The Impact of Financial Transaction Taxes on Stock Markets:

Timing, Heterogeneity, and Migration

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Abstract: We focus on the impact of the French 2012 financial transaction tax (FTT) on trading volumes and volatility. We extend the empirical research by identifying FTT announcement and short-run treatment effects, which can distort difference-in-differences estimates. We also consider long-run volatility measures that better fit the French FTT's legislative design, the heterogeneity of market reactions and the migration of trading volumes to potential substitute stocks. While we find a strong short-term impact on trading volume (announcement effects and short-run effects), the long-run treatment effect is much weaker and only significant for less liquid stocks not participating at the Supplemental Liquidity Provision program of NYSE Euronext. We further find a significant reduction of long-term volatility measures after the FTT effective date as evidence for a market-stabilizing effect, and a significant increase in the trading volume of potential substitute stocks traded at NYSE Euronext as evidence for a migration of trading volumes.

Keywords: Financial transaction tax, market quality, announcement effect, short-run treatment effect

JEL Classification: G02; G12; H24; M41

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1. Introduction

Due to the financial crisis of 2008–2009, the sovereign debt crisis in European countries and the latest efforts of a group of European Union member states to introduce a financial transaction tax (FTT), interest in the impact of such taxes on market quality and stability has increased significantly (e.g., (e.g., Hemmelgarn and Nicodème, 2010; Shackelford et al., 2010; Pomeranets and Weaver, 2013; Becchetti et al., 2014; Coelho, 2016). There are two main arguments for the introduction of an FTT. First, legislators intend to generate tax revenue. Significant tax payments to be achieved with only a low tax rate (Shackelford et al., 2010), low administrative costs, and minor distortion of the real economy (Hemmelgarn and Nicodème, 2010) have been noted as benefits of such a type of tax. As a second argument, proponents claim an enhancement of the stability of financial markets. Since FTT payments represent a significant portion of the returns that can be realized by short-term speculation, it has been argued that such a tax will reduce speculative noise trading and enhance financial stability (Stiglitz, 1989; Summers and Summers, 1989).

On the contrary, FTT opponents have seriously criticized such a form of taxation as ineffective and inefficient (e.g., Schwert and Seguin, 1993; Umlauf, 1993; Jones and Seguin, 1997; Aliber et al., 2003; Baltagi et al., 2006). A main argument is a high tax elasticity of financial investments. Therefore, introducing an FTT in one market would result in the migration of trading activity to either untaxed assets and/or to tax-free markets. Consequently, one should expect a strong reduction in the trading volume of the taxed assets. Thus, in spite of low tax rates, there might be a significant distortion of investment activities and the allocation of capital. In addition, FTT opponents claim that such a tax might harm liquidity and the pricing mechanism, which could lead to an increase in volatility.

Since there is no theoretical consensus on the impact of an FTT, the empirical analysis of FTT effects on stock markets is an important research topic. While a number of papers cover FTT

regulations in Asian markets and Italy (e.g., Liu and Zhu, 2009; Deng et al., 2014; Capelle-Blancard, 2015), the majority of recent papers focus on the introduction of an FTT on August 1, 2012, for French-headquartered stocks with a market capitalization of more than €1 billion (e.g., Becchetti et al., 2014; Meyer et al., 2015; Coelho, 2016; Gomber et al., 2016; Colliard and Hoffmann, 2017). While research regarding the impact of the French FTT on liquidity, volatility, and stock prices is not fully conclusive (for a review of the literature see Burman et al., 2016), a main finding is a strong reduction of trading volume. Estimates suggest a reduction of trading volumes after the FTT introduction date ranging from 10% to 30%. Such a strong decrease in trading volumes might be induced by a migration of trading activities.

We address these issues empirically and extend the research in four aspects. Previous studies interpret the French FTT as a natural experiment and estimate its impact by a difference-in-differences (DiD) estimation. Thus, they compare trading volumes and other related variables (stock prices, volatilities) before and after the FTT introduction deadline. We focus more on the dynamic pattern of the tax reform.[1] We find evidence of announcement effects and short-run treatment effects that differ from the long-run impact of the French FTT on the French stock market and therefore bias estimates of long-run treatment effects. Since the French National Assembly passed the FTT legislation on March 14, 2012, investors had an incentive to antedate transactions of taxable stocks (large-capitalization stocks of the French stock market) to avoid FTT payments. Thus, we expect a positive FTT announcement effect that temporarily increases trading volumes between March 14, 2012, and July 31, 2012 (the FTT announcement period before the introduction date). We further distinguish between short-run and long-run treatment effects and show that short-run market reactions are not necessarily a good predictor of long-

[1] We are not aware of any research interpreting the impact of FTT tax reforms in a dynamic setting as ours does. Colliard and Hoffmann (2017) discuss potential anticipation effects as part of their appendix but find no corresponding evidence. They also account for market anomalies in August 2012 but do not interpret them as short-run treatment effects. Coelho (2016) discusses anticipation effects. However, due to the author's short observation window of three weeks before and after the French FTT introduction deadline, no announcement effects or short-run treatment effects could be identified.

run effects. We expect a strong negative short-term treatment effect on trading volumes as a consequence of the positive announcement effect (antedating of trading activities) and legal uncertainty shortly after the FTT introduction deadline.

We pay more attention to the design of the French FTT and provide evidence that an FTT with similar legal settings could contribute to a market's financial stability. The French FTT encompasses a considerable number of regulations to avoid or at least mitigate a negative impact on liquidity. For example, the tax is limited to the most liquid large-cap stocks (market capitalization of more than €1 billion) and a significant number of trading activities are tax exempt (e.g., market making, clearinghouses, primary market acquisitions, securities financing transactions). Due to intraday netting, pure day trading is not taxed by the French FTT. This has two important implications. First, the French FTT provides an incentive for day trading (i.e., the opening and closing of positions on the same day), which might even increase trading activity for some investors (i.e., investors that open and close positions on two consecutive trading days). Second, since pure day trading is not taxable, the impact of the tax on intraday volatility measures might be small, while there could be a relevant impact on long-term volatility measures. Thus, we focus on long-term volatility. We further add to the empirical research on the heterogeneity of market reactions considering market capitalization and participation in the Supplemental Liquidity Provision program of NYSE Euronext (SLP stocks) as well to the literature on the migration of trading volumes to non-treated substitute stocks traded at the same trading place.

In preliminary tests ignoring announcement and short-run treatment effects, we are able to replicate findings suggesting a strong reduction in trading volume after the introduction date of the FTT in August 2012. However, corresponding evidence becomes widely insignificant if we control for announcement effects and short-run treatment effects. While we find a strong positive FTT announcement effect and a negative short-run treatment effect on the trading

volumes of treated stocks, there is only a significant long-run treatment effect for the (less liquid) stocks not participating in the SLP program. Our findings suggest that evidence of a strong reduction in average trading volume resulting from the French FTT (e.g., Becchetti et al., 2014; Meyer et al., 2015) is due to temporary market reactions.

Regarding stock market volatility, we find a reduction in weekly and monthly volatilities in the short-run and long-run treatment periods. These findings fit well with the theories of Stiglitz (1989) and Summers and Summers (1989), who predict a stabilizing effect of FTTs on stock markets. Our heterogeneity tests suggest that the SLP program of NYSE Euronext "protected" participating stocks from economically significant negative consequences on trading volume, while market capitalization itself does not seem to be as the relevant factor. Thus, very liquid markets seem to provide an opportunity to governments to raise transaction costs in the form FTTs. Nevertheless, we also observe significantly lower trading volumes for the less liquid non-SLP stocks and an increase of trading volumes of potential Dutch and Luxembourg substitute stocks treated at the same market (NYSE Euronext). In an earlier version of this paper (Eichfelder et al., 2017), we also analyzed FTT impact on prices, daily returns and bid-ask spreads without finding clear empirical evidence (similar to the existing literature).

Our findings provide three important implications for tax policy and tax research. First, our results suggest that the French FTT might be "better" than its reputation. We find only a small and barely significant long-run reduction in average trading volume, while there is a positive and significant impact on average long-run volatility measures. Second, our evidence implies that the design of an FTT is important and should have strong implications for the stock market effects of such a tax. In addition, market design is relevant as well. Thus, we find significant treatment effects on long-term but not on short-term volatility measures as well as a high relevance for the SLP program of NYSE Euronext on FTT impact. From this perspective, national governments may benefit from cost-efficient markets by an introduction of FTTs.

Third, from a methodological perspective, we can show that the assessment of the full dynamic structure of a tax reform or another important event might be relevant to identify its long-run impact. Our evidence further suggests that small capitalization stocks (violation of the common trends assumption) and close substitutes of stocks (violation of the stable unit of treatments assumption SUTVA) are no appropriate control group in a difference-in-differences specification of trading volumes, volatilities and related market indicators of large-capitalization stocks.

We structure the paper as follows. Section 2 presents a brief overview of the French FTT regulations introduced in 2012. Section 3 discusses the theoretical background regarding the announcement effects, short-run treatment effects, and long-run treatment effects of the 2012 French FTT reform and develops our hypotheses. We describe the identification strategy and data in Section 4. Section 5 provides the empirical results and Section 6 concludes the paper.

2. The 2012 French FTT

On January 29, 2012, the media informed the French public that President Sarkozy was planning the introduction of an FTT. In January and February, the media published further information on the FTT, reporting an intended rate of 0.1% for stock transactions. As announced by February 6, 2012, the FTT should only apply to the transactions of stocks of French-headquartered companies with a market capitalization of more than €1 billion on January 1, 2012. Thus, only the shares of the most liquid French stocks should be taxed by the French FTT. The reform further included an FTT on high-frequency trading and an FTT on the transactions of sovereign credit swaps (both with a much lower rate of 0.01%). These additional FTTs generated very little tax revenue and are not considered in the following, since they are of minor relevance to our analysis of stock market reactions.

The first reading of Tax Bill No. 2012-354 was on February 16. The French National Assembly finally passed the bill on March 14, 2012. Therefore, since the middle of March 2012, the

introduction of an FTT on French large-capitalization stocks on the first of August was a foreseeable event. Market efficiency suggests that this event was anticipated by the market participants in the announcement period. Following the presidential elections in May, the new President Hollande announced an increase of the FTT rate on stock transactions from 0.1% to 0.2% on June 26, 2012. The National Assembly agreed to the doubling of the FTT rate on July 31, one day before the FTT introduction date. While investment service providers (e.g., banks) are liable for the tax payment, the tax burden shall be on institutional and private investors. The final guidelines of the FTT were released on August 2, 2012.

Compared to FTTs analyzed by previous research, the French FTT has a number of unique properties that should prevent a decline in liquidity and a migration of transactions to other markets (PriceWaterhouseCoopers, 2012; Haferkorn and Zimmermann, 2013). These characteristics are important for understanding the FTT impact on the French stock market. The French tax applies to the acquisition of securities that provide access to capital and voting rights in the issuing company. Since December 2012, cross-listings as well as European depositary receipts (EDRs) and American depositary receipts (ADRs) are also taxed by the French FTT. Therefore, a simple migration of stock trading to other markets was only a potential strategy to avoid FTT payments in the first four months after the introduction date. Considering that the French FTT provided other ways of avoiding tax payments (e.g., day trading, see below) as well as the costs of migration strategies (e.g., higher trading costs and lower liquidity of ADRs), migration was likewise not the best tax avoidance strategy. Since the French FTT has been limited to stocks with a minimum market capitalization of more than €1 billion, the stocks of smaller companies in terms of total capitalization should not have been affected directly by the tax.

