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The Effect of French and Italian Transaction Taxes on Equity Market Microstructure and Market Efficiency

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ABSTRACT **Transaction taxes distort free markets. With the increasing popularity of transaction taxes in France, Italy, and elsewhere in Europe, understanding how these distortions affect market microstructure as well as market efficiency is important for active managers who are not just trying to preserve alpha, but also trying to identify new patterns that may potentially be modeled and traded. Existing research on transaction taxes focuses on market microstructure, and this paper applies a difference-in-difference regression model to estimate the effect of the recently applied transaction taxes on the French and Italian equity markets. The results for market participants subject to the tax from these regressions—a 15–25 percent decrease in volume in France and a 4-8 percent decrease in Italy, a 20–70 basis point increase in bid/ask spreads as a percent of the open price in France and a 80–140 basis point increase in Italy, and no significant change in volatility in either country—may help investors forecast the likely changes in market microstructure if 11 European countries execute their plan to apply a common, cross-national transaction tax. In addition, this paper also considers a topic rarely found in the literature on transaction taxes—market efficiency. Specifically, this paper estimates the increase in the time lag for common (i.e., market-wide) information to affect individual equity prices. Results indicate that the lag increased by approximately 30 percent in France and by more than 150 percent in Italy.**

Transaction taxes distort markets. The eponymous advocate of financial transaction or "Tobin taxes" described the goal of such taxes as limiting "speculative trading" (Tobin, 1978) by throwing "sand in the wheels of international finance" (Eichengreen, Tobin and Wyplosz, 1995).[1] Whether market "wheels" would improve social welfare more by turning less rapidly remains a subjective question better left within the purview of policy makers.[2]

For an active manager, speculative or otherwise, the more salient issues relate to the direct cost of trading securities as well as the indirect changes in market supply and demand curves. The direct costs are obvious. Transacting in any taxed security reduces the return on the investment by the amount of the tax plus any incremental cost needed to comply with the tax collection (e.g., accounting and legal services). Whether this cost is large or small depends on the parameters of the tax and the flexibility with which the manager can operate to express views on a given security. For example, the United Kingdom has maintained a transaction tax of 0.5 percent on equities since 1986,[3] but a liquid market in financial derivatives, particularly contracts for differences, allows many investors to acquire exposure to the underlying equities without incurring the tax (Matheson, 2011). Section I of this paper briefly discusses the state of financial transaction taxes globally, the parameters of the newly imposed transaction taxes in France and Italy, and the evolving form of the transaction taxes being developed elsewhere in Europe.

1 Nobel laureate and economist James Tobin originally proposed a tax on foreign exchange transactions after the fall of the Bretton Woods accord in 1971, but many (e.g., Becchetti, Ferrari and Trenta, 2013) apply the term "Tobin tax" to all financial transaction taxes.

2 For a useful review of the policy implications, see, for example, Hakkio (1994).

3 The Stamp Duty tax rate has changed numerous times since its inception in 1694 (Matheson, 2011).

Some of the indirect changes that arise from financial transaction taxes may also seem obvious, at least based on the extensive body of theoretical and empirical research on the subject.[4] The literature tends to focus on market micro-structure, particularly market volumes, bid/ask spreads, and price volatility. Not surprisingly, most of the research agrees that market volumes decline and bid/ask spreads increase, since the tax diminishes the marginal incentive for all market participants to turn the "sandy wheels" by engaging in a transaction. The effect of transaction taxes on price volatility remains a topic for debate, as articles in both the theoretical and empirical literature offer conflicting findings.[5] Section II of this paper examines each of these three elements of market microstructure in the context of the recently imposed transaction taxes in France and Italy. Fore-shadowing the results, market volumes in France fell by 15–25 percent and in Italy by 4–8 percent relative to the pre-tax period; bid/ask spreads as a percent of a security's open price increased by 20–70 basis points in France and by 80–140 basis points in Italy; and there was no meaningful change in intraday price volatility in either country.

The literature on transaction taxes has tended to ignore another indirect effect that often proves important to active managers—the rate at which markets assimilate new information. To the extent that the "sand in the wheels" delays the transmission of information, markets will operate with less efficiency and thereby create new patterns from which an active manager may potentially profit. Section III of this paper employs a test described by Mech (1993) and Hou and Moskowitz (2005) that measures the degree of friction in a financial market. Applying this measure in the context of changes in transaction taxes shows that the amount of friction – i.e., the delay that a security's price reflects market news – in equity markets increased relative to the pre-tax levels by 30 percent for the median-sized (by market cap) company subject to the tax in France and more than 150 percent in Italy. Like sand is wont to do, this friction also spilled over onto the wheels of smaller cap equities not subject to the tax. Small cap equities that were not directly affected by the transaction tax also saw a 10 (France) to 40 (Italy) percent increase in delay, which is consistent with the literature on equity prices and news (e.g., Lo and MacKinlay, 1990). The values are statistically significant.

Section IV of this paper outlines some of the implications for active managers and their investors. For example, this section puts in perspective the challenges and opportunities that transaction taxes create for active managers. Given the likely proliferation of transaction taxes in Europe and potentially elsewhere, many active managers and their investors will closely study the effect of transaction taxes on their portfolios' bottom lines.

4 See, for example, Matheson (2011) and Pomeranets (2012) for recent surveys of the transaction tax literature.

5 Tobin (1978), Stiglitz (1989) and Summers and Summers (1989) suggest that volatility should theoretically decline due to transaction taxes discouraging "speculative" trading. Amihud and Mendelson (2003) suggest that transaction taxes also discourage informed trading, which tends to increase the dispersion between a security's market price and its fundamental value. The empirical literature, as summarized by Pomeranets (2012), finds that transaction taxes have increased volatility in some cases, decreased volatility in some cases, and had no effect in many cases.

I. Trends in the regulatory environment and overview of the French and Italian Transaction Taxes

The topic of transaction taxes reappears like the periodical cicada. It lingers quietly below the surface for years but inevitably burrows its way above ground to make significant noise. After the global financial crisis that began in Asia in 1997, macroeconomic historian Barry Eichengreen wrote, "Each episode of turbulence in international financial markets prompts calls for taxing foreign-exchange transactions" (Eichengreen, 1999, pg. 88). The same might also be said for transaction taxes on other securities.

Whether the latest buzz of financial transaction taxes will also fade away, like the periodical cicada and the many previous spikes in interest in financial transaction taxes, remains to be seen. However, a very brief overview of the state of transaction taxes in the current financial environment may help paint a background picture for those trying to assess the likelihood of policymakers applying significant transaction taxes in the future. Table I summarizes the current state for select markets. The appendix offers a more complete list.

Table I Status of equity transaction taxes in select markets (more complete list in the appendix)

Country	Equities
Australia	
China	0.1% of principal paid by seller
European Union	0.1% for sellers and buyers planned for 11 countries (Germany, France, Italy, Spain, Belgium, Austria, Greece, Portugal, Slovakia, Slovenia, and Estonia). Details and implementation to be determined. Potentially a cascading tax
France	Tax of 0.20% for buyer (exceptions for equities with less than €1.0B market cap, market makers, and positions held less than 1 day)
Hong Kong	0.10% for both buyers and sellers. Transaction levy of 0.03% also charged to both sides by Securities and Futures Commission (SFC)
Italy	0.12% for on-market transactions and 0.22% for OTC (exceptions for equities with less than e0.5B market cap) paid by buyer
Japan	
South Korea	0.3% on value of shares in corporations or partnerships listed on KOSDAQ paid by seller. Shares on KOSPI subject to 0.15% on value plus additional 0.15% special agricultural tax (total of 0.3%)
Switzerland	0.075% for both buyers and sellers
United Kingdom	Stamp duty of 0.5% on secondary sales of shares and trust holding shares by buyer
United States	Regulator fees of approximately 0.002%

Source: Pomeranets (2012), Matheson (2011), and author's analysis

A. Summary of transaction taxes in global equity markets

In the U.S., home to the world's largest equity market, the regulatory body that manages the exchanges (SEC) has imposed transaction taxes continuously since, at least, the *Securities Exchange Act of 1934*.[6] The state of New York has also imposed financial transaction taxes at various levels and at various times starting from 1905, but the state phased out the tax in 1981 (Pomeranets and Weaver, 2011). At the federal level, there have been many proposals to raise the tax above its current value of approximately 0.002 percent on equities.[7] Both Presidents George H.W. Bush (from 1991-1993) and Bill Clinton (in 1994), perhaps in response to the 1991 economic recession and subsequent budget tightening, submitted budget proposals to Congress asking for new federal transaction taxes ranging from $0.11-$0.15.[8] More recently, the *Wall Street Trading and Speculators Tax Act*, first introduced in 2011 but subsequently reintroduced in 2012 and 2013 (bills S. 410 in the Senate and H.R. 880 in the House of Representatives), proposes a 0.03 percent tax on equity, bond, and derivatives trades. The *Inclusive Prosperity Tax* of 2013 (bill H.R. 1579) would impose a 0.5 percent tax on equity trades, 0.1 percent on bond trades, and 0.005 percent on derivatives and currency trades.

