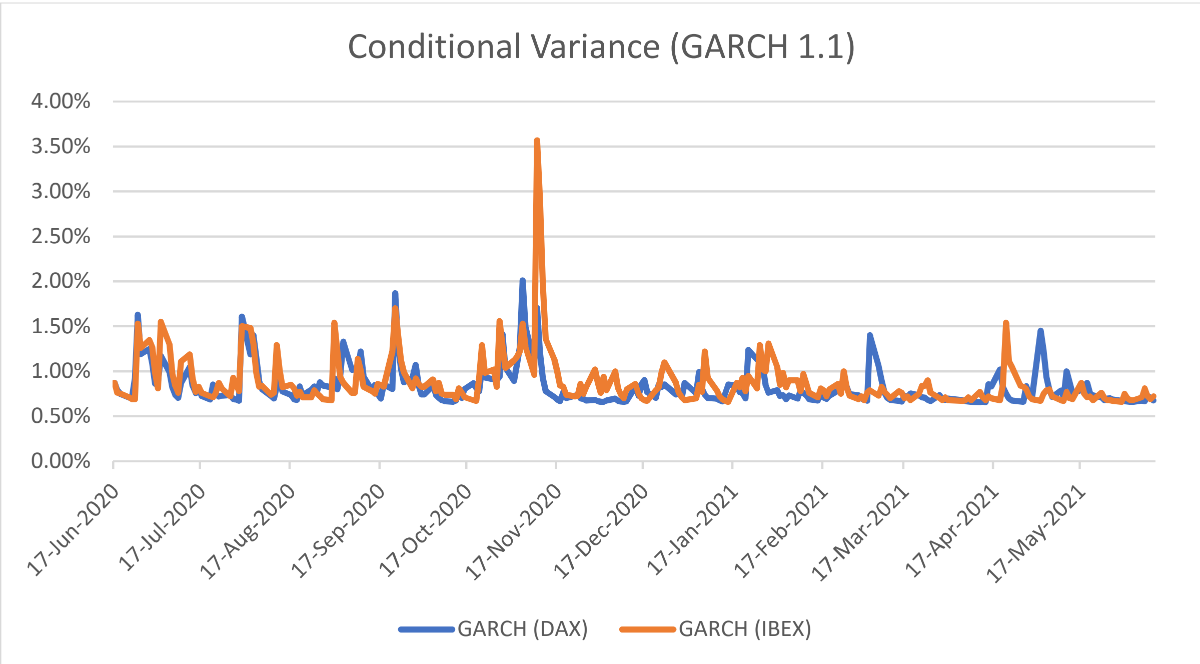
H-L (DAX)


Absolute Return (%)
Rate of Return
8.00%
7.00%
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
17-Jun-2020
17-Jul-2020
17-Aug-2020
17-Sep-2020
17-Oct-2020
17-Nov-2020
17-Dec-2020
17-Jan-2021
17-Feb-2021
17-Mar-2021
17-Apr-2021
17-May-2021
Date (Months)
Absolute Return (IBEX)
Absolute Return (DAX)





(Figure 1 – Diagram representation of each variable for market liquidity and market volatility)

5.2 Results of the DiD Estimation

The results of the DiD estimations are shown in table A below. The scores for the DAX 30 index are present in the first column. The treatment group (IBEX 35) results are considered in column 2 of the table. The findings reveal that the STT has caused a decline in the trading value and the turnover ratio of equities exposed to the STT when compared to control groups. In all subsamples, the coefficients are statistically significant. According to the coefficients in column 1, the overall trade value has decreased by 20 per cent (due to having a coefficient of 0.282. We also see a negative impact in terms of the number of shares exchanged, as indicated by the turnover ratio, however, the results are not significant when comparing the two groups.

The fact that the tax has left trading activity to decline is the expected outcome from those who are for the STT. However, the area which sparks the most interest is whether the tax has deterred those traders who are said to pollute the market with noise and naivety, and, if this was the case, what impact did this leave on the costs of trading and the overall strength of financial markets. There is no strong indication that the imposition of the tax left a statistically significant influence on the liquidity ratio. Insofar as the market's ability to trade huge amounts without altering the price has not changed, we can conclude that the STT did not affect market liquidity.

The rate of volatility is estimated next through the use of the metrics absolute returns, conditional variance and the high to low range. Regardless of the sample size or measure of volatility, we cannot rule out the possibility that the STT does not affect market volatility. The results of the DiD estimations do not provide enough suitable evidence to claim the tax on transactions has led to a rise in volatility rates in the IBEX 35 index. In addition, our data do not support the alternative hypothesis that the tax deters naïve traders away from financial markets drives away mostly. Both impacts of the tax most likely work simultaneously; the STT has to lead to those who are deemed to be knowledgeable in making financial trades to deter from the market whilst, in addition, influencing the more naïve traders away. The lack of participation in entering these financial markets may be a result of the high transaction costs. Instead, traders may prefer to trade in other markets in which the rules and regulations surrounding the tax on securities are less strict.

Model	***Control Group***	***Treatment group***
Sample	DAX 30	IBEX 35
Trading Value		
STT	-0.226	-0.02126
Adj. R^2	0.948	0.846
Turnover Ratio		
STT	-0.186	-0.1289
Adj. R^2	0.282	0.489
Liquidity Ratio		
STT	1.68	-1.491
Adj. R^2	0.177	0.092
Absolute Return		
STT	-0.0179	-0.038
Adj. R^2	0.27	0.211
Conditional Variance		
STT	0.0459	0.039
Adj. R^2	0.392	0.531
H-L Range		
STT	0	0
Adj. R^2	0.141	0.129

(Table A)

6. Robustness check

To ensure our results are robust are reliable, we apply the propensity score matching method.