Corresponding to the rules of the French FTT, a taxable transaction requires a change in the ownership of a security between two trading days. Therefore, pure day trading (the buying and

selling of a stock on the same trading day) is not taxed by the French FTT (intraday netting). While this might mitigate the impact of the French FTT on liquidity provision and trading volume, it also provides a simple way of avoiding FTT payments by opening and closing positions on the same trading day. The bill further included a number of tax exemptions to avoid cascading effects and ensure liquidity provision, including 1) primary market transactions (e.g., mergers, IPOs), 2) intragroup transactions, restructuring transactions, and employee saving schemes, 3) market making, clearinghouses, and similar special trading activities relevant to liquidity provision (central securities depositories), 4) transactions performed under liquidity agreements, 5) exchangeable/convertible bonds, and 6) temporary transfers of securities.

Corresponding exemptions highlight the rigorous commitment of the French legislature to protect liquidity provision. In addition, this extensive list of tax exemptions leaves room for tax avoidance strategies. For example, the temporary transfer of securities provides a wide scope for short-term speculation actions (e.g., lending schemes, sale and repurchase agreements). Regarding the taxation of derivatives, the scope of the French FTT was and is clearly limited. Apart from credit default swaps on sovereign debt, derivatives are not taxed by the French FTT. Since derivatives can be used as substitutes of stocks for short-term speculation, this again highlights the wide range of tax avoidance opportunities of the French FTT. Figure 1 illustrates the process of the French FTT reform.

[Figure 1 about here]

The French government initially expected to raise €1.5 billion in tax revenue per year. The realized tax revenue, based on Organisation for Economic Co-operation and Development data, amounts to €700 million to €800 million (about 50% of the expected revenue). This lower deviation might be driven by a reduction of trading volume (e.g., a migration to other markets), but also by tax avoidance practices resulting in tax-exempt trades. For example, extending tax-

exempt day-trading activities would result in a loss of tax revenue and might even increase trading volume.

3. Theory and Hypotheses

For the derivation of hypotheses, we build on the existing theoretical and empirical literature (for a review see Matheson, 2011; Burman et al., 2016). In line with standard economic theory (e.g., Stiglitz, 1989; Schwert and Seguin, 1993), a considerable number of studies provide evidence of a negative effect of FTTs on trading volumes, since the expected return of short-time trading strategies will be reduced by tax payments.

As documented in Section 2, the French FTT was announced before its introduction on August 1, 2012. Market efficiency suggests that foreseeable future events are anticipated by stock markets (Fama, 1970). Therefore, we expect an impact of the FTT announcement on treated stocks. We focus on March 14, 2012, as the official announcement date, when the French National Assembly passed the legislation in a second reading and interpret the time span between March 14 and July 31, 2012 as FTT announcement period. Since that date, the French FTT was a foreseeable event for French and international investors.[2]

Blouin et al. (2002) and Dhaliwal and Li (2016) provide evidence that shareholders' personal tax incentives affect the timing of stock trades and trading volumes. In addition, economic research in a variety of settings suggests that taxpayers adjust the timing of real transactions as a reaction to tax burdens and investment tax incentives (e.g., House and Shapiro, 2008). As the FTT increased the effective price of a stock, it generated a strong incentive to antedate transactions from the period after the announcement date (i.e., taxed trades) into the

[2] While the French FTT had already been declared by President Sarkozy on January 29, 2012, the detailed regulations were still unspecified at that time. Since corresponding regulations are important for our identification strategy (especially with regard to the limitation of the treatment group to stocks with a minimum market capitalization of €1 billion), we decided to focus on the date the French National Assembly passed the law. We note that investors had sufficient time to shift trading activities from the treatment period (since August 1, 2012) to the announcement period (from March 14, 2012, to July 31, 2012) after the second reading of the FTT legislation.

announcement period. Considering these aspects, we expect a shifting of trading volume from the period shortly after the introduction of the FTT (short-run treatment period) into the announcement period suggesting a positive announcement effect and a negative short-run treatment effect on trading volume.

H1a. *The announcement of the French FTT resulted in a temporary increase of trading volumes in the announcement period and a (strong) short-run decrease of trading volumes shortly after the introduction date for taxable stocks.*

Regarding the long-run impact of FTTs, standard theory suggests a reduction in trading volume. In case of the French FTT, a confounding factor stems from the effective tax exemption of day trading. Since pure day trading is not regarded as taxable, intensifying day trading activities (i.e., opening and closing positions on the same day) may provide an effective strategy to avoid FTT payments if such a behavior is consistent with the overall strategy of the investor. In addition, the French FTT provided a number of additional tax exemptions (e.g., market making) and alternative ways for tax avoidance. As we focus on the average impact on trading activity, we nevertheless follow the literature (e.g., Matheson, 2014; Meyer et al., 2015) and hypothesize a long-run reduction of trading volume. Considering tax design, we expect this long-run effect to be smaller than the short-run impact.

H1b. *The introduction of the French FTT on August 1, 2012, resulted in a (weak) long-run reduction of trading volumes for taxable stocks.*

Regarding FTT impact on stock market volatility, the theoretical literature considers two opposing effects. As argued by Tobin (1978) or Stiglitz (1989), an FTT reduces the incentive for destabilizing short-term speculation based on investor's beliefs instead of fundamental market information (so-called noise trading; Hemmelgarn and Nicodème, 2010; Dávila, 2016). This change in the composition between noise traders and fundamental traders reduces stock market volatility (composition effect). In contrast to this traditional view, Schwert and Seguin

(1993) or Jones and Seguin (1997) bring forward the argument that risk-seeking noise traders might be an important counterparty for hedging strategies and thus provide valuable liquidity to the market. If an FTT drives out noise traders, it becomes harder to find a counterparty for risky transactions, which decreases liquidity and increases volatility (liquidity effect; e.g., Schwert and Seguin, 1993; Hau, 2006; Becchetti et al., 2014).

Theoretically, the impact of an FTT on volatility depends on the relative strength of both effects. If the composition effect dominates the liquidity effect, an FTT will reduce volatility and vice versa (Song and Zhang, 2005; Deng et al., 2014). As discussed in Section 2, the French FTT incorporates a significant number of characteristics to avoid distortion of liquidity and the pricing mechanism. In line with that argumentation, there is a only weak empirical evidence for an impact of the French FTT on liquidity measures like bid-ask spreads (e.g., Becchetti et al., 2014; Meyer et al., 2015; Colliard and Hoffmann, 2017; Gomber et al., 2016). Therefore, we follow the traditional view and hypothesize a negative impact of the French FTT volatility.

H2. *The introduction of the French FTT resulted in a short-run and long-run reduction of the volatility of taxable stocks.*

While intraday volatility measures have been widely used in FTT research (e.g., Capelle-Blancard and Havrylchyk, 2013; Becchetti et al., 2014; Gomber et al., 2016), they do not account for the volatility of prices between trading days. Since pure day trading is not a taxable event for the French FTT, the appropriateness of such intraday measures for the identification of the French FTT's impact on volatility is debatable. One may further raise the question on the relevance of such intraday volatility measures with regard to long-run financial stability. Therefore, we consider intraday volatility as well as two long-term volatility measures (weekly volatility and monthly volatility) for our empirical analyses.

We also address the heterogeneity of FTT impact. The design of the French FTT intends to protect liquidity by a concentration on French stocks with a minimum market capitalization of

€ 1 billion with a weak expected liquidity effect. In our paper, we test if and how the impact of the French FTT on trading volumes and liquidity is related to market capitalization. Following the intentions of the French legislator, we expect that trading volumes of large capitalization stocks with a high liquidity are more robust to FTT effects, while stocks with a smaller market capitalization are more strongly affected.

H3a. *The effect of the French FTT on treated French stocks decreases in the market capitalization of stocks.*

Extending the work of Colliard and Hoffmann (2017), we further test the relevance of the Supplemental Liquidity Provider programme on European blue chips (SLP) of NYSE Euronext on FTT impact. On April 1, 2011 NYSE Euronext launched a program to incentivize supplemental liquidity providers with a financial rebate when they post liquidity that executes against incoming orders (i.e., passive trades) (NYSE Euronext, 2012). Thus, in addition to regular market marking activities the program intended to increase liquidity and to reduce transaction costs for grouped baskets of shares. Colliard and Hoffmann (2017) provide evidence for stronger FTT impact on stocks that did not participate in the SLP program. However, as SLP stocks are typically blue chips and therefore larger than non-SLP stocks, this might in part be due to market capitalization. In addition, Colliard and Hoffmann, do not account for a different timing of FTT effects. Thus, accounting for H3a, we further test H3b.

H3b. *The effect of the French FTT on treated French stocks is smaller for stocks participating in the SLP program.*

Theory suggests a migration of trading volume from treated stocks to untreated substitutes. However, identification of such migration effects is difficult as it remains unclear what relevant substitutes are and therefore empirical evidence on that issue is scarce (Matheson, 2011; Burman et al., 2016). We deal with that issue by considering existing research of Colliard and Hoffmann (2017). The authors argue that especially non-French large capitalization stocks

traded at NYSE Euronext form a natural control group, as the microstructural environment, including trading protocol, the tick size regime, and the fee structure of this group are most similar to the group of treated stocks. In detail, they rely on 32 Dutch and Luxembourg large capitalization stocks traded at NYSE Euronext and Euronext's Universal Trading Platform (UTP) as main control group.[3]

Considering the high degree of similarity between treatment group and control group as well as the low cost of transferring trading volumes within a given market place, one might argue as well that Dutch and Luxembourg large-capitalization stocks form a good proxy for substitute stocks being subject to a migration of trading activity. In this alternative view, the close link between treated stocks and non-treated substitute stocks promotes an above average migration of trading volumes that allows for an identification of "migrated" trading volume. In other words, there is an indirect treatment effect of the French FTT on the substitute stocks resulting in a positive shock of trading volume in any period after FTT announcement. As a result, SUTVA would violated and substitute stocks would not be well suited as a control group.

Therefore, we test the hypothesis if the announcement of the French FTT in March 2012 and its introduction in August 2012 resulted in an increase of the trading volume of Dutch and Luxembourg large capitalization stocks that we regard as close substitutes to the treated French stocks. An important aspect is that the number of treated French stocks (in our sample 108) is large compared to the number of control stocks (in our sample 30 stocks). Therefore, migration effects for substitute stocks might be larger in magnitude than for the treated stocks.

4. *The announcement and the introduction of the French FTT resulted in an increase in trading volume of substitute Dutch and Luxembourg large-capitalization stocks treated at NYSE Euronext.*

[3] In additional tests (e.g., heterogeneity tests), they further include 30 French and 17 non-French small capitalization stocks as part of their control group.

4. Identification Strategy and Data

4.1. Identification Strategy

The most relevant identification strategy of the literature on the market impact of FTTs is the interpretation of tax reforms as natural experiments. This holds especially for the recent introduction of the French FTT in 2012 (e.g., Capelle-Blancard and Havrylchyk, 2013; Becchetti et al., 2014; Coelho, 2016; Colliard and Hoffmann, 2017; Gomber et al., 2016). Note that the French FTT refers exclusively to French-based (headquartered in France) stocks with a minimum market capitalization of €1 billion. The existing literature relies on two types of control groups: a) the large-capitalization stocks of European control markets (e.g., the German DAX) and b) nontaxable French stocks with a market capitalization of less than €1 billion.

Important requirements for such an identification strategy are the common trends assumption and the stable unit of treatments assumption (SUTVA). The common trends assumption demands that the underlying trend of trading volumes and other market indicators of the treatment group should be very close to that of the control group. Testing co-movements between both groups graphically (see Section 5.1), we find strong long-run correlations with the treatment group for a control group of German and UK large-capitalization stocks (listed on the German CDAX and the London Stock Exchange, with a minimum market capitalization of €1 billion in January 1, 2012), but not for French small-capitalization stocks. Hence, we rely on comparisons between the treatment group and a panel of German and UK large-capitalization stocks with a common trend in the pre-announcement period.