In Asia, Japan offers the largest equity market but does not currently impose transaction taxes. In contrast, the equity markets in the higher growth countries of China and South Korea both apply taxes between 0.1 and 0.5 percent. Despite the "sand in the wheels" effect, the World Bank reports that the aggregate market capitalization in the taxed markets in Asia grew 5.2 times faster than in the U.S. (1.8 times faster than Japan) between 2007 and 2012 and more than 2.3 times faster than the U.S. (22.0 times faster than Japan) since 1991.[9] It seems that even if transaction taxes slow the wheels of finance, economic growth offers a stronger, countervailing force.

The state of transaction taxes in Europe is more complex, and it is evolving more rapidly, than in the U.S. or Asia. The European Union released a proposal on February 14, 2013 to tax equity and bond transactions at 0.1 percent and derivatives at 0.01 percent of the notional value. The tax apply at every "material modification" in the transaction chain, thereby creating a "cascade effect" that substantially raises the effective tax rate (PricewaterhouseCoopers, 2013). The tax would apply in the 11 countries that elected to impose the tax: Germany, France, Italy, Spain, Belgium, Austria, Greece, Portugal, Slovakia, Slovenia, and Estonia. Individually, two of these countries—France (as of August 1, 2012) and Italy (as of March 1, 2013)—already apply transaction taxes on their domestic exchanges. At the time, the United Kingdom (among others) opted not to participate in the tax, although it already imposes a 0.5 percent "stamp duty reserve tax" on U.K. incorporated companies whose equities trade on domestic exchanges. More recent reports suggest that disagreements among policy makers across the 11 countries may (at least initially) limit the tax just to equities.[10] Legal objections by other EU countries, particularly the U.K., may also hinder implementation (PricewaterhouseCoopers, 2013).

6 See Matheson (2011) and the SEC's website (http://www.sec.gov/answers/sec31.htm) for more details.

7 The SEC varies the fee over time based on the expected volume of transactions (http://www.sec.gov/news/press/ 2013/2013-74.htm).

8 Some versions of the proposals restricted the tax to options and futures.

9 1991 is the first year that data is available from the World Bank (http://data.worldbank.org/indicator/CM.MKT. LCAP.CD/countries?display=default.).

10 See, for example, the Wall Street Journal 's article "EU's Trading Tax Takes Slow Road" accessed on May 30, 2013 from http://online.wsj.com/article/SB10001424127887324412604578515200971166358.html.

Due to their relative newness and the likely similarities to a broader European Union tax, the remainder of this paper focuses on the recent experiences in France and Italy. The empirical analyses consider changes to the French and Italian equity markets both in isolation and in comparison to equity markets more globally.

B. Overview of French and Italian equity transaction taxes

The French government imposed a 0.2 percent tax on purchases of shares in any publicly traded company headquartered in France with a market capitalization greater than e1 billion beginning on August 1, 2012.11 The French tax allows for several exemptions, including market makers' transactions and positions opened and closed in the same day. Similar to the approach that many institutional investors have adopted in the U.K. (Matheson, 2011), initial reports on the French transaction tax suggested that some institutional investors substituted away from equity shares transactions in favor of derivatives (e.g., contracts for differences) to minimize their tax bill, al-though the French government warned against trading in synthetic instruments to circumvent the tax.[12]

The set of taxed companies in France varies by year. The €1 billion threshold was applied as of August 1, 2012. At the time, 109 companies were subject to the tax (Becchetti et al., 2013). The law that established the tax empowers the French government to reapply its €1 billion threshold annually. When reassessed on January 1, 2013, seven additional companies were added to the list while one was removed.[13] Table II provides summary statistics (based on Bloomberg data) across all trading days on all companies listed on the Paris exchange from January 1, 2012 to August 31, 2013.[14]

Beginning on March 1, 2013, the Italian government imposed a 0.12 percent tax on purchases of shares traded on regulated exchanges and multilateral trading facilities issued by Italian companies domiciled in Italy with a market capitalization greater than €0.5 billion. The new law subjected shares traded off-exchange to a 0.22 percent tax. Barring any further changes, both rates are set to drop two basis points (to 0.1 and 0.2 percent, respectively) in 2014. Similar to France, the Italian law created exemptions for market makers. However, those exemptions were much more limited in scope.[15] As a result, Italian market makers had less flexibility than their French counterparts to offer exposure to individual equity risks through non-equity instruments like swaps. Italy also imposed a separate tax of 0.02 percent on transactions that are amended or cancelled within one half of a second, or if the ratio between the cancelled or amended orders and the completed ones is greater than 60 percent per single instrument. This latter tax targets high frequency traders. Table III provides summary statistics across all trading days on all companies listed on the Borsa Italiana exchange from January 1, 2012 to August 31, 2013.

In France and Italy, as in most other equity markets, liquidity tends to be higher for equities with larger market capitalizations. As reported in Table II and Table III, the companies subject to the tax (i.e., French companies with a market cap greater than e1 billion as of August 1, 2012 and Italian companies with a market cap greater than e0.5 billion as of March

11 The French law included provisions supposedly aimed to discourage high frequency trading, though Haferkorn and Zimmermann (2013) suggests that the effectiveness of those provisions are (at best) limited.

12 See, for example, a Nov. 15 article in Bloomberg entitled "Speculators Find Loopholes in French Trans- action Tax" (http://www.bloomberg.com/news/2012-11-14/french-transaction-tax-misses-mark-as-speculators-find- loopholes.html)

13 See http://www.boursedirect.fr/pdf/Societes TTF.pdf

14 For the sake of simplicity, ADRs have been excluded from the data. The issues of who pays taxes on ADRs and who collects those taxes would unnecessarily complicate the analysis.

15 For details, see http://www.consob.it/mainen/documenti/english/resolutions/res18494.htm

Table II Summary Statistics — French Equities

		All Companies[i]	Taxed Companies[ii] (Market Cap ≥ €1B)	Untaxed Companies[ii] (Market Cap < €1B)
Market Cap	Obs	216,917	45,804	171,113
Millions €	Mean	2,398.107	10,826.139	142.068
	Median	101.450	4555.900	56.520
	Std. Dev	8,728.834	16,451.427	192.975
	Min	0.030	469.130	0.030
	Max	115,056.650	115,056.650	1275.700
Transactions Volume	Obs	216,917	45,804	171,113
Daily number of shares	Mean	342.902	1,455.152	45.172
traded in thousands	Median	3.299	260.749	1.535
	Std. Dev	2,170.865	4,508.376	337.161
	Min	0.001	0.001	0.001
	Max	169,008.085	169,008.085	38,896.768
Bid/Ask Spread[iii]	Obs	205,039	45,414	159,625
% of open price	Mean	1.381	0.270	1.697
	Median	0.784	0.126	1.113
	Std. Dev	1.541	0.488	1.591
	Min	0.038	0.038	0.038
	Max	5.650	5.650	5.650
Intraday Volatility	Obs	212,698	45,738	166,960
$\frac{\text{High}-\text{Low}}{\text{Open Price}}$	Mean	0.023	0.023	0.023
	Median	0.016	0.020	0.014
	Std. Dev	0.030	0.014	0.034
	Min	0.000	0.000	0.000
	Max	1.000	0.224	1.000
Daily Return	Obs	216,917	45,804	171,113
$ln(\frac{\text{Close Price}}{\text{Previous Close Price}})$	Mean	0.000	0.001	0.000
	Median	0.000	0.000	0.000
	Std. Dev	0.032	0.020	0.035
	Min	-1.392	-1.392	-1.386
	Max	1.920	0.202	1.920
Number of Companies[ii]	Count	554	109	445

NOTES:

i Data from Bloomberg covers all common stocks traded on the Borsa Italiana exchange (from January 1, 2012 until August 31, 2013).

ii Number of companies and market cap cuto used for last two columns as of March 1, 2013. Italian transaction tax applied to all companies with a (Market Cap e0.5B) on March 1, 2013.

iii The number of daily observations for the bid/ask spread is lower than that for transaction volumes due to missing values in the dataset from Bloomberg due to obvious data inaccuracies (e.g., a value for the bid exceeding the value of the ask). Even after removing negative bid/ask spreads, the data still contained unreasonable values for the bid/ask spread (e.g. 400+ percent). As a result, the data is winsorized to the 5% and 95% levels. Section III addresses this in more detail.

