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Global Market Surveillance*

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This paper provides evidence on market surveillance from exchanges and securities commissions from twenty-five jurisdictions in North, Central and South America, Western and Eastern Europe, Africa, and Asia. Exchanges as SROs engage in a greater range of single-market surveillance of market manipulative practices than securities commissions, but the scope of cross-market surveillance activity is very similar among exchanges and securities commissions. Cross-market surveillance is more effective with information-sharing arrangements, and securities commissions are more likely to engage in information sharing than exchanges are. Relative to the scope of single-market surveillance, the scope of cross-market surveillance shows a stronger positive association with trading velocity, the number of listed companies, and market

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capitalization. The data also indicate that as at 2005, there is ample scope for jurisdictions to expand their cross-market surveillance and thereby stimulate investor confidence and trading activity. (*JEL* G12, G14, G18, K22)

1. Introduction

In this paper, we examine the market surveillance activities of exchanges and securities commissions[1] from twenty-five jurisdictions in North, Central, and South America, Western and Eastern Europe, Africa, and Asia. We study both single- and cross-market surveillance of market trading to detect manipulative practices carried out by market participants,[2] and relate surveillance activities to trading velocity, listings and market capitalization for a sample of emerging and developed stock markets. Exchanges are basically commercial entities in the business of providing a trading platform for securities and other market contracts. Years ago, trading of securities and market contracts were carried out on trading floors, therefore these were deemed to be the "profit center" of an exchange. Most exchanges around the world, however, have moved on to use electronic trading platforms or systems as more products are traded on a given exchange and more securities houses seek to trade across markets and jurisdictions. Surveillance departments within an exchange carry out the surveillance activities of an exchange, to detect and prevent manipulative practices, which will inevitably be carried out where there is a profit to be made. These surveillance activities are carried out at a cost to an exchange organization, or, rather, surveillance departments are "cost centers." Knowing how the costs of surveillance facilitate the profits of trading activity and the like has been a fundamental question for market integrity and the operation of an exchange (Aitken and

1. For the purposes of this paper, reference to exchanges include organizations that provide a market or markets for one or more of the following products: shares, corporate bonds, government bonds, convertible bonds, warrants, units in collective undertakings, mutual funds, exchange-traded funds, forward interest rate agreements, interest rate, currency and/or equity swaps, exchange-traded options, futures, asset-backed securities, money-market instruments, and derivatives on commodities and other exotic instruments.

2. Unless otherwise indicated, "cross-market" refers to cross-product, cross-market (e.g., two exchanges in one jurisdiction) as well as cross-border (more than one jurisdiction).

Siow, 2003).[3] In this paper, we attempt to explore the relationship between surveillance activities (the cost center) and trading activity (the profit center) to determine the effectiveness of surveillance and its effect on trading velocity, listings, and market capitalization.

Market manipulation refers to a wide range of trading practices that distort prices and enable market manipulators to profit at the expense of other participants, creating information asymmetries. Market surveillance is carried out by exchanges and securities commissions to detect such market manipulation by market participants. The manipulative practices are varied in nature, although there are more commonplace or "standard" practices that are easily identifiable. For example, "insider trading"—the trading of securities based on information unavailable to the general public—is an example of a manipulative practice that is easily identifiable by the public. Other less well publicized manipulative practices include "spoofing" or "painting the tape," which refers to a trader engaging in a series of transactions reported on a public display facility to give the impression of activity or price movement in a security (e.g., misleading trading, switches, giving up priority, layering bid/asks, fictitious orders for the case of spoofing, etc.). "Pumping and dumping" or "ramping" refers to a trader buying at increasingly higher prices, whereby securities are sold in the market (often to retail customers) at the higher prices. There are many other examples of manipulative behavior including, but not limited to, "advancing the bid," "front running," "churning," "capping/pegging," etc.; each defined herein. The types of market activity that exchanges and third-party providers view as suspicious include activities that are objectionable because they are fraudulent (e.g., insider trading) or violate fiduciary responsibilities (e.g., front running). Unless specific terms are indicated, this paper uses "manipulation" as an omnibus term covering all types of market activity that an exchange or regulator may wish to prohibit. This list of manipulative practices is by no means exhaustive as new, more innovative manipulative behavior remain to be labeled as "standard." Also, as electronic trading platforms or systems provide easier trading access across products, markets, and jurisdictions, manipulative practices no longer remain restricted to a single exchange or

3. This view was shared by the heads of the market surveillance departments at a number of different securities commissions and stock exchanges around the world at the 2005 SMARTS, Inc. Conference in Stockholm.

market. Ideally, in the interest of market integrity, surveillance authorities have sophisticated mechanisms to detect such manipulative trading within their own market, as well as across markets, and jurisdictions.