The selection of a well-suited control group is not sufficient to ensure the identification of long-run FTT effects in our setting. As mentioned before, stock trading of the French market in the pre-reform period (before August 1, 2012) may have been affected by the announcement of the French FTT on March 14, 2012. Since corresponding announcement effects imply an increase in trading volumes (Hypothesis 1a), the common trends assumption will be violated in this case

and DiD estimation will lead to an overestimation of the FTT effect on trading volume. The same consideration holds for strong short-run market reactions resulting from an antedating of trades from the post-reform period to the pre-reform period (tax-induced bring-forward effect). Thus, short-run market reactions do not seem to be a good indicator for the long-run impact of the French FTT and might lead to inconsistent estimates.

To account for FTT announcement and short-run FTT effects, we consider two alternative approaches. As a preliminary step, we perform a simple DiD estimation to replicate the result of the literature suggesting a strong reduction in trading volume (e.g., Becchetti et al., 2014). Within this estimation, we consider a pre-announcement period of four months and treatment periods of two, four, and eight months. This preliminary model with the logarithm of the daily trading volume (measured in thousands units of traded stocks) as the dependent variable, can be written as

$$Trading\ Volume_{it} = \alpha + \beta_1 \cdot TPeriod_t + \beta_2 \cdot DiD_{it} + \gamma_k \cdot C_{kit} + \psi_t + \upsilon_i + u_{it}, \quad (1)$$

where $TPeriod_t$ is a dummy variable with a value of one for observations of stock i at time t after July 31, 2012 (treatment period) and DiD_{it} is an interaction term of $TPeriod_t$ and a dummy variable for French large-capitalization stocks subject to the 2012 FTT. Since we consider stock fixed effects υ_i, there is no need to account for a dummy variable for treated French stocks. The term C_{kit} is a vector of k control variables, including the daily price-to-book ratio in percentage points (*PTB Ratio*), the logarithm of daily market capitalization in millions of euros (*MC*), and the logarithm of the current year earnings before interest, taxes, depreciation, and amortization in thousands of euros (*EBITDA*). We further include month fixed effects ψ_t to control for stock market seasonality and an error term u_{it}.

We assume that the results of Equation (1) might be distorted by announcement effects and short-run treatment effects. Therefore, we re-estimate the model but exclude observations from

the announcement period as well as observations shortly after the introduction date (short-run treatment period). As suggested by our graphical analysis (see Section 5.1), we consider a short-run treatment period of one month. Therefore, we compare a pre-announcement period of four months (November 14, 2011 until March 14, 2012) with a long-run treatment period after initial short-run market reactions of two, four or eight months

$$Trading\ Volume_{it} = \alpha + \beta_1 \cdot LTPeriod_t + \beta_2 \cdot LDiD_{it} + \gamma_k \cdot C_{kit} + \psi_t + \upsilon_i + u_{it}, \quad (2)$$

with $LTPeriod_t$ as a dummy variable for stock-day observations after August 31, 2012, and $LDiD_{it}$ (an interaction term of $LTPeriod_t$ with a dummy for treated stocks) as a measure for the long-run FTT effect.

A disadvantage of Equation (2) is that it does not provide an estimate for short-run treatment or announcement effects. Therefore, we extend our analysis by including observations from four periods: a) the pre-announcement period, b) the announcement period, c) the short-run treatment period, and d) the long-run treatment period. We use the pre-announcement period as a reference point and include dummy variables and DiD interaction terms for the three other periods. Thus, we estimate

$$\begin{aligned} Y_{it} = {} & \alpha + \beta_1 \cdot ADiD_t + \beta_2 \cdot SDiD_{it} + \beta_4 \cdot LDiD_{it} \\ & \beta_3 \cdot APeriod_t + \beta_5 \cdot STPeriod_t + \beta_6 \cdot LTPeriod_t + \gamma_k \cdot C_{kit} + \psi_t + \upsilon_i + u_{it}. \end{aligned} \quad (3)$$

$APeriod_t$, $STPeriod_t$, and $LTPeriod_t$ are dummy variables for the announcement period (March 14 to July 31, 2012), the short-run treatment period (August 1 to 31, 2012) and long-run treatment periods of two, four, or eight months after August 31, 2012. $ADiD_{it}$, $SDiD_{it}$ and $LDiD_{it}$ are the DiD interaction terms of $APeriod_t$, $STPeriod_t$, and $LTPeriod_t$ with a dummy variable for treated firms and identify the corresponding announcement and treatment effects.

We use measures for trading volume and volatility as the dependent variables Y_{it}. In robustness tests (see Eichfelder et al., 2017), we also analyzed measures for stock prices and liquidity (bid-

ask spread). The variable *Trading volume* is defined the same way as in Equations (1) and (2) (the logarithm of 1,000 traded stock units per day and stock). We use three simple alternative measures for the daily, weekly, and monthly volatility of each stock. As the daily measure we use the relative intraday volatility, defined as the difference between the highest and the lowest execution price per day, divided by the closing price $\left(=\left(Highest\ price_{it} - Lowest\ price_{it}\right)/Price_{it}\right)$. As the long-term weekly (monthly) volatility measure, we use the standard deviation of the closing prices in euros over one week (month) divided by the average of closing prices that week (month) $\left(Relative\ weekly/monthly\ volatility = STD\left(Price_{it}\right)/Mean\left(Price_{it}\right)\right)$.

For our tests of H3a and H3b, we further add statistical indicators on stock heterogeneity. We consider a dummy variable for stocks being part of the SLP program in 2012 (*SLP*) and the logarithm of daily market capitalization in millions of euros (*MC*). We interact these variables with our difference-in-differences indicators in order to identify heterogeneous announcement effects, short-run treatment effects and long-run treatment effects for different types of stocks. Considering the heterogeneity indicators H (either *SLP* or/and *MC*), we can rewrite the generalized model as

$$\begin{aligned} Y_{it} = {} & \alpha + \beta_1 \cdot ADiD \times H_{it} + \beta_2 \cdot SDiD \times H_{it} + \beta_3 \cdot LDiD \times H_{it} \\ & + \beta_4 \cdot ADiD_{it} + \beta_5 \cdot SDiD_{it} + \beta_6 \cdot LDiD_{it} \\ & + \beta_7 \cdot APeriod_t + \beta_8 \cdot STPeriod_t + \beta_9 \cdot LTPeriod_t \\ & + \beta_{10} \cdot APeriod \times H_{it} + \beta_{11} \cdot STPeriod \times H_{it} + \beta_{12} \cdot LTPeriod \times H_{it} \\ & + \gamma_k \cdot C_{kit} + \psi_t + \upsilon_i + u_{it}. \end{aligned} \tag{4}$$

We may abstain from controlling for the heterogeneity measure H as such. *MC* is already included in the control vector C_{kit} and *SLP* is captured by our firm fixed effects. Nevertheless, we account for interaction terms of both variables with our treatment period variables *APeriod*, *STPeriod*, and *LTPeriod*. We identify the relevance of heterogeneity for the causal impact of the FTT reform by the interaction terms $ADiD \times H$, $SDiD \times H$ and $LDiD \times H$.

To identify migrated trading volume to substitute stocks, we re-estimate Equation (3) with UK and German large capitalization stocks as control group (as in the previous regressions) and the Dutch and Luxembourg stocks as treatment group. Thus, to identify migration effects claimed by H4, we rely on a group of stocks that the existing literature regards as very similar to the treatment group (Colliard and Hoffmann, 2017), and which therefore might be a good candidate for substitute stocks. A benefit for our analysis is that the aggregate trading volume of these substitute stocks is much smaller than the aggregate trading volume of the treated French stocks. As a result, a relatively small withdrawal of trades from the French treated stocks might induce large exogenous variation in trading volumes of substitute stocks.

4.2. Data

Following most papers (e.g., Becchetti et al., 2014; Meyer et al., 2015; Colliard and Hoffmann, 2017; Gomber et al., 2016), our analysis is based on data from regulated lit markets. Colliard and Hoffmann (2013) and to some extent Coelho (2016) also consider data from OTC, dark pools, and other non-regulated trading venues. Taking into account that the analyzed French stock market (the Paris Stock Exchange, part of NYSE Euronext) is one of the biggest in Europe, we select the two other largest Western European stock markets as the control group, namely, those of the United Kingdom (the London Stock Exchange) and Germany (the Frankfurt Stock Exchange).

This can be justified as follows: 1) London and Frankfurt are geographically close to the French trade center, Paris, and are economically and politically closely related to France. 2) The London Stock Exchange is a leading trading place affecting other European stock markets. 3) No major tax reforms were implemented in the control group during the relevant period. 4) While prices and trading volumes in London and Frankfurt are related to those in Paris, the stocks of our control group are no perfect substitutes for French stocks (e.g., cross-listings, ADRs, or EDRs). This is a benefit because it limits the risk of our control group being affected

by the French FTT regulation (e.g., by a migration of trading volumes). For example, considering the typically low trading volumes of ADRs, the French FTT might largely increase trading in ADRs in relative terms, which would lead to a violation of SUTVA and inconsistent DiD estimates. Such concerns also hold for the group of substitute stocks that we use to test H4 suggesting a migration of trading volumes (Luxembourg and Dutch stocks traded at NYSE Euronext). In our case, problems with SUTVA are very unlikely, since the aggregate trading volume of our control group (London and Frankfurt) is much higher than that in Paris. 5) Our graphical analysis provides strong evidence of a common trend for the relevant dependent variables (i.e., trading volumes, volatilities) between our treatment and control groups in the period before the FTT announcement.

For our tests of a migration of trading volumes to substitute stocks (H4), we further consider a panel of Luxembourg and Dutch stocks with a minimum market capitalization of € 1 billion treated at NYSE Euronext that we consider as potential substitutes for the treated French stocks. While Colliard and Hoffmann (2017) rely on these stocks as control group and argue that these stocks are similar with regard to the market place and stock characteristics to treated stocks, this argument can also be used to hypothesize a migration of trading volumes of the treated French stocks to the untreated Luxembourg and Dutch stocks.

We collect stock market and financial statement information using the Datastream database of Thomson Reuters. While information on trading volumes and stock prices (including closing prices, highest and lowest prices) are available on a daily basis, financial statement data are available at an annual level. We use information on all relevant stocks for four periods: 1) The pre-announcement period considers the four months before the announcement of FTT (from November 14, 2011 until March 14, 2012). 2) The announcement period ranges from March 14, 2012, to July 31, 2012. The period after FTT introduction is divided into 3) a short-run treatment period (August 1 to August 31, 2012) and 4) a long-run treatment period of two, four,

or eight months beginning at September 1, 2012. We adjust the raw data in two ways: 1) We exclude all observations with missing information on trading volumes, prices, or control variables and 2) we do not consider observations with a negative book value.[4] Our final data are an unbalanced panel ranging from November 14, 2011 to either October 31, 2012 (long-run treatment period of two months), December 31, 2012 (long-run treatment period of four months), or April 30, 2013 (long-run treatment period of four months).

In Table 1, we provide descriptive statistics for long-run treatment periods of two months (eight months) with 25,165 (37,779) observations of French stocks, 69,429 (102,876) observations of German and UK control stocks, and 7,189 (10,730) observations of Luxembourg and Dutch substitute stocks. Thus, for each observation of a treated French stock, we have about 2.7 observations in the control group and about 0.3 observations in the substitute group. Considering SUTVA, exogenous shocks resulting from a migration of trading volumes might be much stronger for the (small) substitute group compared to the large control group.