Table III Summary Statistics — Italian Equities

		All Companies[i]	Taxed Companies[ii] (Market Cap ≥ €0.5B)	Untaxed Companies[ii] (Market Cap < €0.5B)
Market Cap	Obs	106,760	31,923	74,837
Millions €	Mean	1,405.973	4,446.121	109.146
	Median	105.455	1,463.970	54.560
	Std. Dev	5,232.885	8,846.185	243.267
	Min	0.170	38.030	0.170
	Max	74,780.050	74,780.050	4,694.480
Transactions Volume	Obs	106,760	31,923	74,837
Daily number of shares	Mean	4,731.827	11,622.752	1,792.385
traded in thousands	Median	65.8035	895.192	21.503
	Std. Dev	38,798.677	39,330.752	38,193.310
	Min	0.000	0.000	0.000
	Max	4,291,759.032	1,449,208.851	4,291,759.032
Bid/Ask Spread[iii]	Obs	105,290	31,912	73,378
% of open price	Mean	2.003	0.848	2.505
	Median	1.289	0.249	1.862
	Std. Dev	2.085	1.324	2.154
	Min	0.063	0.063	0.063
	Max	7.728	7.728	7.728
Intraday Volatility	Obs	106,744	31,923	74,821
$\frac{\text{High}-\text{Low}}{\text{Open Price}}$	Mean	0.034	0.033	0.035
	Median	0.029	0.028	0.029
	Std. Dev	0.028	0.022	0.031
	Min	0.000	0.000	0.000
	Max	0.844	0.844	0.667
Daily Return	Obs	106,760	31,923	74,837
$ln(\frac{\text{Close Price}}{\text{Previous Close Price}})$	Mean	0.000	0.001	-0.000
	Median	0.000	0.000	0.000
	Std. Dev	0.046	0.049	0.044
	Min	-2.871	-2.871	-2.170
	Max	4.605	4.588	4.605
Number of Companies[ii]	Count	254	77	177

NOTES:

i Data from Bloomberg covers all common stocks traded on the Borsa Italiana exchange (from January 1, 2012 until August 31, 2013).

ii Number of companies and market cap cuto used for last two columns as of March 1, 2013. Italian transaction tax applied to all companies with a (Market Cap €0.5B) on March 1, 2013.

iii The number of daily observations for the bid/ask spread is lower than that for transaction volumes due to missing values in the dataset from Bloomberg due to obvious data inaccuracies (e.g., a value for the bid exceeding the value of the ask). Even after removing negative bid/ask spreads, the data still contained unreasonable values for the bid/ask spread (e.g. 400+ percent). As a result, the data is winsorized to the 5% and 95% levels. Section III addresses this in more detail.

1, 2013) had mean daily transaction volumes more than thirty times greater than the volumes for untaxed French equities and more than six times greater than Italian untaxed equities, respectively. The difference between France and Italy may be explained, in part, by the differences in the market cap threshold for taxation in the respective countries (€1B versus €0.5B). Consistent with the notion that shares in larger cap equities trade with greater liquidity, the mean bid/ask spread divided by the opening price for taxed equities was only 12.3 percent the level of untaxed equities in France and 30.7 percent the level in Italy.[16] Intraday volatility, as measured by the difference between the daily high and low price divided by the daily open price, showed no economically meaningful difference between taxed and untaxed equities.

The unweighted daily average return for the all companies over this period was slightly positive in both countries (less than one basis point per day). Companies with a market cap greater than the tax threshold enjoyed greater mean daily returns. To put the return data in context, the MSCI France Index (MXFR), a free float equity cap index for all companies listed in France, gained 25.1 percent between January 1, 2012 and August 31, 2013. The MSCI Italy Index (MXIT) gained 5.8 percent over the same period.

16 The number of daily observations for the bid/ask spread is lower than that for transaction volumes due to missing values in the dataset from Bloomberg as well as the removal of some data points due to obvious reporting inaccuracies (e.g., a value for the bid exceeding the value of the ask). The following section discusses this data issue in greater detail.

II. Effect of transaction tax on the French and Italian market microstructures

To test for the causal effect of the transaction tax on French and Italian equities, a simple regression model would fail due to the omission of time-varying explanatory variables. The "August effect" in France offers one such example. Equity volumes in France may have fallen after the tax was imposed on August 1, 2012 due to the imposition of the transaction tax or due to the beginning of the traditional summer holiday that left the equity exchanges short on market participants.

As a control for this "August effect" and other omitted, and potentially unobservable, time varying factors, this paper employs a difference-in-differences econometric model similar to Becchetti et al. (2013).[17] To understand the logic behind this approach, consider again the example of French equity volumes. The difference in volumes for companies with a market cap greater than €1 billion before and after August 1, 2012 can be compared to the difference in volumes for companies with a market cap less than €1 billion before and after the same date. The difference in these two differences then measures the causal effect of the transaction tax assuming that any omitted factor (e.g., summer holidays) had similar proportional influences on companies independent of those companies' market capitalizations.[18]

The difference-in-differences model is applied over varying time periods. A longer time frame tends to smooth out factors that may be short-term in nature (e.g., the one month summer holiday period) and that may temporarily and differentially affect one group of companies. A shorter time frame focuses the analysis more on the immediate effect of the tax, but the smaller sample size makes the estimates less robust to omitted, idiosyncratic factors that are transitory in nature but that influence the dependent variable. One such idiosyncratic factor would be a flight to quality (e.g., risk on/risk off behavior). For example, the Italian election on February 25, 2013 yielded an uncertain outcome that affected confidence in Italian financial markets.[19] To the extent this affected the market microstructure, or affected the market microstructure for larger cap equities differently than smaller cap equities, the shorter-duration difference-in-differences model may introduce more bias into the results than a longer-duration model.

Equation 1 defines the difference-in-differences econometric model for the three market microstructure (dependent) variables in question: *Volume, Bid/Ask Spread*, and *Intraday Volatility*. For expositional and notational simplicity, Equation 1 only applies to the French equity market. A nearly identical specification applies to the Italian equity markets with only the dates (March 1, 2013) and market cap tax threshold (€0.5 billion) altered.

For each equity on each day, the dependent variable in Equation 1 is regressed against a dummy variable equal to one if the date is after August 1 (*Post Aug. 1*), a second dummy variable equal to one if the market cap of the company is greater than e1 billion on August 1, 2012 (*MarketCap ≥ €1B*),[20] the interaction of those two dummy variables (*Post Aug.*

17 Unlike Becchetti et al. (2013), this paper extends the analysis beyond a three month window, analyzes Italy in addition to France, and supplements the difference-in-differences analysis to incorporate data from countries that did not apply a transaction tax.

18 An alternative specification, described below, relaxes the assumption in the difference-in-differences model inBecchetti et al. (2013) that factors other than the tax had a proportional effect on all companies within a country.

19 See Saret (2013b) for an overview of the financial market implications of the February Italian elections.

20 Since the list of taxable equities in France is reassessed annually on January 1, the indicator variable for whether a firm is subject to the tax was recalculated for data after January 1, 2013. However, for the sake of clarity, Equation 1 ignores this complication.

*1 * MarketCap ≥ €1B*), and other control variables such as a constant and GICS sector-specific dummies. The error term E is allowed to vary over time and by equity (i.e., the model is a random effects panel regression).

Equation 1

$$Y = PostAug.1 + MarketCap \geq €1\text{B} + (PostAug.1 * MarketCap \geq €1\text{B}) + Other\ Control\ Variables + \varepsilon$$

In Equation 1, the primary independent variable of interest is the interaction term (*Post Aug. 1 * MarketCap ≥ €1B*). This dummy variable equals one for all days after the tax has taken effect (i.e., after August 1, 2012) for the 109 French companies subject to the tax. The value of the variable changes after January 1, 2013 for the eight firms whose tax status reversed on that date.