While the terms insider trading and market manipulation are commonplace in the literature, the formal discipline in which these concepts take center stage, namely, market surveillance, has traditionally been shrouded in secrecy. The oft-cited reason for this opaqueness is to refrain from giving would-be insider traders and/or market manipulators inspiration or ideas that might allow them to work the system to avoid detection. But arguably, in view of the intense competition for both new listings and trades, companies and investors should be in a position to compare and contrast the capabilities of different surveillance authorities as part of making a considered judgment about the risk/benefits of listing and investing in particular markets. Because manipulative activities are likely to have adverse consequences in terms of attracting new listings/investors to, and retaining existing listings/investors in, a marketplace, both exchanges and securities commissions have developed appropriate regulations and invested in security market surveillance. Prior research has analyzed the relationship between surveillance efforts and market integrity (Comerton-Forde and Rydge, 2006). This paper will extend this analysis by looking at the relationship between market integrity and market efficiency. Understanding the effectiveness of security market surveillance departments should help investors to gain confidence in a marketplace and therefore it seems sensible to compare and contrast such divisions. This paper represents a first attempt to do so.

The specific issues addressed in our empirical analyses are as follows. First, to what extent is single- and cross-market market surveillance carried out in different regions around the world? Second, how effective is single- versus cross-market surveillance, and to what extent does single- and cross-market surveillance matter for facilitating an exchange's turnover velocity and market capitalization? The data examined, while somewhat understandably limited in volume, provide a first-ever international comparison between single- and cross-market surveillance around the world. While prior theory and evidence has examined various aspects of market manipulation and surveillance of such manipulative practices,[4] no prior study has

4. This literature is briefly reviewed in Section 2 of this paper.

provided a direct international comparison between single- and cross-market surveillance activities.

The new surveillance data introduced in this paper provide a number of new insights about sources of international differences in market integrity. First, in jurisdictions where exchanges are self-regulatory organizations (SROs),[5] the exchanges carry out more intensive single-market surveillance than securities commissions. However, exchanges as SROs do not play a greater role in cross-market surveillance than securities commissions.

Second, cross-market surveillance is much more effective when different jurisdictions have information-sharing arrangements, and when such information sharing is broader in scope. Interestingly, securities commissions are more likely to engage in information sharing than exchanges. This is perhaps intuitive as securities commissions are less likely to view themselves as competitors among regulatory bodies than exchanges, which are more commercial in nature.[6]

Note that there exists considerable debate about the effectiveness of SROs, especially in light of exchanges demutualizing, moving from the not-for-profit model to for-profit model and the resulting conflicts of interest from markets competing with one another (DeMarzo, Fishman, and Hagerty, 2005; Carson, 2003; Fleckner, 2006; Karmel, 2002; O'Hara and Mendiola, 2003; Pritchard, 2003; Romano, 2002; Reiffen and Robe, 2007). Our findings contribute to this literature by indicating that exchanges continue to have a self-interested role in maintaining the integrity of their own market in order to attract new listings and increase trading activity. However, exchanges as SROs face barriers to information sharing for cross-market surveillance (as indicated under the second point immediately above) and hence there appears to be a pronounced role for securities commissions in facilitating cross-market surveillance. While the central aim of our paper is not to address the debate about effectiveness of self-regulation in the literature, we hope our evidence inspires further work on the topic. Our central interest in this paper is in exploring issues to do with surveillance not previously considered in the literature.

5. An SRO is an exchange or regulator that has been given the responsibility and authority to regulate its members.

6. For example, this view was shared by the surveillance authorities at NASD in conversations held in late May 2007 in Washington, DC.