[Table 1 about here]

Compared to the treatment group, average trading volumes (i.e., the number of traded shares per day) are higher in the control group and the substitute group. In case of the control group, this is due to the high trading volumes in London. Regarding the substitute group, the relatively low share prices suggest a higher turnover measured by the number of traded shares. For daily returns, we find no relevant differences between the control group and the treatment group, while there are higher average returns and a much higher standard deviation of returns for the substitute stocks. In general terms, differences in means (e.g. different average trading volumes), are no problem for our analysis, since time-invariant differences in means are

[4] We exclude these observations, since the trading of the securities of loss firms and especially bankrupt firms might be affected by specific and untypical capital market reactions.

captured by stock fixed effects. Graphical evidence in the pre-announcement period suggests a strong co-movement of trading volumes between treatment and control group (Section 5.1.).

Descriptive statistics of the various volatility measures (relative intraday volatility, relative weekly volatility, relative monthly volatility), and market capitalization are very close to each other in all three groups. Compared to the treatment group, average EBITDA values are somewhat higher in the group of substitute stocks. While the median price-to-book ratio is similar for all three groups, we find a very high mean price-to-book ratio for the control group. This is due to a small number of UK stocks with very high price-to-book ratios. Again, we control for such differences in average characteristics by stock fixed effects in our regressions.

5. Results

5.1. Graphical Evidence

For our graphical analysis, we calculate the weekly mean values of the logarithm of trading volumes (in thousands of units of traded stocks) and our other dependent variables for the treatment group and the control group. A main target of this analysis is to determine if our data meet the common trends assumption for both groups (French large-capitalization stocks with a minimum market capitalization of at least €1 billion on January 1, 2012; German and UK large-capitalization stocks). Our observation period includes a pre-announcement period of four months, the announcement period (March 14, 2012, to July 31, 2012), the short-run treatment period, and a long-run treatment period of four months. We also provide graphical evidence for French small-capitalization stocks as a potential alternative control group.

To account for the fact that the average levels of trading volume and other market indicators differ between stocks and markets, we de-mean all variables with their average value over the whole observation period for each stock. For example, we subtract the mean of *Trading volume* for each stock over the whole period from the current value of *Trading volume* for all observations. De-meaning seems to be useful to address whether trends (and not means) differ

between the control group and the treatment group. Note that constant differences in mean values are captured by the stock fixed effects of our regression models and do not affect our regression results. Thus, de-meaning fits our regression approach well.

Figures 2 and 3 show graphical evidence for de-meaned *Trading volume* (the logarithm of thousands of units of traded stocks) of the treatment group in comparison to the control group (Figure 2) or in comparison to French small-capitalization stocks (Figure 3). We center the observation period and define the reference point (week 0) as the week when the French FTT was introduced. Boundaries between the announcement period, the short-run treatment period, and the long-run treatment period are marked by vertical lines. The announcement period ranges from week -20 to week 0 and the short-run treatment period from week 1 to week 4.

While we find strong co-movement between French stocks and the control group, French small-capitalization stocks do not seem to be appropriate as an alternative control group with regard to the common trends assumption. The graphical evidence of Figure 2 supports H1a and H1b. Thus, we observe abnormally high trading volumes of the treated stocks in the announcement period and abnormally low trading volumes of treated stocks in the short-run treatment period. In the longer perspective (after week 4), we do not observe large differences in trading volumes for the treatment group and the control group.

[Figure 2 about here]

[Figure 3 about here]

Figure 4 documents graphical evidence for the relative intraday volatility and the relative weekly volatility. We abstain from providing evidence for the non-appropriate French small-capitalization stocks as well as for monthly volatilities, which do not fit a weekly illustration well. We mostly observe strong co-movement of both groups in the pre-announcement period and conclude that German and UK stocks with a minimum market capitalization of €1 billion

should be a well-suited control group for our analysis. Confirming H2, graphical evidence suggests abnormally low volatilities of the treatment group in the treatment period.

[Figure 4 about here]

Figure 5 reports graphical evidence for trading volumes of the group of substitute stocks compared to the group of control stocks. While we find a strong co-movement of trading volumes of both groups in the pre-announcement period (before March 14, 2012), there is graphical evidence for a significant increase in average trading volumes of the substitute stocks in the announcement period, the long-run treatment period and especially shortly before and after the introduction date of the French FTT. Such graphical evidence is consistent with the expectation that a migration of trading activities from the French stocks to the Dutch and Luxembourg substitute stocks resulted in an exogenous shock in trading volumes of these stocks. Thus, graphical evidence supports H4.

5.2. Short-run and Long-run Effects on Trading Volume and Volatility

We present the regression results for distorted and non-distorted long-run treatment effects (Equations (1) and (2), respectively) on trading volume as well as for long-run treatment effects, short-run treatment effects, and announcement effects (Equation (3)). Note that the literature provides by far the strongest empirical evidence for the impact of the French FTT on trading volume (e.g., Capelle-Blancard and Havrylchyk, 2013; Becchetti et al., 2014; Coelho, 2016).

We execute regressions by OLS and use robust standard errors clustered for each stock to account for heteroscedasticity and the autocorrelation of standard errors. As documented by Petersen (2009), these clustered (Rogers) standard errors produce correct estimates and correctly sized confidence intervals in the presence of cross-sectional (stock effects) and time-series (time effects) correlations of standard errors and are more accurate than Fama-MacBeth estimates in the presence of stock effects. We report the adjusted *R*-squared values considering the explanatory power of the stock fixed effects. Regression coefficients for trading volumes

can be interpreted as semi-elasticities. Thus, we recalculate coefficients for our DiD dummy variables to determine the relative effect on trading volume by $\exp\left(\hat{\beta}_i - 1/2 \cdot Var\left(\hat{\beta}_i\right)\right) - 1$. The estimated regression coefficient is $\hat{\beta}_i$ and the variance $Var\left(\hat{\beta}_i\right)$ is the squared estimated standard error of $\hat{\beta}_i$ (see also Kennedy, 1981).

[Table 2 about here]

As a preliminary step, we estimate Equation (1) for treatment periods of two, four, and eight months after the FTT introduction date to replicate the literature and provide results in the Models 1 to 3 of Table 2. These "naïve" models do not account for announcement and short-run treatment effects and suggest a strong and significant reduction in trading volume resulting from the introduction of the French FTT. FTT impact is larger for shorter treatment periods and ranges from a reduction of 11.8% (Model 3 for a treatment period of eight months after August 1, 2012) to a reduction of 16.9% (Model 1 for a corresponding period of two months). This is somewhat smaller than most estimates (e.g., Becchetti et al., 2014; Meyer et al., 2015; Gomber et al., 2016) but fits well with the fact that most papers focus on even shorter observation periods of one to six months, which are more strongly affected by short-term treatment effects (for corresponding evidence, see Models 7 to 9). Thus, we are able to replicate previous findings if we do not account for announcement and short-run treatment effects.

In Models 4 to 6 we estimate Equation (2) excluding observations of the announcement period and the short-run treatment period. Thus, our estimates for *LDiD* (long-run treatment effect) rely on a comparison of observations before March 14, 2012, and after August 31, 2012. Results change dramatically. As expected, we obtain negative coefficients. However, the estimated FTT impact is very small and not significantly different from zero in any specification. This supports our expectation that existing estimates of long-run treatment effects depend largely on temporary announcement and short-run treatment effects.

In Models 7 to 9 of Table 2 we estimate the impact of the French FTT by Equation (3) for long-run treatment periods of two, four and eight months. Thus, we explicitly identify the announcement effect and the short-run treatment effect on trading volume with the additional DiD interaction terms *ADiD* and *SDiD* for the announcement period (March 14, 2012 to July 31, 2012) and the short-run treatment period (August 1 to 31, 2012). Confirming H1a, we find positive and significant announcement effects and negative and significant short-run treatment effects. Similar to our Models 4 to 6, coefficients of long-run treatment effects *LDiD* are negative but not significantly different from zero. Estimates for announcement effects range from an increase of trading volume of 5.2% to 6.3%, while estimates for short-run treatment effects suggest a reduction of trading volume in August 2012 by 16.4% to 17.3%. Overall, our findings suggest that the French FTT resulted in strong short-run stock market reactions anticipating the introduction of the FTT, while estimates for average long-run treatment effects are not statistically different from zero. Our results suggest that previous findings of a strong reduction in trading volumes by up to 30% result from short-term market reactions around the introduction date of the French FTT and not from lasting long-term changes in trading volume.

In Table 3, we estimate Equation (3) considering announcement effects and short-run treatment effects with our different volatility measures as dependent variables. Thus, we estimate the impact of the French FTT on intraday volatility, weekly volatility and monthly volatility. As discussed before, we expect a stronger impact on the long-run volatility measures as day-trading is not taxed by the French FTT. In the Models 1 to 3 we report regression results for our difference-in-differences interaction terms *ADiD*, *SDiD*, and *LDiD* with relative intraday volatility as dependent variable. In the Models 4 to 6 (7 to 9) we report corresponding results if we use relative weekly (monthly) volatility as dependent variable.

[Table 3 about here]

Confirming the existing literature (e.g., Meyer et al., 2015; Gomber et al., 2016; Colliard and Hoffmann, 2017), we find no significant empirical evidence for a long-run reduction of intraday volatility. Results for announcement effects and short-run treatment effects for intraday volatility are contradictory with positive announcement effects and negative short-run treatment effects. A potential explanation might be that the FTT resulted in a positive shock in trading volume in the announcement period (higher volatility) and a negative shock in the short-run treatment period (lower volatility). Thus, effects on intraday volatility might result from exogenous variation in trading volumes, while the direct impact of the French FTT on intraday volatility might be small or even non-existent considering the tax-exemption for day trading.

Regression results for long-term volatility measures provide a clearly different picture. In these regressions, we observe consistently negative and statistically significant coefficient estimates for short-run and long-run-treatment effects. Regression coefficients can be interpreted as reduction of the volatility measure in percentage points. Considering average values of relative weekly and monthly volatilities in the treatment group (Table 1), we are able to calculate an estimate for the average reduction of volatility resulting from the French FTT. For weekly volatility, our results a long-run (short-run) reduction of volatility range from 7.7% to 13.1% (15.5% to 15.9%). For monthly volatility, the estimates are even higher with a long-run (short-run) reduction of average volatility of 12.7% to 17.1% (24.6% to 24.8%). Allover and confirming H2 as well as theoretical suggestions from Stiglitz (1989) and other authors, we find a economically and statistically significant reduction of long-run volatility measures of treated stocks after the introduction of the French FTT in comparison to our control group.

5.3. Heterogeneity of FTT Effects

Addressing the heterogeneity of stock market reactions for different types of stocks, we estimate Equation (4) with participation in the SLP program (*SLP*) and market capitalization (*MC*) as stock attributes. Again we account for the timing of market reactions and identify heterogeneous

reactions by the triple difference interaction terms (e.g., *ADiD* × *SLP*). In Models 1 to 3 (4 to 6) of Table 4, we focus on SLP participation (market capitalization), while Models 7 to 9 consider both aspects. In general terms, we observe stronger announcement effects for SLP stocks (Models 1 to 3) and large capitalization stocks (Models 4 to 6). However, controlling for both aspects, coefficients for heterogeneous announcement effects are neither significant for market capitalization nor for SLP participation. Thus, one should interpret this observation with caution.

[Table 4 about here]

By contrast and confirming H3b, we find much weaker short-run and long-run treatment effects for SLP stocks. In Models 1 to 3, we observe a statistically significant short-run and long-run reduction of trading volumes for non-SLP stocks (identified by *SDiD* and *LDID*) and the opposed effect for SLP stocks (identified by *SDiD* × *SLP* and *LDID* × *SLP*). This finding confirms H3b and suggests that participation in the SLP program seems to have "immunized" the participating stocks. Hence, trading volumes of participating SLP stocks remained widely unaffected by the introduction of the French FTT and trading volumes of non-SLP stocks decreased by 25.9% to 26.9% in the short-run and by 9.8% to 12.0% in the long-run. Thus, while we were not able to identify a significant average reduction in trading volume in Table 2, Table 4 reveals that only SLP stocks remained virtually unaffected by the French FTT. These heterogeneous reactions of SLP stocks remain significant in the Models 7 to 9.