The average causal impact on the Spanish Index is explored through this method. The coefficients of the metrics for market liquidity and market volatility are shown in the table below. The propensity score matching method engages in a procedure to locate with the highest level of accuracy possible the most matching score that is similar to the control group. Within this model, the coefficient which is of most significance is the trading value. Then, the most significant coefficients in the model are liquidity, volatility and then turnover ratio. As anticipated, our coefficient results in statistical significance. Furthermore, the coefficients are also positive in their respective signs.

The technique 'nearest-neighbour matching' technique is deployed to create the results of our model that do not fall for any other matching methods that are highly varied. Within the propensity score matching method, altercations in the data to suit bias are not needed as the method pairs covariates that are single continuous. Nevertheless, the nearest-neighbour matching method applies a correction term when considering multiple continuous covariates that facilitate scenarios in which bias takes place and thus allows the method to avoid such bias considerations. The amount of matches that can take place is capped at two. Furthermore, we engage the Mahalanobis distance as the term which is biased in correction in both the market value and the correction term. The previous statistical significance order that was regarded in the prior table is not followed for table B.

The impact on our control group is shown in section B of table B. The value of our coefficient for the trading value, turnover ratio and liquidity in our model of evaluation demonstrate results of negatively significant estimators. This suggests that the value of each market quality parameter has declined since the implementation of the tax. However, volatility displays a coefficient which holds a positive estimate. This suggests that volatility has increased following the tax.

A major risk of the existing tax may be that volume of traders who participate in Spanish financial markets may move their investments to foreign stock markets where arbitrage opportunities are of a higher opportunity to attain. This is what precisely took place with the Swedish securities transaction tax example. However, the tax imposed on the Swedish market was introduced so that every equity asset traded in Sweden made through domestic brokerage firms, was made to be within the law of the tax. If traders undertook certain actions, the tax was very avoidable, therefore, the Swedish STT was not very effective in reducing noise traders and market volatility. The Spanish STT, on the other hand, is assigned to all those who are liable for the tax (the market allocation is not considered). As a result, we should not observe any significant altercations in the size of the market share for Spanish stocks during the entirety, with all things being equal, of the tax.

Variable	*Treatment Sample*		*Control Sample*	
Market quality measures	PSM	NNM	PSM	NNM
Trading Value	0.329	0.198	-0.255	-0.143
Turnover Ratio	0.067	0.148	-0.491	-0.568
Liquidity Ratio	0.428	0.269	-0.367	-0.179
Absolute Returns	0.091	0.042	-0.346	-0.255
Conditional Variance	0.411	0.032	0.032	-0.026
H-L Range	0.232	0.521	-0.542	-0.045

(Table B)

7. Discussion and limitations

7.1 Discussion of Related Work

Many other studies also adopt a DiD approach to follow the concerns of other STT's. Saporta and Kan (1997) compare the shares of UK firms that were deemed liable to pay the given transaction tax with the analogous American Depository Receipts to examine variations in the UK stamp duty from 1955 to 1996. (ADRs). Although this method of DiD is appealing, it is limited as it is forced to only examine the influence on market volumes due to the close correlation between stock and ADR prices due to arbitrage. Furthermore, the limited size of their control group, which comprises only four ADRs, reduces the credibility of their findings. Liu (2007) uses similar tests to explore STT change in Japan in 1989. Liu concludes that his control group of Japanese ADRs experienced a drastic decline.

Much like our study, Foucault et al. (2011) also employs the DiD method to examine a stock market reform in France that eliminates the ability to trade highly liquid stocks with end-of-month settlement and as a result, leads to the rise of the cost of speculative trading for retail investors, they are considered to be the 'noise' traders in financial markets. This change in the tax system is comparable to the implementation of a STT. The authors use difference-in-difference methods and demonstrate the spot market as the control group to signify the new addition of the tax has resulted in the volatility levels of the stock to reduce at a rapid rate.

7.2 Are the results of our observation too general?

On Spanish equities, the STT rate is 0.2 per cent. When compared to the UK stamp duty rate of 0.5 per cent or the previous Swedish STT of 2 per cent, this rate of tax is regarded as being considerably low. As the correlations between the variables are most likely nonlinear in nature, there is no consistent way to induce this result in a higher tax rate. However, it is important to note that the Swedish STT had little to no effect on volatility.

8. Concluding remarks

The impact of the Spanish securities transaction tax on the market quality parameters of market liquidity and market volatility is assessed in this study. This is the main topic of the area which is questioned and argued in the economic policy debates regarding whether or not the use of financial transaction taxes slows down the rate of speculative activity in the economy and therefore allows a financial market that epitomizes stability and reliability. This stability in financial markets is much desired by investors as it optimizes the likelihood to increase their rates of returns on their investments in these markets. Those who oppose the tax, on the other hand, claim that taxing financial transactions will lead to a decline in market liquidity, which may in turn increase volatility.

The influence of the STT's implementation in Spain on the 21st of January 2021 on market liquidity and volatility is examined in this article. As the STT is only applicable to the large Spanish companies with a high market capitalization value, we have a control group of the DAX 30, a German-based stock index may, which facilitates the utilization of a difference-in-difference approach. Our findings demonstrate that the STT has decreased stock levels.

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