Third, there is evidence in the data that market activity is facilitated by surveillance efforts. In particular, we find that cross-market surveillance is highly positively correlated with turnover velocity, the number of listed companies, and market capitalization, and this finding holds even after controlling for endogeneity of surveillance activities vis-à-vis trading activity. We also find some evidence that single-market surveillance is positively related to trading velocity, but this latter evidence is less robust and has an economically smaller effect relative to the impact of cross-market surveillance on trading. As well, we do not find any relation between single-market surveillance and the number of listed companies and/or market capitalization. Overall, the data are consistent with the view that cross-market surveillance facilitates stock market activity, and partially indicative of a similar role for single-market surveillance.

Finally, as at 2005, the data indicate that most jurisdictions are focused on single-market surveillance, and have insufficient experience and/or technology to properly carry out cross-market surveillance. There is ample scope for jurisdictions to expand their cross-market surveillance. The data are consistent with the view that an increase in cross-market surveillance would stimulate investor confidence and trading activity.

This paper is organized as follows. Section 2 describes the institutional details in regard to market surveillance and briefly surveys some related literature. The data are introduced in Section 3. Multivariate tests are carried out in Section 4. Section 5 discusses extensions and future research in relation to the analyses carried out in this study. The last section concludes.

2. Market Manipulation and Surveillance

This paper is related to a number of papers on the law and economics of securities regulation, market surveillance, market efficiency, and market integrity. There is evidence from a few country- and market-specific studies that manipulative trading impedes market integrity, as well as theoretical work on the topic. For instance, Hillion and Suominen (2004) study manipulation around closing times. Merrick, Naik, and Yadav (2005) study the effect of trading activities in one market in relation to price changes in another market, thereby enabling manipulators to profit from what is known as a "squeeze." Pirrong (1993, 1995, 1999, 2004) studies the relationship

between commodity and financial markets and the ability of market manipulators to profit from cross-market manipulation. Easterbrook (1986) and Kumar and Seppi (1992) provide similar analyses of manipulation of futures markets. As well, Ni, Pearson, and Poteshman (2005) provide evidence of manipulative trading as between stock prices and derivative prices in that stock prices tend to converge on the strike price of the associated derivative at the time of expiration of the derivative (see also Jarrow, 1992, 1994, for evidence of manipulation of derivatives markets). Aggarwal and Wu (2003) provide evidence from USA that market manipulation impedes market efficiency (see also Allen and Gale, 1992, and Allen and Gorton, 1992, for related theoretical work). Comerton-Forde and Rydge (2006) show surveillance efforts improve market integrity in Australia. Aitken and Siow (2003) provide international evidence of market efficiency in terms of transaction costs and market integrity based on the likelihood of a security being subject to ramping in the last 15 minutes of trading; they find a strong positive correspondence between efficiency and integrity.[7] La Porta *et al*. (2006) and Daouk, Lee, and Ng (2006) provide evidence that market integrity around the world depends critically on securities regulation.[8]

Based on the prior literature, therefore, we may infer that market integrity depends not only on market regulation but also on the quality of market surveillance that limits the extent of market manipulation. Prior work, however, has not directly examined the role of single- and cross-market surveillance in facilitating market integrity in an international setting. Our paper fills this gap in the literature.

2.1. The Scope of Single- and Cross-Market Surveillance

As with most trading platforms, surveillance systems within exchanges around the world are automated (Harris, 2002; Clayton, Jorgensen, and Kavajecz, 2006). Real-time computer surveillance systems alert surveillance staff of unusual trading activity based on orders and executed trades. Such alerts are not usually based on single trades but are generated based on patterns of trading to detect potential manipulative practices. Computer

7. See also Gerard and Nanda (1993); Felixson and Pelli (1999); Mahoney (1999); and Vitale (2000).

8. For related work, see La Porta *et al*. (1997, 1998, 1999a, 1999b, 2002); Romano (1993, 2002); Berkowitz *et al*. (2003); Pistor *et al*. (2003); and Pistor and Xu (2003).

software providers, such as SMARTS Group, Inc.,[9] customize its system to manage the type of alerts provided to surveillance staff. Such customization is necessary as the exchanges or securities commissions around the world differ in scope and requirements for surveillance. The set of alerts in conjunction with manipulative practices depicted in table 1 is comprehensive for most surveillance systems, however, and these alerts apply to both single-market manipulations as well as cross-market manipulations. The central focus of the empirical analyses herein is first on documenting the extent to which the scope of manipulation, as presented in table 1, are suspected/detected, and second on the scope of single- and cross-market surveillance in relation to trading liquidity and other measure of market quality in different exchanges around the world.