Considering the market capitalization of stocks, we find contradictory evidence. In Models 4 to 6, we find weaker short-run treatment effects for large-capitalization stocks (positive coefficient estimates of *SDiD* × *MC*). However, if we also account for SLP participation (Models 7 to 9), there is some (weak) evidence for stronger long-run effects of the French FTT on trading volumes of large-capitalization stocks, which is not significant for a long-run treatment period of eight months. Allover, our evidence for market capitalization is contradictory and we cannot

confirm H3a suggesting a weaker impact of the French FTT on trading volumes of large capitalization stocks.

In Table 5, we report regression results for Equation (4) with volatility measures as dependent variables. Allover, the evidence in these regressions is weak and we do not find large significant heterogeneity in the impact of the French FTT on volatility. While announcement effects seem to be somewhat stronger for SLP stocks (especially for intraday volatilities), there is also (weak) evidence for smaller announcement effects of large capitalization stocks. For short-run and especially long-run effects, we find almost no significant regression coefficients. Thus, we abstain from interpreting that evidence in detail.

[Table 5 about here]

5.4. Migration of Trading Volume

To test H4 hypothesizing a migration of trading volumes to substitute stocks, we re-estimate Equations (2) and (3) with Dutch and Luxembourg large-capitalization stocks as treatment group and UK and German stocks as control group. Thus, we test if we find an exogenous shock in trading volumes of substitute stocks in comparison to our standard control group in the announcement period (after FTT announcement) and especially the short-run and long-run treatment periods (after the FTT effective date). We document regression results in Table 6.

In the first three rows (Models 1 to 3), we estimate the long-term treatment effect by a comparison of the long-term treatment period with observations in the pre-treatment period as specified by Equation (2). In Models 4 to 6, we estimate Equation (3) to identify announcement effects, short-run treatment effects and long-run treatment effects. We abstain from reporting "naïve" models not accounting for announcement and short-run treatment effects.

[Table 6 about here]

We find evidence for a significant exogenous increase in trading volumes of the Dutch and Luxembourg substitute stocks after the effective date of the French FTT 2012. Estimates for

the long-run effect range from an increase of trading volume of 10.0% to about 18.1%. This is a somewhat similar magnitude as our long-run estimate for the decrease in trading volumes of French non-SLP stocks (see Subsection 5.3). We also find evidence for positive and statistically significant short-term market reactions ranging from 7.0% to 7,3% (announcement effects), respectively 21.9% to 22.7% (short-run treatment effects). Overall evidence is consistent with our hypothesis that the French FTT 2012 resulted in an increase of trading activities of substitute stocks traded at the same market as the treated French large capitalization stocks.

5.5. Robustness checks

We estimated an extensive number of alternative specifications and cross checks to test the robustness of our findings. In the current version, we abstain from reporting the results of these tests to keep the paper concise, but we can provide results upon request. In addition, an earlier draft of this paper (Eichfelder et al., 2017) contains detailed information on robustness checks and alternative specifications.

Bertrand et al. (2004) argue and provide evidence that the standard errors of DiD estimates could be severely understated for serially correlated data. This holds especially for data with a high number of repeated observations, as in our case. Thus, significance might be due to the number of observations and not to the economic relevance of FTT effects. As a first robustness test, we re-estimate our models with collapsed data. As suggested by Bertrand et al. (2004), we calculate the collapsed average values for four periods: the pre-announcement period, the announcement period, the short-run treatment period, and a long-run treatment period. Corresponding results are consistent with our baseline estimates.

In a second robustness test, we use propensity score matching to increase the correlation between the treatment and the control group in the pre-announcement period. We define a matched control group (i.e., a subgroup of the full control sample) with especially strong co-movement in the pre-announcement period. Using pre-matched samples does not change our

baseline estimates significantly. In a third set of tests, we use a triple difference specification to account for seasonality effects. In these tests, we find somewhat weaker but still significant short-run treatment effects for trading volume.

Eichfelder et al. (2017) provide a detailed documentation on all these kinds of robustness tests. They also report regression results with other market indicators as dependent variables (like daily returns and bid-ask spreads). These additional specifications do not provide clear evidence that the French FTT affected bid-ask spreads or daily returns. In a last set of tests, we account for the impact of the French presidential and parliamentary elections in 2012 on trading volumes and volatilities of the treated French stocks that might lead to inconsistent estimates for our announcement effects. Excluding observations from the period before the French presidential or parliamentary elections (March 14, 2012 until June 17, 2012) does not significantly change our estimates for announcement effects. It turns out that estimated announcement effects do not result from these elections in 2012.

6. Conclusion

We analyze the impact of the 2012 French FTT on trading volumes and volatility. We contribute to the research in four ways. First, while the literature typically compares observations of treated and untreated stocks directly before and after the FTT's introduction date (August 1, 2012), we find evidence of temporary market reactions surrounding the FTT introduction date (FTT announcement effects, short-run treatment effects). Our findings suggest an antedating of trades that means abnormally high trades in the announcement period and abnormally low trades in the short-run treatment period. Simple DiD estimates ignoring such temporary effects may be biased due to a violation of the common trends assumption.

Second, the French FTT might have been more effective than its reputation and empirical studies (largely ignoring short-term market reactions) suggest. Estimates of the average long-run impact on trading volume are typically negative but economically small and not statistically

different from zero. Only for the sample of non-SLP stocks we find a significant reduction of trading volume by about 10%. By contrast, we find robust empirical evidence of a long-run reduction in the weekly and monthly volatilities of stock prices, which fits well with the theoretical considerations of Stiglitz (1989) and Summers and Summers (1989). Thus, the French FTT might provide pathways for a reduction in volatility without severely affecting trading volumes or liquidity.

Third, we contribute to the small literature on the heterogeneity of FTT impact. We confirm the finding of Colliard and Hoffmann (2017) for a smaller impact of the French FTT on stocks participating in the Supplementary Liquidity Provision program (SLP stocks). Different from Colliard and Hoffmann (2017), our evidence suggests no relevant short-run or long-run FTT effects on trading volumes of SLP stocks. Thus, the SLP program seems to have "protected" treated stocks from a reduction of trading volumes resulting from the French FTT.

Fourth, we provide a methodological contribution to difference-in-differences estimation in the context of financial markets and FTT regulations. Our findings on announcement effects and short-run treatment effects suggest that short-run market reactions surrounding the effective date of an event (e.g., effective date of the French FTT) might not provide a consistent estimate for long-run effects if investors anticipate such events (e.g., by antedating trading activities to the period before that event). We further provide evidence that trends of small capitalization stocks are not common to trends of large capitalization stocks. If this holds in general terms, then small capitalization stocks, which have been used as a control group by the research on the French FTT, are no valid control group for large-capitalization stocks. Our findings on the migration of trading volumes to substitute stocks (Dutch and Luxembourg stocks treated at NYSE Euronext) suggest further that close substitute stocks might not be an appropriate control group as SUTVA might be violated and there might also be an indirect treatment effect on the control group.

Note that our research relies on lit market data from NYSE Euronext Paris compared to London and Frankfurt stock exchange. Thus, we do not consider alternative trading facilities such as OTC or dark pools, which have been analyzed by Colliard and Hoffmann (2013) and Coelho (2016). For further research, it might be an interesting to determine if the FTT announcement effects and short-run treatment effects on trading volume as well as the short-run and long-run treatment effects on long-term volatility measures identified are also relevant in other marketplaces (especially OTC) and for similar FTT regulations, such as the 2013 Italian FTT.

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Figure 1: FTT introduction process in France

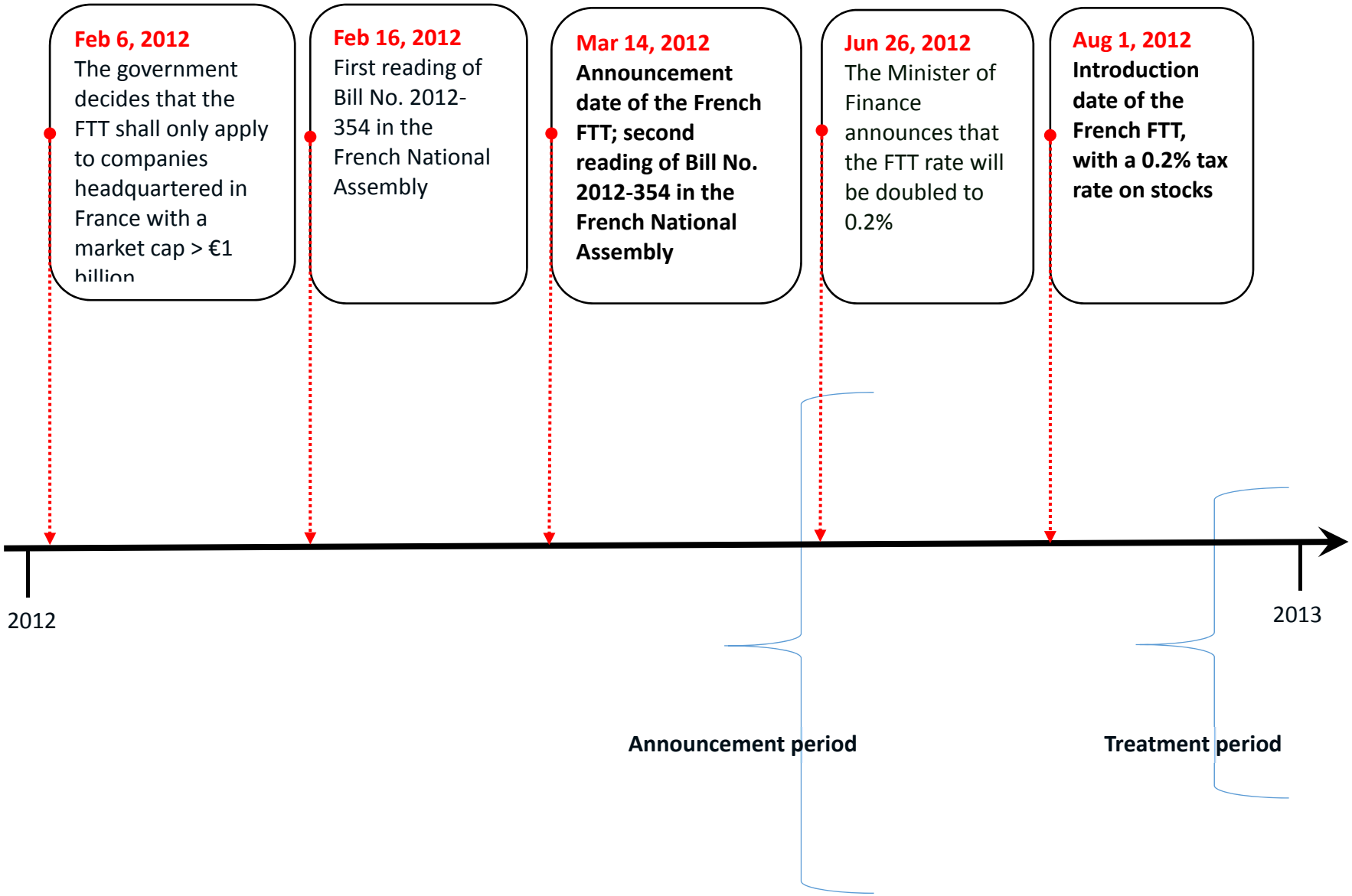
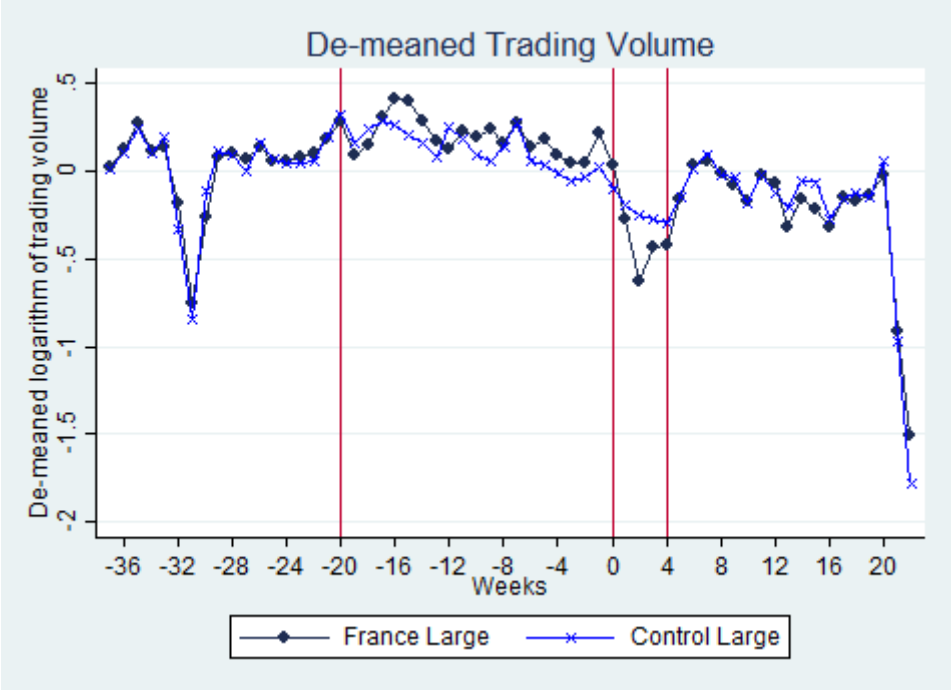
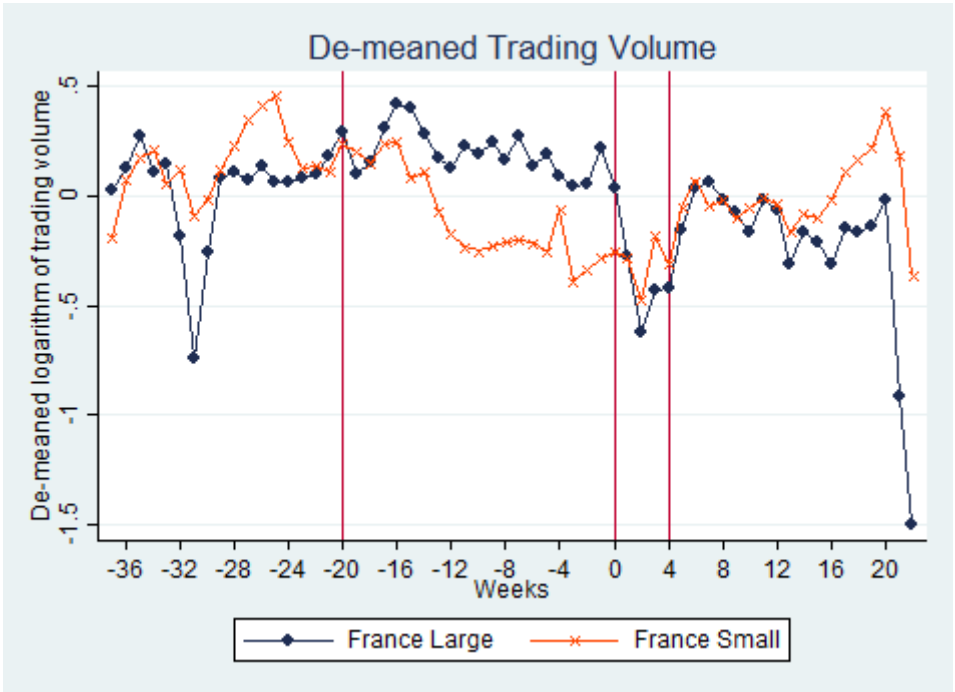