To understand how Equation 1 is a difference-in-differences model, consider the parameterized version of the equation:

$$Y_{it}^1 = \beta_0^1 + \beta_1^1(PostAug.1) + \beta_2^1(MarketCap \geq €1\text{B}) + \beta_3^1(PostAug.1 * MarketCap \geq €1\text{B}) + \beta_s^1(GICS\ sector\ dummies) + \varepsilon_{it}^1$$

The expected value of the dependent variable in Equation 1 (*i.e., Y*) before August 1, 2012 (i.e., the dummy variable *Post Aug. 1* equals zero) for equities with a market cap below the tax threshold (i.e., the dummy variable *MarketCap = €1B* equals zero) is:

$$E\left[Y_{it}^1 | PostAug.1 = 0,\ MarketCap \geq €1\text{B} = 0\right] = \beta_0^1 + \beta_s^1(GICS\ sector\ dummies)$$

Similarly, the expected value of the dependent variable after August 1, 2012 (i.e., the dummy variable *Post Aug. 1* equals one) for equities with a market cap below the tax threshold is:

$$E\left[Y_{it}^1 | PostAug.1 = 1,\ MarketCap \geq €1\text{B} = 0\right] = \beta_0^1 + \beta_1^1 + \beta_s^1(GICS\ sector\ dummies)$$

The difference between these two expectations is β_1^1, which reflects the change in the expected value of the dependent variable for equities below the €1B tax threshold before and after August 1. The table below summarizes the differences in the expected dependent variable before and after August 1 for companies below and above the tax threshold.

Firm Size	**Aug. 1, 2012**	**Expected Value of Dependent Variable** $E[Y_{it}^1 \mid \text{dummy variables}]^i$	**Difference**	**Difference-in-Differences**
$MarketCap < €1\text{B}$	Before	β_0^1	β_1^1	β_3^1
	After	$\beta_0^1 + \beta_1^1$		
$MarketCap \geq €1\text{B}$	Before	$\beta_0^1 + \beta_2^1$	$\beta_1^1 + \beta_3^1$	
	After	$\beta_0^1 + \beta_1^1 + \beta_2^1 + \beta_3^1$		

In plainer language, the coefficient (β_3^1) on the interacted dummy variables (i.e., *PostAug.1 * MarketCap* ≥ €1B) is the difference-in-differences term when the treatment group is French equities subject to the tax and the control group is French equities not subject to the tax.

The challenge with Equation 1 is that it assumes the transaction tax had no effect on equities not subject to the tax. In light of the information and other spillover effects between large capitalization equities and small capitalization equities within the same market (as in Lo and MacKinlay, 1990), that assumption seems unconvincing. Equation 1 also assumes that any factor other than the transaction tax had a proportional effect on equities subject to the tax as those not subject to the tax. This assumption may also be problematic if an economic or financial force (e.g., risk on/risk off) makes one group of assets (e.g., large cap equities) relatively more attractive than another (e.g., small cap equities).

Equation 2 extends the difference-in-differences model from Equation 1 to incorporate informa- tion from other markets. Again, for the sake of simplicity, this model only focuses on France, but a nearly identical specification applies to Italy.

Equation 2

$$Y = PostAug.1 + MarketCap \geq €1\text{B} + (PostAug.1 * MarketCap \geq €1\text{B}) + France + (MarketCap \geq €1\text{B} * France) + (PostAug.1 * France) + (PostAug.1 * MarketCap \geq €1\text{B} * France) + Other\ Control\ Variables + \varepsilon$$

In Equation 2, a dummy variable equal to one for companies listed on the French exchanges (France) is interacted with the date the tax was imposed (*PostAug.1*) and the market cap tax threshold (MarketCap ≥ €1B). The primary independent variables of interest are then the two difference-in-difference terms: *PostAug.1 * France* and *PostAug.1 * France * MarketCap* ≥ €1B. The first term equals one for all French equities after August 1 and captures the market-wide effect of the tax. The second term equals one for all French equities subject to the tax after August 1.

In effect, Equation 2 defines a new control group and two treatment groups. The control group consists of all companies not listed in France. The first treatment group is the set of publicly listed companies in France not subject to the tax. The second treatment group is the set of companies in France subject to the tax.

In addition to France and Italy, the countries included in the full data set used in Equation 2 include the world's largest equity markets in developed countries (Australia, Canada, Germany, Japan, Switzerland, U.K., and U.S.), as well as the other equity markets in Europe (Denmark, Finland, Ireland, Netherlands, Norway, Portugal, and Spain). In total, there are 15 countries in the data set, with daily data for each equity in each country from January 1, 2012 until August 31, 2013. The total number of observations exceeds 4.9 million. In order to prevent cross-contamination of the results, the regressions that analyze the French transaction tax exclude Italian equities. Similarly, the regressions that analyze the Italian transaction tax exclude French equities.

The following subsections offers greater detail on the regression results for both the single- country specifications (i.e., Equation 1) and multiple-country specifications (i.e., Equation 2) as well as the shorter time frames (i.e., +/- one month) and the full-time frame (January 1, 2012 until August 31, 2013). The August 31, 2013 cutoff date was chosen intentionally. In September 2013, the Italian government imposed an additional tax on derivatives. Addressing the effect of this tax might overly complicate the analysis.

A. Volume

Table IV reports the results from estimating Equations 1 and 2 for daily equity volumes. Similar to the distribution of market capitalizations, the distribution for daily equity volumes is skewed by the presence of some highly traded (mostly large market cap) equities. As a result, Table IV reports the panel regressions using the log of daily volume as the dependent variable. In comparison to the raw (i.e., non-log) daily volume, using log volumes in Equation 1 generates qualitatively similar results, but it improves the statistical fit of the model.

The first four columns of Table IV measure the change in volume due to the French transaction tax, while columns 5–8 refer to the Italian markets. The odd numbered columns restrict the analysis to only the country in question (i.e., Equation 1). For those models, the control group is the set of French (Italian) companies below the market cap tax threshold of e1B (e0.5B), and the treatment group is the set of companies above the threshold. The even numbered columns estimate Equation 2 and incorporate data from the full set of countries (U.S., U.K., Japan, Germany, etc.). For these columns, large French (Italian) equities subject to the tax can be compared to large non-French (non-Italian) equities as well as smaller French (Italian) equities not subject to the tax. In addition, these columns test for spillover effects on French (Italian) equities not directly subject to the tax but nevertheless indirectly effected due to broad, tax-driven changes in the French (Italian) equity markets.

Focusing first on the results for large French equities, the first four columns of Table IV show that equity volumes decreased for French equities subject to the tax after August 1, 2012 (the coefficient[21] on *Post Tax Date * Taxed Country Fixed Effect * MarketCap ≥ threshold* ranges from -0.09 to -0.47). This decline is incremental to the decline in equity volumes for French equities not subject to the tax (the coefficient on *Post Tax Date * Taxed Country Fixed Effect* ranges from -0.01 to -0.25). In other words, equity volumes fell for all French equities after the government imposed a transaction tax, but the effect was significantly larger for equities subject to the tax.

The results from the full time period and country data set available (i.e., column 4) indicate that equity volumes for French equities subject to the tax fell nearly 24 percentage points more than French equities not subject to the tax.[22] Equity volumes for French firms not subject to the tax fell 0.7 percent. Volumes for firms subject to the tax fell 24.2 percent.[23] To put this estimate in perspective, the CAC 40 benchmark index showed a 27 percent decline in volume on August 1 relative to the index's 15 day moving average, although that measurement does not take into effect other changes in the French equity markets (e.g., the August effect) or the broader French economy.

21 Note that where the data set only included a single country, the country fixed effect was dropped. However, for the sake of clarity in reading the table, results for the single-country regressions are reported in the row showing the fixed effect so that the difference-in-difference effect for companies above the tax threshold can be read from left to right without skipping rows.

22 Recall that the dependent variable is log volume, so calculating the percent change in volume requires a straight-forward algebraic manipulation of the coefficients in Table IV.