Compared to cross-market surveillance systems, single-market surveillance systems can be customized and installed at comparatively low costs relative to the market capitalization of any given exchange around the world. Many smaller exchanges do not have the resources to effectively carry out single-market surveillance themselves (this involves appropriate technology as well as strong market knowledge among surveillance staff members, effective regulation, strong political will, etc.) and as such external surveillance providers offer outsourcing (even in a different country relative to the country in which the exchange is based) of full-service, standard single-market surveillance for a minimal cost. For example, SMARTS Group (www.smartsgroup.com) has installed security market surveillance systems at the Saudi Arabian Stock Exchange, the Abu Dhabi Securities Market, the Dubai Financial Markets, and the Securities and Commodities Commission of the UAE and provides a staff member and full service single-market surveillance off-site from Sydney, Australia. SMARTS Group can be contacted directly for their pricing schedules; at the time of writing, the annual cost was easily affordable by even the smallest exchanges. The SMARTS Group also provides on-site surveillance for the London Stock Exchange and many other exchanges around the world.

Cross-market surveillance (including cross-product, cross-market within a jurisdiction, and cross-border) requires much greater technical sophistication, which an exchange cannot replicate easily for the following reasons.

9. http://www.smartsgroup.com/ More generally, see Harris (2002).

Table 1. Indicators of market manipulation

Advancing the bid	Increasing the bid for a security or derivative to increase its price
Capping [pegging]	Effecting transactions of instrument underlying an option shortly before the options expiration date to prevent a rise/decline in price of the instrument so previously written call/put options will expire worthless, protecting premiums previously received.
Churning	Frequent and excessive trading of a client's account.
Commodity flows to delivery points (1)	Large shipments of the commodity flow to the delivery point immediately prior to and during the delivery period. Moreover, shipments *from* the delivery point are abnormally small during the delivery period as traders amass stocks to make delivery.
Commodity flows to delivery points (2)	Delivery point receipts are abnormally small *after* the delivery period because of the glut of the commodity at the delivery point that results from the artificially large receipts during the delivery period. Shipments from the delivery point increase after the end of a corner as some of the excess shipments are returned to their original sources and delayed shipments are released.
Contract prices at different expirations	The price of the manipulated contract is abnormally high relative to the price of the contracts expiring later (that is, the price of the "front month" contract is artificially high relative to the deferred or "back month" contracts).
Corner	Securing control of the bid/demand-side of both the derivative and the underlying asset. Dominant position can be exploited to manipulate the price of the derivative and/or the asset.
Dissemination	Dissemination of false or misleading market information.
Front running	A transaction to the detriment of the order giver on the basis of and ahead of an order which he is to carry out for another.
Insider trading	When a trade has been influenced by the privileged possession of corporate information or price-sensitive market order that has not yet been made public.
Marking the close	Buying or selling securities or derivatives contracts at the close of the market in an effort to alter the closing price of the security or derivatives contract.
Marking the open	The placing of purchase orders at slightly higher prices/sale orders at lower prices to drive up/suppress the price of the securities when the market opens.
Matched orders	Transactions where both buy and sell orders are entered at the same time with the same price and quantity by different but colluding parties.
Mini manipulation	Trading in the underlying security of an option in order to manipulate its price so that the options will become in-the-money.
Money laundering	Creating the appearance that money value obtained from serious crimes, such as drug trafficking or terrorist activity, originated from a illegitimate source.
Option expiration date	Stock Price or Volume Changes at Option *Expiration* Date: unusual changes in the stock price and/or trading volume around the date of expiration of the option.

(*continued*)

Table 1. (*Continued*)