Figure 2: Trading volume, German and UK large cap as control



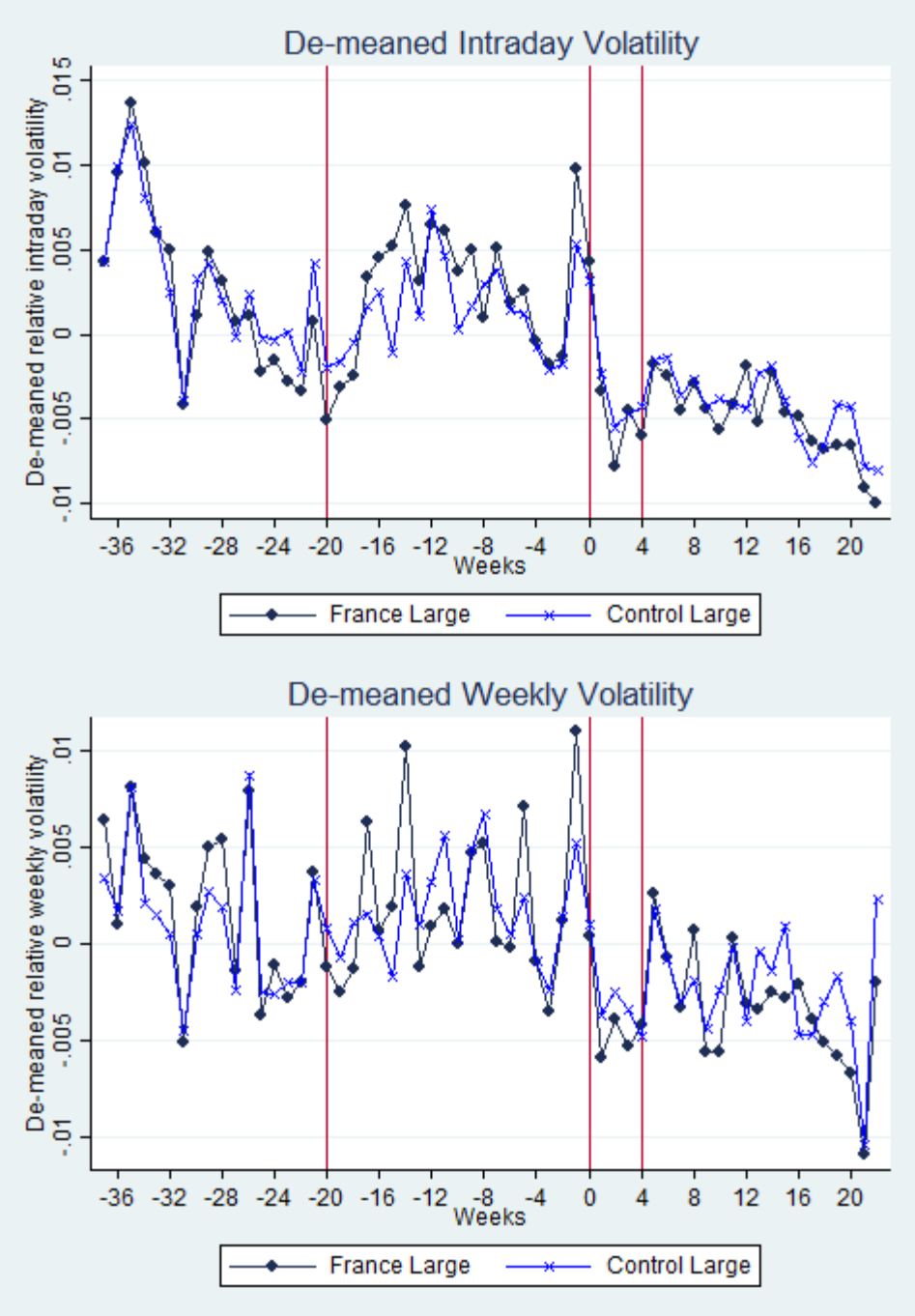
Note: Week -20 indicates the announcement date (March 14, 2012) and week 0 the introduction date (August 1, 2012). The period between these dates is the announcement period. The period from week 0 to week 4 is the short-run treatment period and the time span from week 4 onward is the long-run treatment period.

Figure 3: Trading volume, French small cap as control



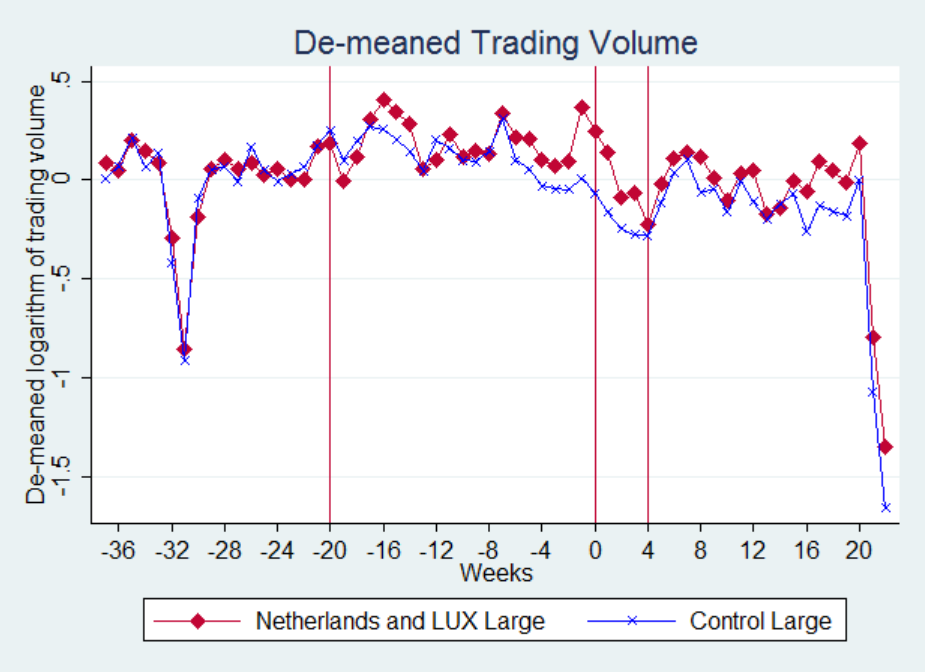
Note: Week -20 indicates the announcement date (March 14, 2012) and week 0 the introduction date (August 1, 2012). The period between these dates is the announcement period. The period from week 0 to week 4 is the short-run treatment period and the time span from week 4 onward is the long-run treatment period.

Figure 4: Volatility measures, German and UK large cap as control



Note: Week -20 indicates the announcement date (March 14, 2012) and week 0 the introduction date (August 1, 2012). The period between these dates is the announcement period. The period from week 0 to week 4 is the short-run treatment period and the time span from week 4 onward the long-run treatment period.

Figure 5: Migration of trading volume to Dutch and LUX stocks



Note: Week -20 indicates the announcement date (March 14, 2012) and week 0 the introduction date (August 1, 2012). The period between these dates is the announcement period. The period from week 0 to week 4 is the short-run treatment period and the time span from week 4 onward is the long-run treatment period.