23 The difference-in-difference is then -0.7 percent minus -24.2 percent which equals -23.5 percentage points.

Table IV log(Volume)

	France				Italy			
	+/- 1 month		Full Period		+/- 1 month		Full Period	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Taxed Country Fixed Effect (FE) (*France* | *Italy*)		−3.19*** (0.13)		−2.17*** (0.11)		0.26 (0.19)		0.17 (0.19)
Post tax date (Aug.1, 2012 | March 1, 2013)		0.05*** (0.00)		0.05*** (0.00)		−0.01*** (0.00)		0.08*** (0.00)
Post tax date * Taxed Country FE	−0.20*** (0.02)	−0.25*** (0.02)	−0.01 (0.01)	−0.06*** (0.01)	−0.21*** (0.03)	−0.20*** (0.02)	0.01 (0.01)	−0.07*** (0.01)
Market Cap ≥ tax threshold (≥ *€1.0B* | ≥ *€0.5B*)		1.31*** (0.05)		1.23*** (0.04)		1.60*** (0.04)		1.38*** (0.04)
Market Cap ≥ tax threshold * Taxed Country FE	5.85*** (0.31)	4.25*** (0.29)	0.94*** (0.15)	−0.73*** (0.12)	3.59*** (0.30)	2.04*** (0.34)	3.77*** (0.31)	2.41*** (0.34)
Post tax date * Market Cap ≥ threshold		−0.19*** (0.01)		0.19*** (0.00)		0.13*** (0.01)		0.33*** (0.00)
Post tax date * Taxed Country FE * Market Cap ≥ threshold	−0.28*** (0.05)	−0.09** (0.04)	−0.27*** (0.02)	−0.47*** (0.01)	0.16*** (0.05)	0.03 (0.04)	−0.08*** (0.02)	−0.41*** (0.02)
Constant	−7.19*** (0.80)	−2.44*** (0.08)	−4.67*** (0.76)	−2.26*** (0.07)	−4.00*** (0.73)	−2.14*** (0.08)	−4.18*** (0.73)	−2.19*** (0.08)
Observations	23,518	573,129	216,917	5,350,873	9,488	474,387	98,999	4,917,260
Countries in data	France	All except Italy	France	All except Italy	Italy	All except France	Italy	All except France

NOTES

All monetary values expressed in euros. Data from Bloomberg.

Even numbered columns estimate Equation 1. Odd numbered columns estimate Equation 2. All models estimated using panel random eects and include sector fixed effects. Even numbered columns also include country fixed effects. For the sake of clarity in reading the table, results for the single-country regressions are reported in the row showing the fixed effects so that the difference-in-difference coefficient can be read from left to right without skipping rows.

Standard errors in parentheses.

***Significant at the 1 percent level. **Significant at the 5 percent level. *Significant at the 10 percent level.

A starker contrast exists between French equities with a market cap greater than €1B and non-French equities with a market cap greater than €1B. Based on the results in column 4, French equities with a market cap greater than €1B saw their equity volumes fall by 24 percent. Over the same period, non-French equity with a market cap greater than a €1B enjoyed 28 percent higher equity volumes. The difference between those two differences is 52 percentage points.

To test whether the transaction tax on large cap French equities created a negative spillover effect on small cap (i.e., untaxed) French equities, columns 2 and 4 of Table IV report the results from estimating Equation 2. As noted earlier, Equation 2 also controls for factors other than the tax that differentially affect large or small cap equities. The coefficient on *Post Tax Date * Taxed Country Fixed Effect* captures this change. In both columns 2 and 4, the coefficients are negative (-0.25 and -0.06) and statistically signicant. Column 2 implies that the equity volume for French companies with market cap less than €1 billion fell by 23 percentage points relative to the equity volume of non-French companies with a market cap less than €1 billion. The magnitude of the effect estimated in Column 4 is smaller (6 percentage points) but still statistically different than zero. The difference between columns 2 and 4 may reflect the French proclivity for taking vacations in August (Saret, 2013a), which manifests as a larger decline in equity trading volumes in France during the month of August than in many other countries.

The results for Italy appear a bit more complex. Similar to columns 1 and 2 of Table IV that refer to France, columns 5 and 6 also focus on the two month window (i.e., one month before and one month after) centered on the date that the tax was imposed (March 1, 2013) in Italy. The estimated coefficients *Post tax date * Taxed Country FE* indicate that overall volumes declined for all Italian equities after the tax was imposed, but the decline was smaller for equities subject to the tax than for equities not subject to the tax. In other words, the coefficients on *Post Tax Date * Taxed Country Fixed Effect * MarketCap ≥ threshold* in columns 5 and 6 are greater than zero but smaller in magnitude than the coefficients on *Post tax date * Country FE*.

There are numerous potential explanations for the positive sign on the coefficients for *Post Tax Date * Taxed Country Fixed Effect * MarketCap ≥ threshold* in columns 5 and 6. One explanation might be that the short-term results are skewed by the economic and political uncertainty following the Italian national parliamentary election held in late February. The party that captured a plurality of the vote from that election required several weeks to forge a coalition, during which time the party's leader resigned and, more importantly for equity markets, the likelihood for a dramatic change in economic policy (e.g., the ending or delaying of fiscal austerity in Italy) fluctuated.[24] Another potential explanation is that the timing and/or provisions of the law surprised market participants in Italy more than in France.[25] As a result, it required a longer period for the market to react to the structural changes. A third potential explanation is statistical chance, as the coefficient is significant in column 5 but not in column 6.

The longer term results measured in columns 7 and 8 are more consistent with both the theoretical and historical estimates of the effect of transaction taxes on equity volumes. Column 7 suggests that the equity volume for taxed companies in Italy fell by 8 percentage points relative to untaxed companies in Italy. Column 8 suggests that volumes

24 For a more detailed overview of the effect of political uncertainty on financial markets during this period, see Saret (2013b).

25 Anecdotal evidence based on discussions with some market participants.

Table V Bid/Ask Spread % of open price

	France				Italy			
	+/- 1 month		Full Period		+/- 1 month		Full Period	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Taxed Country Fixed Effect (FE) (*France* | *Italy*)		−4.78*** (0.39)		−4.62*** (0.30)		−4.60*** (0.49)		−3.35*** (0.46)
Post tax date (Aug.1, 2012 | March 1, 2013)		−0.10*** (0.01)		0.42*** (0.00)		0.25*** (0.01)		0.48*** (0.00)
Post tax date * Taxed Country FE	−0.12*** (0.01)	−0.02 (0.04)	−0.22*** (0.00)	−0.64*** (0.02)	0.26*** (0.02)	0.03 (0.06)	−1.11*** (0.01)	−1.57*** (0.03)
Market Cap ≥ tax threshold (≥*€1.0B* | ≥*€0.5B*)		−6.10*** (0.14)		−5.60*** (0.12)		−5.45*** (0.12)		−5.39*** (0.11)
Market Cap ≥ tax threshold * Taxed Country FE	−1.85*** (0.13)	4.21*** (0.86)	−0.40*** (0.07)	5.60*** (0.34)	−1.36*** (0.11)	4.17*** (0.88)	−1.73*** (0.12)	3.75*** (0.82)
Post tax date * Market Cap ≥ threshold		0.07*** (0.02)		−0.53*** (0.01)		−0.25*** (0.02)		−0.56*** (0.01)
Post tax date * Taxed Country FE * Market Cap ≥ threshold	0.12*** (0.03)	0.06 (0.09)	0.21*** (0.01)	0.75*** (0.04)	−0.10*** (0.03)	0.12 (0.11)	0.32*** (0.02)	0.86*** (0.05)
Constant	2.30*** (0.36)	6.92*** (0.23)	1.75*** (0.31)	6.53*** (0.19)	1.62*** (0.27)	6.13*** (0.20)	3.01*** (0.29)	6.02*** (0.19)
Observations	21,862	568,746	205,039	5,296,493	9,472	474,054	98,390	4,930,365
Countries in data	France	All except Italy	France	All except Italy	Italy	All except France	Italy	All except France

NOTES

All monetary values expressed in euros. Data from Bloomberg.

Even numbered columns estimate Equation 1. Odd numbered columns estimate Equation 2. All models estimated using panel random eects and include sector fixed effects. Even numbered columns also include country fixed effects. For the sake of clarity in reading the table, results for the single-country regressions are reported in the row showing the fixed effects so that the difference-in-difference coefficient can be read from left to right without skipping rows.

Standard errors in parentheses.

***Significant at the 1 percent level. **Significant at the 5 percent level. *Significant at the 10 percent level.

for untaxed companies in Italy fell by 7 percentage points relative to similarly sized companies in other equity markets. Volumes on taxed Italian equities fell by 6 percentage points, while comparably sized non-Italian equities saw a 51 percentage point increase in volumes.

B. Bid/Ask Spread

Table V reports the results from estimating Equations 1 and 2 for daily bid/ask spreads as a percent of the day's open price. Again, focusing on the coefficients on *Post Tax Date * Taxed Country Fixed Effect * MarketCap ≥ threshold* show that bid/ask spreads tended to increase due to the tax. Similar to the situation with Italian equity volumes, the results in columns 5 and 6 appear to be outliers relative to the theoretical and empirical research that consistently shows that spreads widen due to the tax.

In most cases, these estimates are statistically and economically significant. Compared to both the mean (0.27 percent of the equity's open price) and median (0.13 percent) bid/ask spreads for French equities with market caps greater than €1 billion, the increase in the bid/ask spread in France was large. Column 4 shows that the bid/ask spread as a percent of the open price increased by 75 basis points. When compounded with the French transaction tax itself (0.20 percent), the effective cost of entering a position more than tripled (as a percent of the open price) for the average equity.