Option introduction date	Stock price or volume changes at option *introduction* date: Unusual changes in the stock price and/or trading volume around the date of introduction of the option.
Parking or warehousing	Hiding the true ownership of securities/underlying by creating a set of fictitious transactions and trades.
Pre-arranged trade	Transactions in which the price, terms, or contra-side have been prearranged.
Prices of Related Products at delivery Locations	The expiring futures price and the spot price at the delivery market are abnormally high relative to prices at other, nondeliverable locations; the prices of related products; and prices of nondeliverable grades of the same commodity.
Pump & dump/ramping	Buying at increasingly higher prices. Securities are sold in the market (often to retail customers) at the higher prices.
Short sales	A market transaction in which an investor sells stock he does not have or he has borrowed in anticipation of a price decline. This is not per se manipulative but is considered manipulative in some jurisdictions in conjunction with other types of actions; for example, in Canada, under UMIR Rule 6.2(viii)(ix), a short sale cannot be at a price that is less than the last sale price.
Spoofing/painting the tape	Engaging in a series of transactions reported on a public display facility to give the impression of activity or price movement in a security (e.g., misleading trading, switches, giving up priority, layering bid/asks, fictitious orders for the case of spoofing, etc.).
Spot and futures prices at different delivery points	The spot price in the delivery market declines both absolutely and relative to deferred month futures prices and spot prices at other locations around the end of futures trading or the delivery period.
Squeeze	Taking advantage of a shortage in an asset by controlling the demand side and exploiting market congestion during such shortages in a way as to create artificial prices.
Strike price and stock price at expiration	Option strike price equals (or is close to) underlying stock price at option expiration.
Trade through	The completion of a client's order at a price inferior to the best posted bid or ask. This is not per se considered manipulative, but many commentators (and the surveillance authorities themselves) did consider it manipulative because the market maker who received the order is unable or unwilling to fill it at the best posted bid or ask price, and hence the trade is instead executed at the market maker's price.
Wash sale	Improper transaction in which there is no genuine change in actual ownership of the security or derivative contract.
Year end /as Of trades	Transactions executed at a particular date to establish gains or losses or conceal portfolio losses or true positions.

This table summarizes primary different types of market manipulation that is considered by market surveillance authorities (stock exchanges in the case of SROs or securities commissions/regulatory authorities for other exchanges) for both single- and cross-market surveillance.

The level of sophistication of financial trading patterns across different products (such as derivatives and securities) is much more complicated (and our data below suggest many of the surveillance authorities in different countries do not appear to be aware of the ways in which traders can carry out manipulative cross-market trades). A computer software to detect cross-market manipulations so as to pick up patterns of trading across markets requires significantly greater sophistication than the simple single-market trading alerts. External surveillance providers such as SMARTS Group do provide cross-market surveillance, but such productized or customized solutions come at a substantially higher cost both for the development of the technology and for carrying out the surveillance. Surveillance staff members need to coordinate surveillance across the different markets monitored, which requires proper organizational alignment among all those involved. As well, for cross-market and cross-border surveillance there needs to be formal information-sharing arrangements and coordination of surveillance for cross-market and cross-border surveillance to be legally authorized, permissible, and effective. Such coordination is further complicated by the protectionist policies arising from the commercial self-interest of the respective markets and the related cross-jurisdictional legality issues. In short, cross-market surveillance is much more costly and complicated than single-market surveillance

It is important to note that the different types of market manipulation identified in table 1 can be the subject of both single- and cross-market surveillance. Any type of single-market manipulation can also be a cross-market manipulation (e.g., for a security that is listed on more than one exchange). For example, wash trades may take place across markets (in fact, multiple transactions across markets could be used as a way to disguise wash trades). Front-running may also take place across markets where brokers place orders ahead of client orders for the same security traded on a different exchange. It is also important to note that short sales and trade throughs may not be considered manipulative behavior per se, as indicated in table 1, but were considered important enough by various surveillance authorities that vetted our list of manipulations (these items can be manipulative in conjunction with other activities).[10]

10. Regardless, we considered the empirics and regressions with and without short sales and trade throughs as manipulative and did not find any material differences in our results.