Table 1: Descriptive statistics

Treatment period: 2 months	French stocks			Control stocks			Substitute stocks		
Observations	25,165			69,429			7,189		
Variable	Mean	Median	Standard deviation	Mean	Median	Standard deviation	Mean	Median	Standard deviation
Trading volume (1000s)	1,636.65	326.50	4,556.68	3,548.07	940.60	13,917.33	3,058.66	814.80	6,126.71
Daily return (%)	0.044	0.000	2.126	0.069	0.051	1.962	0.643	0.035	44.196
Share price (€)	52.31	34.21	66.91	700.90	359.38	951.52	29.85	26.20	29.29
Relative intraday volatility (%)	2.64	2.29	1.54	2.44	2.08	1.64	2.46	2.14	1.36
Relative weekly volatility (%)	1.76	1.48	1.18	1.58	1.32	1.11	1.74	1.45	1.92
Relative monthly volatility (%)	3.26	2.80	1.98	2.96	2.50	1.82	3.19	2.84	2.24
Market capitalization (million €)	10,246.86	4,407.98	15,408.72	9,911.96	3,084.00	17,569.48	12,026.89	4,923.39	18,994.47
Price-to-book ratio (%)	1.53	1.25	1.47	264.65	1.70	4,450.79	2.01	1.69	1.31
EBITDA (1000s €)	2,420.77	892.17	4,398.64	2,356.63	483.00	5,719.66	3,280.74	565.88	9,137.27
Treatment period: 8 months	French stocks			Control stocks			Substitute stocks		
Observations	37,779			102,876			10,730		
Variable	Mean	Median	Standard deviation	Mean	Median	Standard deviation	Mean	Median	Standard deviation
Trading volume (1000s)	1,572.55	305.20	4,846.69	3,275.20	901.90	12,397.29	3,117.52	840.30	6,373.64
Daily return (%)	0.067	0.012	1.968	0.075	0.057	1.877	0.497	0.049	36.238
Share price (€)	52.31	34.21	66.91	726.23	366.94	978.76	29.92	26.65	27.31
Relative intraday volatility (%)	2.64	2.29	1.54	2.33	1.95	1.59	2.34	2.00	1.42
Relative weekly volatility (%)	1.76	1.48	1.18	1.51	1.25	1.10	1.69	1.37	1.97
Relative monthly volatility (%)	3.26	2.80	1.98	2.84	2.40	1.80	3.18	2.71	2.49
Market capitalization (millions €)	10,246.86	4,407.98	15,408.72	10,225.97	3,249.93	17,908.52	12,472.37	5,232.09	19,152.92
Price-to-book ratio (%)	1.53	1.25	1.47	312.14	1.78	5,294.29	2.06	1.70	1.43
EBITDA (1000s €)	2,420.77	892.17	4,398.64	2,318.39	483.00	5,591.19	3,266.84	726.40	8,737.40

The number of observations is smaller for relative weekly (monthly) volatilities.

Table 2: Trading volume, baseline tests

Model	1	2	3	4	5	6	7	8	9
Reference period	APeriod	APeriod	APeriod	Pre-APeriod	Pre-Aperiod	Pre-APeriod	Pre-APeriod	Pre-Aperiod	Pre-APeriod
Long-run treatment period	2 months	4 months	8 months	2 months	4 months	8 months	2 months	4 months	8 months
DiD	**-0.185*** **	**-0.155*** **	**-0.125*** **						
	(0.0300)	**(0.0286)**	**(0.0318)**						
TPeriod	-0.101***	-0.102***	-0.106***						
	(0.0160)	(0.0154)	(0.0154)						
ADiD							**0.0612** **	**0.0579** **	**0.0507***
							(0.0282)	**(0.0281)**	**(0.0281)**
SDiD							**-0.178*** **	**-0.182*** **	**-0.189*** **
							(0.0421)	**(0.0420)**	**(0.0422)**
LDiD				**-0.00617**	**-0.0246**	**-0.0384**	**-0.0145**	**-0.0279**	**-0.0382**
				(0.0412)	**(0.0386)**	**(0.0374)**	**(0.0404)**	**(0.0380)**	**(0.0373)**
APeriod							0.0662***	0.0683***	0.0714***
							(0.0169)	(0.0168)	(0.0167)
STPeriod							-0.133***	-0.128***	-0.122***
							(0.0234)	(0.0230)	(0.0229)
LTPeriod				0.130***	0.157***	0.174***	0.0680**	0.0768***	0.0846***
				(0.0334)	(0.0323)	(0.0307)	(0.0263)	(0.0256)	(0.0250)
MC	0.116	-0.0289	-0.117	0.175	0.0482	-0.0675	0.0709	0.000718	-0.0734
	(0.198)	(0.150)	(0.106)	(0.142)	(0.134)	(0.113)	(0.138)	(0.129)	(0.109)
PTB Ratio	3.10e-06	3.59e-07	-1.05e-06	1.12e-06	-6.87e-06***	-4.71e-06***	-1.32e-06	-6.83e-06***	-3.71e-06***
	(2.38e-06)	(1.65e-06)	(7.03e-07)	(1.72e-06)	(1.50e-06)	(9.12e-07)	(1.76e-06)	(1.50e-06)	(8.82e-07)
EBITDA			1.95e-05	-0.000127***	-0.000122**	-4.11e-05	-0.000103	-0.000105	-3.21e-05
			(3.83e-05)	(4.63e-05)	(5.50e-05)	(2.75e-05)	(6.81e-05)	(6.80e-05)	(2.69e-05)
Stock fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Month fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Number of observations	48,447	65,808	95,755	49,340	65,031	95,464	95,094	110,785	141,218
Number of stocks	393	393	397	393	396	397	393	396	397
Adjusted R-squared	0.948	0.946	0.940	0.935	0.930	0.933	0.941	0.937	0.937

The dependent variable is the logarithm of the number of traded shares (in thousands). We calculate estimates by OLS with stock and month fixed effects. Heteroscedasticity-robust standard errors are clustered by stock level and documented in parentheses. The superscripts ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The variable *TPeriod* is a dummy variable with a value of one in the treatment period after July 31, 2012; *LTPeriod* is a dummy variable with a value of one in the long-run treatment period after August 31, 2012; and *DiD* and *LDiD* are the interaction terms of *TPeriod* and *LTPeriod*, respectively, with a dummy variable for treated French stocks. We consider the logarithm of market capitalization in millions of euros (*MC*), the price-to-book ratio (*PTB Ratio*), and the ratio of EBITDA to market capitalization (*EBITDA*) as additional stock controls.

Table 3: Volatility, baseline tests

Model	1	2	3	4	5	6	7	8	9
Volatility measure	Intraday volatility			Weekly volatility			Monthly volatility		
Long-run treatment period	2 months	4 months	8 months	2 months	4 months	8 months	2 months	4 months	8 months
ADiD	**0.00106****	**0.00104****	**0.00108****	**-0.000532**	**-0.000544**	**-0.000503**	**-0.00296****	**-0.00302****	**-0.00302****
	(0.000423)	**(0.000429)**	**(0.000435)**	**(0.000488)**	**(0.000491)**	**(0.000495)**	**(0.00142)**	**(0.00141)**	**(0.00141)**
SDiD	**-0.00139****	**-0.00141****	**-0.00136****	**-0.00278*****	**-0.00279*****	**-0.00273*****	**-0.00803*****	**-0.00810*****	**-0.00810*****
	(0.000665)	**(0.000667)**	**(0.000659)**	**(0.000676)**	**(0.000675)**	**(0.000665)**	**(0.00172)**	**(0.00171)**	**(0.00169)**
LDiD	**-0.000899**	**-0.000896**	**-0.00109**	**-0.00135****	**-0.00170*****	**-0.00230*****	**-0.00415*****	**-0.00513*****	**-0.00559*****
	(0.000684)	**(0.000709)**	**(0.000677)**	**(0.000604)**	**(0.000585)**	**(0.000572)**	**(0.00154)**	**(0.00148)**	**(0.00143)**
APeriod	-0.00237***	-0.00235***	-0.00238***	-0.00187***	-0.00186***	-0.00189***	-0.0168	-0.0129	-0.00868
	(0.000350)	(0.000352)	(0.000349)	(0.000537)	(0.000536)	(0.000535)	(0.0220)	(0.0217)	(0.0230)
STPeriod	-0.00456***	-0.00453***	-0.00461***	-0.00492***	-0.00490***	-0.00499***	-0.0205	-0.0166	-0.0124
	(0.000460)	(0.000464)	(0.000458)	(0.000664)	(0.000665)	(0.000662)	(0.0221)	(0.0218)	(0.0231)
LTPeriod	-0.00376***	-0.00373***	-0.00377***	-0.00276***	-0.00265***	-0.00257***	-0.0190	-0.0148	-0.0105
	(0.000478)	(0.000501)	(0.000483)	(0.000694)	(0.000694)	(0.000683)	(0.0221)	(0.0217)	(0.0231)
MC	-0.00908***	-0.00948***	-0.00814***	-0.00567***	-0.00588***	-0.00474***	-0.0138***	-0.0145***	-0.0144***
	(0.00125)	(0.00165)	(0.00137)	(0.00115)	(0.00123)	(0.00101)	(0.00305)	(0.00262)	(0.00254)
PTB Ratio	4.29e-07***	3.39e-07***	6.15e-08***	2.05e-07***	1.57e-07***	3.53e-08***	3.73e-07***	2.63e-07***	6.22e-08***
	(1.51e-08)	(1.46e-08)	(9.11e-09)	(1.39e-08)	(1.18e-08)	(7.33e-09)	(3.52e-08)	(2.88e-08)	(1.80e-08)
EBITDA	-1.19e-06	-1.25e-06	-4.43e-07	8.26e-09	-7.52e-08	2.11e-07	-1.49e-06	-1.64e-06	-2.89e-06**
	(1.46e-06)	(1.38e-06)	(4.15e-07)	(9.49e-07)	(9.56e-07)	(3.35e-07)	(2.52e-06)	(2.39e-06)	(1.29e-06)
Stock fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Month fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Number of observations	95,094	110,785	141,218	19,988	23,433	29,825	4,708	5,494	6,979
Number of stocks	393	393	397	393	396	397	393	396	397
Adjusted R-squared	0.299	0.302	0.296	0.261	0.258	0.248	0.441	0.433	0.420

The dependent variable is the logarithm of the number of traded shares (in thousands). We calculate estimates by OLS with stock and month fixed effects. Heteroscedasticity-robust standard errors are clustered by stock level and documented in parentheses. The superscripts ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The variable *TPeriod* is a dummy variable with a value of one in the treatment period after July 31, 2012; *LTPeriod* is a dummy variable with a value of one in the long-run treatment period after August 31, 2012; and *DiD* and *LDiD* are the interaction terms of *TPeriod* and *LTPeriod*, respectively, with a dummy variable for treated French stocks. We consider the logarithm of market capitalization in millions of euros (*MC*), the price-to-book ratio (*PTB Ratio*), and the ratio of EBITDA to market capitalization (*EBITDA*) as additional stock controls.