The results in Italy over the longer-term (columns 7 and 8) are even more economically significant. The bid/ask spread on taxed companies in Italy (median value of 0.28 percent) increased by 86 basis points relative to comparably sized companies outside Italy. While the median bid-ask spreads in Italy (0.28 percent) tend to be twice as high for companies subject to the tax than French companies subject to the tax (0.12 percent), the tax rate in Italy was much lower (0.12 percent versus 0.2 percent), which implies that the effect of the tax in Italy was proportionally more significant. Part of the explanation for the significantly larger effect in Italy than France may lie with the fact that the French law granted greater flexibility to market makers (e.g., using swaps) than the Italian law. Further research, using intraday data, is likely necessary to address this question.

C. Intraday Volatility

As noted earlier, past theoretical and empirical research have offered conflicting guidance on the effect of transaction taxes on volatility. Arguments for decreased volatility tend to focus on the reduction in speculative trading (e.g., Tobin (1978), Stiglitz (1989), and Summers and Summers (1989)). Arguments for increased volatility focus on the lower volumes and liquidity, which exacerbate changes to small perturbations in financial market supply and demand curves (e.g., Amihud and Mendelson (2003) and Pomeranets and Weaver (2011)). Roll (1989) finds no evidence that transaction taxes affect volatility.

The results for France and Italy rest squarely on the fence of the debate. For both countries, there was no meaningful change (two decimal points) in intraday volatility after the tax was imposed. This result applies to both taxed and untaxed companies. The results do not depend on whether the panel regression model only includes a single country or the full set of countries. In short, factors other than the tax likely have a more meaningful effect on intraday volatility than the tax itself.

Table VI Intraday Price Volatility ($\frac{\text{High—Low}}{\text{Open Price}} * 100\%$)

	France				Italy			
	+/- 1 month		Full Period		+/- 1 month		Full Period	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Taxed Country Fixed Effect (FE)		−0.07		−0.26		−0.02***		−0.05
(*France* | *Italy*)		(0.06)		(0.30)		(0.01)		(0.05)
Post tax date		0.01		−0.09***		−0.00		0.02**
(Aug.1, 2012 | March 1, 2013)		(0.01)		(0.02)		(0.00)		(0.01)
Post tax date * Taxed Country FE	−0.00***	−0.01	−0.00***	0.08	−0.00***	−0.00	−0.01***	−0.03
	(0.00)	(0.03)	(0.00)	(0.10)	(0.00)	(0.00)	(0.00)	(0.07)
Market Cap ≥ tax threshold		−0.06***		−0.26**		−0.03***		−0.05***
(≥€*1.0B* | ≥€*0.5B*)		(0.02)		(0.11)		(0.00)		(0.01)
Market Cap ≥ tax threshold *	0.00**	0.07	0.00	0.26	−0.00**	0.03***	−0.00***	0.05
Taxed Country FE	(0.00)	(0.14)	(0.00)	(0.63)	(0.00)	(0.01)	(0.00)	(0.09)
Post tax date *		−0.01		0.09**		0.00		−0.02
Market Cap ≥ threshold		(0.01)		(0.04)		(0.00)		(0.02)
Post tax date * Taxed Country FE *	−0.00***	0.01	−0.00***	−0.09	0.00***	0.00	0.00***	0.02
Market Cap ≥ threshold	(0.00)	(0.07)	(0.00)	(0.21)	(0.00)	(0.01)	(0.00)	(0.12)
Constant	0.02***	0.07*	0.02***	0.16	0.03***	0.06***	0.03***	0.07***
	(0.01)	(0.04)	(0.01)	(0.17)	(0.00)	(0.00)	(0.00)	(0.02)
Observations	23,038	580,780	212,698	5,402,574	9,488	483,492	98,999	5,025,966
Countries in data	France	All except Italy	France	All except Italy	Italy	All except France	Italy	All except France

NOTES

All monetary values expressed in euros. Data from Bloomberg.

Even numbered columns estimate Equation 1. Odd numbered columns estimate Equation 2. All models estimated using panel random eects and include sector fixed effects. Even numbered columns also include country fixed effects. For the sake of clarity in reading the table, results for the single-country regressions are reported in the row showing the fixed effects so that the difference-in-difference coefficient can be read from left to right without skipping rows.

Standard errors in parentheses.

***Significant at the 1 percent level. **Significant at the 5 percent level. *Significant at the 10 percent level.

III. Effect on Rate of Information Absorption

While the change in market microstructure due to the imposition of the transaction tax presents important information for active managers, it only tells part of the story. Changes in market efficiency, such as the speed with which market prices reflect new information, also remain critical for creating active returns in excess of the market.

The relationship between information flows and the speed of price adjustment is not a new topic. Lo and MacKinlay (1990) show that equities with larger market capitalization react faster than smaller cap equities to new information that affects market-wide returns. Brennan, Jegadeesh and Swaminathan (1993) attribute part of this effect to the difference in the number of equity analysts covering a particular equity. Surprisingly, there has been significantly less study of this information lag effect following changes in transaction taxes.[26]

To estimate the change in the rate of information absorption in equity returns, this analysis utilizes a test developed by Mech (1993) and applied by Hou and Moskowitz (2005). For computational tractability, the type of information is restricted to news that affects the returns to the entire market (i.e., common information). Both Mech (1993) and Hou and Moskowitz (2005) show that their measure of the delay in a single equity's absorption of common information news absorption can explain equity premiums not otherwise explained by size, liquidity, or microstructure effects. Mech (1993) further argues that transaction costs (as measured by the bid/ask spread) slow the price adjustment mechanism for equities and thereby create autocorrelation in a portfolio.[27]

The test described by Mech (1993) and Hou and Moskowitz (2005) involves two steps. The first step is to identify the change in the return to equity *j* in period *t* (r_{jt}) that can be explained by contemporaneous ($R_{m,t}$) and lagged ($R_{m,t-n}$) changes in the market returns R_m. Equation 3 expresses this relationship. If an equity responds immediately to market news, the coefficient on contemporaneous market returns (β_j) will be significantly different than zero, but the coefficients ($\delta_j^{(-n)}$) on the lagged market returns will not. However, if equity j responds with some delay, than some of the $\delta_j^{(-n)}$ coefficients will be significantly different than zero.

Equation 3

$$r_{j,t} = \alpha_j + \beta_j R_{m,t} + \sum_{n=1}^{N} \delta_j^{(-n)} R_{m,t-n} + \varepsilon_{j,t}$$

The second step is to use the estimated coefficients from Equation 3 to construct a measure of price delay for each equity *j*. The delayed price adjustment for a given equity can be quantified by the fraction of variation in individual equity returns that can be explained by lagged market returns. As expressed in Equation 4, the *Delay* measure is simply one minus the ratio of the R^2 for the regression model described by Equation 3 in which the coefficients on all lagged market returns are constrained to zero divided by the R^2 for the unrestricted version of Equation 3.

26 This author found no such published articles when searching thorough JSTOR.

27 Mech (1993) argues that this finding is inconsistent with the efficient markets hypothesis.

Equation 4

$$Delay = 1 - \frac{R^2_{\delta_j^{(-n)}=0, \forall n \in [1,20]}}{R^2}$$

More intuitively, the numerator in Equation 4 is the fraction of an individual's equity returns that can be explained only by contemporaneous changes in the market returns. The denominator is the fraction of an individual equity's return that can be explained by contemporaneous and lagged market returns. If all common information is assimilated immediately into an individual equity's return, then the ratio of the numerator and denominator should be one and the equity-specific measure $Delay_j$ should be zero. Conversely, if lagged market returns explain all of an individual equity's return, then the numerator in Equation 4 should be zero and the $Delay_j$ measure should be one. Simply, the larger the *Delay* measure, the more that lagged market returns explain current individual equity returns, which implies that market prices reflect new information more slowly.

Mech (1993) argues that the *Delay* measure allows for the comparison of equities with different risk characteristics. The equity specific R^2 calculated in Equation 2 increases with the equity's market risk and decreases with its idiosyncratic risk. Using the ratio of R^2 makes the *Delay* measure insensitive to a single equity's risk.[28]

Testing for the change in the degree of delay following the imposition of the transaction tax is straightforward. Consider the case for France (the case for Italy is analogous). The *Delay* measure in Equation 4 can be calculated for each equity before and after the transaction tax was imposed on August 1, 2012.[29] To test whether the transaction tax increased the delay, Equation 5 describes an ordinary least squares (OLS) regression. The dependent variable is the change in *Delay* for each equity *j*. The independent variables include a dummy equal to one for companies with a market capitalization greater than €1 billion on August 1, 2012, the log value for the company's market capitalization on August 1, and the interaction between those two terms:

Equation 5

$$\Delta Delay_j = MarketCap \geq €1\text{B} + log(MarketCap) + MarketCap \geq €1\text{B} * log(MarketCap)$$

The interaction term between *MarketCap ≥ €1B* and *log (MarketCap)* tests whether companies significantly larger than the tax threshold (i.e., companies with a market cap significantly more or significantly less than *€1B*) were affected differently than companies slightly above the threshold.