In addition to examining the scope of single- and cross-market surveillance, we also assess in this paper the effectiveness of the surveillance systems in different jurisdictions around the world. Effectiveness depends on a number of factors. First, alerts should minimize false positive and maximize true positive manipulative practices. To be able to do this, the surveillance system needs to ascertain normal trading activity to set the abnormal alert parameters. For example, normal price and volume measures need to be set for typical trading ranges for a particular product traded on the exchange. Second, a surveillance department should be able the reconstruct all trading activity to replay the full order/quote schedule. It is also important for market surveillance to identify the activity of each market participant. Third, the surveillance staff needs to be versed on the issues that need to be investigated. The quality of a surveillance system depends on the quality of the software used and the degree to which the surveillance staff are educated and trained with regard to using the information provided in the alerts. Fourth, the effectiveness of a surveillance system also depends on the degree to which market participants are informed about the surveillance activities. Fifth, for cross-market surveillance, surveillance effectiveness depends to a significant degree on the extent to which information is shared across jurisdictions. Sixth, the efficiency of the surveillance system depends on the regulatory framework. In many jurisdictions around the world, the exchanges themselves are SROs whereby they establish their own listing standards, monitor and discipline market participants for violation of their rules of operation. In other jurisdictions, the securities commission has a greater role in setting listing standards and trading rules. Recent empirical evidence is consistent with the view that private enforcement benefits markets while public enforcement does little to benefit markets (La Porta *et al*., 2006) and more specifically, recent theory finds that SROs that are for-profit organizations have greater incentives to enforce rules than not-for-profit SROs and misreporting by reportees is more likely when an SRO is not-for profit (Reiffen and Robe, 2007).

2.2. Empirical Predictions

The degree to which the exchange versus the securities commission is involved in surveillance is likely to have a significant influence on the scope of surveillance. We would expect jurisdictions to offer a greater scope of single-market surveillance when the surveillance task has been delegated to

the exchange, as opposed to the securities commission in the jurisdiction. Exchanges have a financial interest in ensuring the integrity of their markets to attract new listings and trading activity. At the same time, however, exchanges have less incentive to share information and engage in cross-market surveillance, as discussed in Section 2.1, and hence exchanges that carry out surveillance activities are not necessarily more likely to engage in cross-market surveillance than securities commissions.

In addition to the exchanges' competitive concerns, another factor might be at work. From an exchange's perspective, "investor confidence" suffers the greatest harm when investors lose money and think the exchange is to blame. If a manipulative trading strategy takes place across multiple markets, there is a greater chance that any particular exchange can convince investors that the other markets were to blame for allowing the manipulative trading to take place. A securities regulator that supervises all the relevant markets must also take blame for problems in any of them. Each of these factors therefore leads to our first prediction:

Hypothesis 1: *Delegation of the surveillance task to an exchange instead of a securities commission gives rise to a greater scope of single-market surveillance but not a greater scope of cross-market surveillance.*

As an alternative to hypothesis 1, it is possible to conjecture that public enforcement may be associated with greater surveillance insofar as public regulators have more severe enforcement powers, and can secure more information from market participants through legal proceedings, etc. These competing hypotheses are the central focus in La Porta *et al*. (2006) in the context of securities regulation and initial public offerings around the world, and are summarized more completely therein. But La Porta *et al*. find evidence in support of the view that private enforcement benefits markets but public enforcement does not, and hence this prior work is more in line with Hypothesis 1 than the alternative hypothesis. As discussed in La Porta *et al*., business rules governing the trading of exchange products and outlining restricted trading activity are in some jurisdictions drafted by the exchange, while in other jurisdictions drafted by the securities commission or some other independent government regulator. Typically, jurisdictions with business rules that have been drafted by the exchange are more precise in terms of the exact nature of prohibitive activities, while jurisdictions in which the business rules were written by securities commissions or some

other government entity tend to be more ambiguous and imprecise.[11] In our empirical analyses, we explicitly control for the extent to which trading rules are drafted by an exchange versus a securities commission. Additional controls for legal indices used in La Porta *et al*. and various other legal indices were immaterial and therefore excluded as explicit control variables from our empirical tests below.

Note that we may further expect the scope of surveillance to be positively correlated with the number of departments involved in the trading process, including surveillance. A greater number of departments enable greater segregation of tasks across departments and more autonomy for each department, particularly for the surveillance department. In particular, if the exchange has a separate "regulatory" department that is not grouped together with the "listing" or "trading" department, then the regulatory department may be expected to engage in more surveillance. In contrast, when there is a single department carrying out both trading and surveillance, there is a potential conflict of interest with competing departmental objectives, and as such, potentially less surveillance. Note, however, that there is no direct link between the number of departments and market quality. The number of departments and market quality are at most indirectly related insofar as an increase in the number of departments leads to more surveillance, and in turn more surveillance leads to higher market quality.