Table 4: Volume, heterogeneity tests

Model	1	2	3	4	5	6	7	8	9
Long-run treatment period	2 months	4 months	8 months	2 months	4 months	8 months	2 months	4 months	8 months
ADiD × SLP	**0.0922****	**0.0915****	**0.0982****				**0.0743**	**0.0741**	**0.0804**
	(0.0466)	**(0.0462)**	**(0.0463)**				**(0.0580)**	**(0.0572)**	**(0.0569)**
SDiD × SLP	**0.240*****	**0.240*****	**0.247*****				**0.165****	**0.163****	**0.168****
	(0.0698)	**(0.0695)**	**(0.0694)**				**(0.0742)**	**(0.0732)**	**(0.0725)**
LDiD × SLP	**0.226*****	**0.158*****	**0.131****				**0.245*****	**0.191*****	**0.170*****
	(0.0629)	**(0.0594)**	**(0.0576)**				**(0.0604)**	**(0.0599)**	**(0.0563)**
ADiD × MC				**0.0441***	**0.0450****	**0.0478****	**0.0241**	**0.0250**	**0.0260**
				(0.0228)	**(0.0227)**	**(0.0227)**	**(0.0269)**	**(0.0266)**	**(0.0264)**
SDiD × MC				**0.0738****	**0.0756****	**0.0795****	**0.0296**	**0.0318**	**0.0342**
				(0.0357)	**(0.0356)**	**(0.0356)**	**(0.0373)**	**(0.0369)**	**(0.0367)**
LDiD × MC				**0.0143**	**-0.00602**	**0.00409**	**-0.0517***	**-0.0575****	**-0.0418**
				(0.0338)	**(0.0305)**	**(0.0310)**	**(0.0311)**	**(0.0287)**	**(0.0293)**
ADiD	0.0155	0.0126	0.00268	-0.323	-0.333	-0.365*	-0.185	-0.196	-0.214
	(0.0438)	(0.0437)	(0.0438)	(0.209)	(0.209)	(0.209)	(0.225)	(0.223)	(0.222)
SDiD	-0.297***	-0.300***	-0.311***	-0.831**	-0.851**	-0.892***	-0.527	-0.549*	-0.580*
	(0.0654)	(0.0654)	(0.0656)	(0.332)	(0.332)	(0.332)	(0.328)	(0.326)	(0.325)
LDiD	-0.126**	-0.106*	-0.102*	-0.154	0.0113	-0.0788	0.300	0.367	0.238
	(0.0612)	(0.0579)	(0.0564)	(0.316)	(0.284)	(0.289)	(0.285)	(0.259)	(0.266)
APeriod	0.0665***	0.0685***	0.0714***	0.155*	0.167**	0.176**	0.155*	0.167**	0.176**
	(0.0170)	(0.0168)	(0.0168)	(0.0833)	(0.0831)	(0.0840)	(0.0833)	(0.0831)	(0.0841)
STPeriod	-0.132***	-0.128***	-0.122***	-0.414***	-0.399***	-0.388***	-0.415***	-0.399***	-0.388***
	(0.0234)	(0.0231)	(0.0229)	(0.121)	(0.120)	(0.120)	(0.121)	(0.120)	(0.120)
LTPeriod	0.0685***	0.0771***	0.0847***	-0.266**	-0.208*	-0.0164	-0.266**	-0.208*	-0.0166
	(0.0264)	(0.0256)	(0.0250)	(0.127)	(0.124)	(0.126)	(0.127)	(0.124)	(0.126)
Stock controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
DiD controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Stock fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Month fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Number of observations	95,094	110,785	141,218	94,170	109,713	139,782	94,170	109,713	139,782
Number of stocks	393	393	397	393	396	397	393	396	397
Adjusted R-squared	0.941	0.937	0.937	0.938	0.935	0.934	0.938	0.935	0.934

The dependent variable is the logarithm of the number of traded shares (in thousands). We calculate estimates by OLS with stock and month fixed effects. Heteroscedasticity-robust standard errors are clustered by stock level and documented in parentheses. The superscripts ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The variable *TPeriod* is a dummy variable with a value of one in the treatment period after July 31, 2012; *LTPeriod* is a dummy variable with a value of one in the long-run treatment period after August 31, 2012; and *DiD* and *LDiD* are the interaction terms of *TPeriod* and *LTPeriod*, respectively, with a dummy variable for treated French stocks. Stock controls include the logarithm of market capitalization in millions of euros (*MC*), the price-to-book ratio (*PTB Ratio*), and the ratio of EBITDA to market capitalization (*EBITDA*). DiD controls consider interaction terms of *APeriod*, *STPeriod*, and *LTPeriod* with the logarithm of market capitalization in millions of euros (*MC*). Corresponding interaction terms with *SLP* are omitted by reason of multi-collinearity.

Table 5: Volatility, heterogeneity tests

Model	1	2	3	4	5	6	7	8	9
Volatility measure	Intraday volatility			Weekly volatility			Monthly volatility		
Long-run treatment period	2 months	4 months	8 months	2 months	4 months	8 months	2 months	4 months	8 months
ADiD × SLP	**0.00163***	**0.00162***	**0.00163***	**0.00273****	**0.00272****	**0.00272****	**0.00450**	**0.00450**	**0.00450**
	(0.000941)	**(0.000940)**	**(0.000957)**	**(0.00110)**	**(0.00110)**	**(0.00111)**	**(0.00278)**	**(0.00278)**	**(0.00279)**
SDiD × SLP	**0.000790**	**0.000763**	**0.000782**	**0.00204**	**0.00202**	**0.00201**	**0.000614**	**0.000595**	**0.000571**
	(0.00135)	**(0.00135)**	**(0.00134)**	**(0.00147)**	**(0.00147)**	**(0.00145)**	**(0.00336)**	**(0.00336)**	**(0.00335)**
LDiD × SLP	**0.00222**	**0.00100**	**0.00155**	**0.00110**	**0.000910**	**0.00122**	**0.00169**	**0.00245**	**0.00297**
	(0.00147)	**(0.00162)**	**(0.00156)**	**(0.00124)**	**(0.00136)**	**(0.00137)**	**(0.00271)**	**(0.00275)**	**(0.00268)**
ADiD × MC	**-0.000745****	**-0.000745****	**-0.000755****	**-0.000637**	**-0.000637**	**-0.000641**	**-0.000640**	**-0.000645**	**-0.000635**
	(0.000371)	**(0.000370)**	**(0.000370)**	**(0.000478)**	**(0.000478)**	**(0.000476)**	**(0.00113)**	**(0.00113)**	**(0.00113)**
SDiD × MC	**0.00114***	**0.00115***	**0.00113***	**0.000166**	**0.000175**	**0.000159**	**0.00255***	**0.00256***	**0.00258***
	(0.000632)	**(0.000632)**	**(0.000629)**	**(0.000728)**	**(0.000728)**	**(0.000724)**	**(0.00138)**	**(0.00139)**	**(0.00139)**
LDiD × MC	**-0.000192**	**-0.000150**	**-0.000160**	**-0.000152**	**-0.000278**	**-8.96e-05**	**0.00114**	**0.000774**	**0.000744**
	(0.000753)	**(0.000835)**	**(0.000789)**	**(0.000597)**	**(0.000675)**	**(0.000672)**	**(0.00118)**	**(0.00121)**	**(0.00123)**
ADiD	0.00669**	0.00666**	0.00679**	0.00381	0.00380	0.00389	0.00171	0.00171	0.00161
	(0.00296)	(0.00296)	(0.00294)	(0.00378)	(0.00378)	(0.00376)	(0.00921)	(0.00920)	(0.00918)
SDiD	-0.0117**	-0.0118**	-0.0115**	-0.00521	-0.00528	-0.00507	-0.0296**	-0.0297**	-0.0300**
	(0.00527)	(0.00527)	(0.00524)	(0.00590)	(0.00589)	(0.00586)	(0.0116)	(0.0116)	(0.0117)
LDiD	-0.000335	-2.12e-05	-0.000380	-0.000420	0.000356	-0.00200	-0.0141	-0.0121	-0.0125
	(0.00622)	(0.00676)	(0.00641)	(0.00493)	(0.00547)	(0.00543)	(0.0100)	(0.0101)	(0.0103)
APeriod	-0.00465***	-0.00462***	-0.00476***	0.000855	0.000864	0.000749	0.00713**	0.00712**	0.00720**
	(0.00141)	(0.00142)	(0.00141)	(0.00138)	(0.00138)	(0.00138)	(0.00345)	(0.00339)	(0.00338)
STPeriod	-0.00317	-0.00311	-0.00324	-0.00243	-0.00240	-0.00253	-0.000721	-0.000676	-0.000551
	(0.00247)	(0.00247)	(0.00248)	(0.00206)	(0.00206)	(0.00208)	(0.00501)	(0.00503)	(0.00508)
LTPeriod	-0.00379*	-0.00169	-0.00124	-0.00343*	-0.00143	0.000151	-0.00190	0.00121	0.00444
	(0.00222)	(0.00255)	(0.00224)	(0.00175)	(0.00204)	(0.00179)	(0.00456)	(0.00453)	(0.00403)
Stock controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
DiD controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Stock fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Month fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Number of observations	94,170	109,713	139,782	94,170	109,713	139,782	94,170	109,713	139,782
Number of stocks	393	393	397	393	396	397	393	396	397
Adjusted R-squared	0.299	0.302	0.297	0.276	0.270	0.256	0.477	0.462	0.443

The dependent variable is the logarithm of the number of traded shares (in thousands). We calculate estimates by OLS with stock and month fixed effects. Heteroscedasticity-robust standard errors are clustered by stock level and documented in parentheses. The superscripts ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The variable *TPeriod* is a dummy variable with a value of one in the treatment period after July 31, 2012; *LTPeriod* is a dummy variable with a value of one in the long-run treatment period after August 31, 2012; and *DiD* and *LDiD* are the interaction terms of *TPeriod* and *LTPeriod*, respectively, with a dummy variable for treated French stocks. Stock controls include the logarithm of market capitalization in millions of euros (*MC*), the price-to-book ratio (*PTB Ratio*), and the ratio of EBITDA to market capitalization (*EBITDA*). DiD controls consider interaction terms of *APeriod*, *STPeriod*, and *LTPeriod* with the logarithm of market capitalization in millions of euros (*MC*). Corresponding interaction terms with *SLP* are omitted by reason of multi-collinearity.

Table 6: Migration of Trading Volume

Model	1	2	3	4	5	6
Long-run treatment period	2 months	4 months	8 months	2 months	4 months	8 months
DiD						
TPeriod						
ADiD				**0.0711****	**0.0679****	**0.0678****
				(0.0316)	**(0.0313)**	**(0.0319)**
SDiD				**0.206*****	**0.202*****	**0.200*****
				(0.0559)	**(0.0558)**	**(0.0563)**
LDiD	**0.105***	**0.131****	**0.168*****	**0.0971***	**0.125****	**0.165*****
	(0.0542)	**(0.0604)**	**(0.0607)**	**(0.0535)**	**(0.0591)**	**(0.0599)**
APeriod				0.0815***	0.0827***	0.0842***
				(0.0169)	(0.0168)	(0.0168)
STPeriod				-0.112***	-0.107***	-0.102***
				(0.0230)	(0.0226)	(0.0222)
LTPeriod	-0.0667	-0.0827	-0.107	0.0923***	0.0973***	0.102***
	(0.114)	(0.111)	(0.104)	(0.0260)	(0.0260)	(0.0256)
MC	0.156	0.0381	-0.129	0.0940	0.00863	-0.128
	(0.164)	(0.158)	(0.129)	(0.159)	(0.151)	(0.125)
PTB Ratio	1.26e-06	-6.89e-06***	-4.50e-06***	-1.53e-06	-6.99e-06***	-3.52e-06***
	(1.91e-06)	(1.70e-06)	(1.02e-06)	(1.94e-06)	(1.67e-06)	(9.89e-07)
EBITDA	-0.000193***	-0.000197***	-5.60e-05**	-0.000195***	-0.000196***	-4.58e-05*
	(6.21e-05)	(6.80e-05)	(2.55e-05)	(5.49e-05)	(5.94e-05)	(2.41e-05)
Stock fixed effects	YES	YES	YES	YES	YES	YES
Month fixed effects	YES	YES	YES	YES	YES	YES
Number of observations	40,303	53,157	77,641	77,726	90,580	115,064
Number of stocks	393	396	397	393	396	397
Adjusted R-squared	0.914	0.907	0.911	0.922	0.917	0.917

The dependent variable is the logarithm of the number of traded shares (in thousands). We calculate estimates by OLS with stock and month fixed effects. Heteroscedasticity-robust standard errors are clustered by stock level and documented in parentheses. The superscripts ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The variable *TPeriod* is a dummy variable with a value of one in the treatment period after July 31, 2012; *LTPeriod* is a dummy variable with a value of one in the long-run treatment period after August 31, 2012; and *DiD* and *LDiD* are the interaction terms of *TPeriod* and *LTPeriod*, respectively, with a dummy variable for treated French stocks. We include the logarithm of market capitalization in millions of euros (*MC*), the price-to-book ratio (*PTB Ratio*), and the ratio of EBITDA to market capitalization (*EBITDA*) as additional stock controls.