Similar to Equation 1, Equation 5 applies only when the control group is the set of French companies not subject to the tax (i.e., French equities with a market cap less than e1 billion on August 1, 2012) and the treatment group is the set of French companies that are subject to the tax. This analysis has the advantage of obfuscating any cross-country,

28 Hou and Moskowitz (2005) liken the Delay measure to an F-test on the joint significance of all the lagged variables

29 The eight French companies whose tax status changed on January 1, 2013 present a complication. Since Equation 4 requires a look-back period to calculate an R2, applying econometric tools like panel models and/or regression discontinuity models would prove unnecessarily complicated, especially in light of the relatively few number of tax status changes. Instead, this paper simply drops those eight companies from the data set after January 1, 2013. Applying alternative specifications (e.g., including them in the data set or dropping them entirely) had no economically meaningful effect on the results.

time-varying differences in markets, but it assumes that any change, other than the financial transaction tax, affected companies above the tax threshold in a proportional manner to any company below the tax threshold. Akin to Equation 2, Equation 6 expands the data set to include other countries and introduces country-specific fixed effects:

Equation 6

$$\begin{aligned}\Delta Delay_j = & MarketCap \geq €1\text{B} + log(MarketCap) + \\ & MarketCap \geq €1\text{B} * log(MarketCap) + \\ & MarketCap \geq €1\text{B} * France + \\ & log(MarketCap) * France + \\ & MarketCap \geq €1\text{B} * log(MarketCap) * France\end{aligned}$$

Table VII reports the results for an OLS regression of Equations 5 and 6. Similar to the previous tables, the first two columns of Table VII refer to France, and the second two columns refer to Italy. The even numbered columns use data that cover single countries (i.e., Equation 5), while the odd numbered columns use the full set of countries (Equation 6). In all cases, the coefficient on the coefficient *Market Cap ≥ tax threshold * Taxed Country Fixed Effect*[30] is positive, which implies that the transaction tax increased the delay between market wide news and changes in an equity's price.

All four columns in Table VII report a positive coefficient on the dummy variable *MarketCap ≥ threshold * Taxed Country Fixed Effect*, which shows that companies subject to the tax suffered an increase in the delay in the time required for news that affected the broad market to be fully reflected in an individual company's equity price. This result is statistically significant and controls for other factors such as market capitalization and country and sector fixed effects. Using the coefficients in column 2 and the median market capitalization for companies in France subject to the tax, the results show that *Delay* increased by more than 30 percent after transaction taxes were imposed. This is consistent with Mech (1993), who also shows that higher transaction costs tend to slow the rate that an individual equity reflects market-level information. In Italy, the increase in *Delay* was even greater at 170 percent. More research is necessary to understand the differences in results between France and Italy.[31]

For companies not directly affected by the transaction tax, (i.e., those with a market capital ization below the tax threshold), the average delay also increased. Using the median value for *log (Market Cap)* as of the date the tax was imposed for companies not subject to the tax in France shows that mean *Delay* increased by nearly 10 percent relative to the

30 Note (as above), where the data set only included a single country, the country fixed effect was dropped. However, for the sake of clarity in reading the table, results for the single-country regressions are reported in the row showing the fixed effect so that the effect for companies in taxed countries can be read from left to right without skipping rows.

31 One potential avenue to explore is the role of market makers in each country, as the tax exemptions for market makers differed significantly in France and Italy. See, for example, PricewaterhouseCoopers (2013).

mean *Delay* before the tax was imposed. The comparable value for Italian equities was 41 percent. This is consistent with Lo and MacKinlay (1990), who argue that a portfolio of small cap equities is correlated with the lagged returns on a portfolio of large cap equities, but not vice versa. Since information tends to spread from larger cap equities to smaller cap equities, an increase in the delay for larger cap equities should also trickle down to smaller cap equities.

The interaction terms between *Market Cap ≥ tax threshold and log(MarketCap)* are all negative. This shows that for companies subject to the transaction tax, the tax increased *Delay* overall but relatively less so for larger cap equities. Intuitively, the transaction tax afflicted larger cap (and generally more liquid) equities less than smaller cap equities that were also subject to the tax.

One downside of the *Delay* measure is that it is bounded by the unit interval, which violates the assumptions behind ordinary least squares estimation that the dependent variable is normally distributed. As a robustness check to the results reported in Table VI, this paper following Mech (1993) in applying a log transformation to the *Delay* variable in Equation (4), which requires dropping the observations for which the *Delay* variable is zero. The results, not reported here, are qualitatively the same as the original model and statistically more significant, albeit on a smaller sample.

An obvious question is what was the mechanism by which the transaction tax increase decreased the informational efficiency (i.e., increased the *Delay* variable) for equities subject to the tax. Unfortunately, the answer appears less obvious. Changes in the market microstructure—volume, bid/ask spread, and intraday price volatility—explain only a small fraction of the variation.

Table VIII reports the results of an analysis of the market microstructure changes on the *Delay* variable for both French and Italian taxes. To augment Equation 6, three new variables are calculated for each equity both before and after France and Italy imposed their respective taxes: the mean volume, mean bid/ask spread as a percent of the open price, and the mean intraday price relationship to the change in *Delay*. The third variable has no statistically significant effect. As importantly, the R^2 and *Adjusted* R^2 for columns 4 and 8 in Table VIII are only slightly higher than the corresponding values in Table VII. This suggests that the market microstructure variables add little in the way of explaining the change in market informational efficiency.

Table VII Change in Measure of Price Delay (ΔDelay)

		All Companies[i]	Taxed Companies[ii] (Market Cap ≥ €0.5B)	Untaxed Companies[ii] (Market Cap < €0.5B)
Market Cap	Obs	106,760	31,923	74,837
Millions €	Mean	1,405.973	4,446.121	109.146
	Median	105.455	1,463.970	54.560
	Std. Dev	5,232.885	8,846.185	243.267
	Min	0.170	38.030	0.170
	Max	74,780.050	74,780.050	4,694.480
Transactions Volume	Obs	106,760	31,923	74,837
Daily number of shares	Mean	4,731.827	11,622.752	1,792.385
traded in thousands	Median	65.8035	895.192	21.503
	Std. Dev	38,798.677	39,330.752	38,193.310
	Min	0.000	0.000	0.000
	Max	4,291,759.032	1,449,208.851	4,291,759.032
Bid/Ask Spread[iii]	Obs	105,290	31,912	73,378
% of open price	Mean	2.003	0.848	2.505
	Median	1.289	0.249	1.862
	Std. Dev	2.085	1.324	2.154
	Min	0.063	0.063	0.063
	Max	7.728	7.728	7.728
Intraday Volatility	Obs	106,744	31,923	74,821
$\frac{\text{High}-\text{Low}}{\text{Open Price}}$	Mean	0.034	0.033	0.035
	Median	0.029	0.028	0.029
	Std. Dev	0.028	0.022	0.031
	Min	0.000	0.000	0.000
	Max	0.844	0.844	0.667
Daily Return	Obs	106,760	31,923	74,837
$ln(\frac{\text{Close Price}}{\text{Previous Close Price}})$	Mean	0.000	0.001	-0.000
	Median	0.000	0.000	0.000
	Std. Dev	0.046	0.049	0.044
	Min	-2.871	-2.871	-2.170
	Max	4.605	4.588	4.605
Number of Companies[ii]	Count	254	77	177

NOTES

All regressions include sector fixed effects. Columns 2 and 4 also include country fixed effects.

Where the data set only included a single country, the country fixed effect was dropped. However, for the sake of clarity in reading the table, results for the single-country regressions are reported in the row showing the country fixed effect so that the Delay for companies above the tax threshold can be read from left to right without jumping across rows.

Standard errors in parentheses.

***Significant at the 1 percent level. **Significant at the 5 percent level. *Significant at the 10 percent level.

Table VIII Change in Measure of Price Delay (ΔDelay) with additional control variables

	France				Italy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Taxed Country Fixed Effect (FE)	−0.051*	−0.049*	−0.052**	−0.048*	−0.027	−0.018	−0.028	−0.017
	(0.026)	(0.027)	(0.027)	(0.026)	(0.052)	(0.053)	(0.053)	(0.053)
Market Cap ≥ tax threshold	0.026	0.040**	0.037**	0.029*	0.148***	0.158***	0.152***	0.153***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.014)	(0.014)	(0.014)	(0.014)
Market Cap ≥ tax threshold * Taxed Country FE	0.404***	0.390***	0.393***	0.401***	0.665***	0.657***	0.661***	0.661***
	(0.143)	(0.144)	(0.144)	(0.143)	(0.167)	(0.167)	(0.167)	(0.167)
log(Market Cap)	−0.003***	−0.003***	−0.003***	−0.003***	0.021***	0.022***	0.021***	0.022***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
log(Market Cap) * Taxed Country FE	0.013**	0.013**	0.013**	0.013**	0.033***	0.032**	0.033***	0.032**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.013)	(0.013)	(0.013)	(0.013)
Market Cap ≥ tax threshold * *log*(Market Cap)	−0.005**	−0.007***	−0.006***	−0.006***	−0.024***	−0.026***	−0.025***	−0.025***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Market Cap ≥ tax threshold * *log*(Mkt. Cap) * Taxed Country FE	−0.050***	−0.048***	−0.048***	−0.049***	−0.101***	−0.099***	−0.100***	−0.100***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.024)	(0.024)	(0.024)	(0.024)
%Δ Mean Volume	0.000***			0.000***	0.000***			0.000***
	(0.000)			(0.000)	(0.000)			(0.000)
Δ Mean Bid/Ask Spread % of open price		0.002***		0.002***		0.003***		0.003***
		(0.001)		(0.001)		(0.001)		(0.001)
Δ Mean Intraday Price Volatility			0.000	0.000			0.001	0.001
			(0.000)	(0.000)			(0.001)	(0.001)
Constant	0.093***	0.090***	0.094***	0.089***	0.064***	0.058***	0.065***	0.057***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)
Observations	14,521	14,513	14,520	14,513	12,899	12,885	12,900	12,885
R^2	0.127	0.118	0.118	0.128	0.140	0.138	0.136	0.141
Adjusted R^2	0.126	0.116	0.116	0.126	0.138	0.136	0.134	0.139

Notes: See notes below Table VII.

NOTES

See notes below Table VII

IV. Conclusion

At any market price, a transaction tax diminishes the marginal incentive for a seller to part with a security and the marginal desire for a buyer to acquire the security. Policy makers can debate whether those distortions improve or harm social welfare. Long-term institutional investors tend to focus on two questions more salient to their portfolios: (1) How will a transaction tax affect the cost of entering and exiting a position and (2) Will transaction taxes benefit or harm the net alpha (i.e., market outperformance) generation process for the active managers in an investor's portfolio?

The answer to the first question is relatively straightforward. The tax itself (obviously) imposes a direct cost. Similar to analyses of other markets, this paper also quantifies some of the indirect effects that the taxes have on the market microstructure in France. Transaction taxes reduce market volumes, and lower volumes tend to increase trade "slippage" costs (i.e., the extent to which the market moves against a trader placing a large order). Transaction taxes also lead to wider bid/ask spreads, which has the effect of transferring more of the returns of trading from investors to market makers. For active managers, accurately incorporating these changes in an optimized trading process necessitates analytical bandwidth.

The answer to the second question is less straightforward but still intuitive. On the one hand, the increasing cost of entering and exiting a position consumes some of the gross alpha. This is particularly true for funds that turn over their positions more frequently. This may also be true for funds that are more concentrated in their holdings. Managers operating a more diversified portfolio may be able to utilize a wider set of equities (some taxed and some untaxed) and instruments to express their views.

On the other hand, as the recent experiences in France and Italy highlight, transaction taxes affect more than just market microstructure. They also reduce market efficiency. More specifically, the lag for common (i.e., market-wide) information to affect individual equity prices seems to increase following the imposition of the tax. This effect was particularly pronounced for equities subject to the tax, but the cascading effect described by Lo and MacKinlay (1990) whereby larger cap equities react more quickly to common information than smaller cap equities also seems to apply in France and Italy. The delay increased for both equities subject to the tax and, to a lesser extent, equities not subject to the tax. Higher turnover funds, to the extent that they are capable of entering and exiting positions more rapidly, may benefit from such technical opportunities more than their lower turnover (and presumably slower) peers.

Of course, not all active managers are alike. An active manager that can enter and exit a position more efficiently (independent of speed) than other market participants has a distinct advantage. Whether that opportunity exceeds the costs (direct and indirect) of the tax likely depends on the parameters of the tax, the forecasting and execution acumen of the manager, and the magnitude of the potential price change.

The bottom line for active investors is that there is potentially alpha to be found, and not just preserved, through a deeper understanding of how the transaction taxes affect the behavior of market participants. New taxes may mean new patterns that can potentially be modeled and traded. Transaction taxes are not simply another cost to bear.

Appendix A Securities Transaction Taxes in G20 and Selected Other Markets

Country	Equities	Bonds/Loans	Foreign exchange transactions	Derivatives
Argentina	Federal stamp duty on share transfers abolished in 2001	Provincial stamp duty, usually 1%, may affect bonds and debentures		
Australia				
Brazil	Eliminated tax (IOF) in 2013	Eliminated tax (IOF) in 2013	Eliminated tax (IOF) in 2013	Eliminated tax (IOF) in 2013
China	0.1% of principal paid by seller			
European Union	0.1% for sellers and buyers planned for 11 countries (Germany, France, Italy, Spain, Belgium, Austria, Greece, Portugal, Slovakia, Slovenia, and Estonia). Details and implementation to be determined. Potentially a cascading tax			0.01% on notional value planned for trades tied to specific countries
France	0.20% for buyer (exceptions for equities with less than €1.0B market cap, market makers, and positions held less than 1 day)			
Hong Kong	0.10% for both buyers and sellers. Transaction levy of 0.03% also charged to both sides by Securities and Futures Commission (SFC)			
India	0.125% for both buyers and sellers on delivered trades. 0.025% on intraday transactions for the seller			Equity options: 0.017% on premium for seller and 0.0125% on exercise paid by purchaser Commodity derivatives: 0.01% since 2013. Futures: 0.01% on delivery price paid by seller for both equity-linked and commodity-linked contracts
Indonesia	0.10% tax on sale of equities on the IDX. Additional 0.04% IDX levy on value of all transaction to both buyers and sellers			
Italy	0.12% for on-market transactions and 0.22% for OTC (exceptions for equities with less than €0.5B market cap) paid by buyer	0.25%-2% on loan principal		Derivatives tax implemented Sep. 1, 2013. Tax varies by type of instrument

Continued on next page.

Appendix A Continued Securities Transaction Taxes in G20 and Selected Other Markets

Country	Equities	Bonds/Loans	Foreign exchange transactions	Derivatives
Argentina	Federal stamp duty on share transfers abolished in 2001	Provincial stamp duty, usually 1%, may affect bonds and debentures		
Australia				
Brazil	Eliminated tax (IOF) in 2013	Eliminated tax (IOF) in 2013	Eliminated tax (IOF) in 2013	Eliminated tax (IOF) in 2013
China	0.1% of principal paid by seller			
European Union	0.1% for sellers and buyers planned for 11 countries (Germany, France, Italy, Spain, Belgium, Austria, Greece, Portugal, Slovakia, Slovenia, and Estonia). Details and implementation to be determined. Potentially a cascading tax			0.01% on notional value planned for trades tied to specific countries
France	0.20% for buyer (exceptions for equities with less than €1.0B market cap, market makers, and positions held less than 1 day)			
Hong Kong	0.10% for both buyers and sellers. Transaction levy of 0.03% also charged to both sides by Securities and Futures Commission (SFC)			
India	0.125% for both buyers and sellers on delivered trades. 0.025% on intraday transactions for the seller			Equity options: 0.017% on premium for seller and 0.0125% on exercise paid by purchaser Commodity derivatives: 0.01% since 2013. Futures: 0.01% on delivery price paid by seller for both equity-linked and commodity-linked contracts
Indonesia	0.10% tax on sale of equities on the IDX. Additional 0.04% IDX levy on value of all transaction to both buyers and sellers			
Italy	0.12% for on-market transactions and 0.22% for OTC (exceptions for equities with less than €0.5B market cap) paid by buyer	0.25%-2% on loan principal		Derivatives tax implemented Sep. 1, 2013. Tax varies by type of instrument

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Source: Pomeranets (2012), Matheson (2011), and author's analysis

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