A greater scope of surveillance, however, does not necessarily mean that it will be more effective. More effective surveillance has real outcomes, in terms of greater trading activity, a greater number of listed companies, and higher market capitalization. Our second primary hypothesis is that the scope of single-market surveillance is less directly connected with market activity

11. When the business rules are drafted (and amended as needed) by the exchange itself, the exchange is able to promptly react to trends or trading behavior that may be potentially manipulative or in conflict with the interests of market participants. Exchange staff members deal with trading issues directly and are therefore more capable of determining what is required from its rules to ensure that market participants are deterred from certain activities. As we mentioned in an earlier section, while many manipulative practices have been identified as standard and generally restricted, many innovative ones have yet to be deemed as such. We may expect that business rules play an important role in preventing manipulative trading activity. When business rules are drafted (and amended) by other regulatory bodies, preventative amendments to business rules may not be implemented as swiftly as there will be the inevitable consultative process and other bureaucracy to be overcome.

than the scope of cross-market surveillance. Because single-market surveillance is comparatively straightforward and can be more easily replicated on an exchange at comparatively low cost, single-market surveillance is not as effective at distinguishing an exchange and instilling confidence among traders relative to that of competitor exchanges. In contrast, cross-market surveillance is sufficiently complex and costly so that it cannot be replicated by lower quality exchanges. Cross-market surveillance will be carried out by higher quality exchanges and inspire confidence among traders and facilitate market activity.

Hypothesis 2: *Surveillance enhances investor confidence, mitigates abuse and thereby facilitates trading activity, a greater number of listed companies and higher market capitalization. Cross-market surveillance is more effective in this regard than single-market surveillance, because cross-market surveillance can only be implemented with sufficient skills, financial resources, and organizational resolve.*

Note that it is natural to expect that the scope of surveillance is endogenous to market activity. For instance, since larger exchanges will have larger budgets and more resources for surveillance, causality between surveillance and market quality measures is ambiguous. In our empirical tests, we present results with and without instrumental variables to control for endogeneity. Our empirical analyses in the next sections are based on a new dataset that measures the scope of single- and cross-market surveillance. The data are introduced in the next section.

3. Data and Summary Statistics

The data in this paper are derived from questionnaires sent to seventy-five jurisdictions around the world.[12] One limitation to obtaining data through a survey is the possibility of sample selection and response bias. While we acknowledge that this is a possibility, we believe from a detailed analysis of the responses received and the data obtained from the responses that this concern does not arise in this exercise. First, the jurisdictions were identified from various sources including the membership of The World Federation of Exchanges, the trade association of the exchange industry, which comprises fifty-four exchanges that account for over 97 percent of global stock

12. A copy of the survey is available on request from the authors.

market capitalization, and the affiliate and correspondent organizations of the federation (another fifty-five organizations).[13] Potential respondents were also identified from the International Organization of Securities Commissions' (IOSCO) membership, which comprises one hundred and ten securities commissions.[14] Of the potential respondents, however, thirty-five transitional or frontier markets with more negligible market capitalization have been excluded because we believe that the possibility of sample selection bias is mitigated by the extent of total global market capitalization of the exchanges/jurisdictions that were sent survey questionnaires. Second, survey data were gathered for a final sample of twenty-five jurisdictions, which we believe to be an extremely good response rate in view of the very detailed confidential information required of the respondents. The jurisdictions participating in the study comprise sixteen exchanges and nine securities commissions from North, Central, and South America, Western and Eastern Europe, Africa, and Asia. There were no overlaps of exchanges and securities commissions. For reasons of confidentiality, we do not identify any particular jurisdiction due to the sensitive nature of some of the data collected and the potential for readers to identify specific organizations based on location. The geographic distribution of the exchanges is, however, presented in table 2, panel A. Finally, the survey questionnaires we designed were also vetted by Regulation Services, Inc. (Canada), SMARTS, Inc. (Australia), the Singapore Stock Exchange, and the Australian Stock Exchange to ensure that the possibility of sample selection bias is further mitigated by the breadth of information obtained. The questionnaires were directed toward the Head of the Surveillance Departments in the exchange and/or securities regulators in the jurisdiction.

We realize that we cannot absolutely rule out the possibility of a sample selection and response bias due to the unique nature of the data collection and the rather limited number of jurisdictions that have a significant enough market activity. Limitations in our sample size, as well as the limited information about comparable academic work on single-market versus cross-market surveillance, however, make reliable statistical comparisons of

13. See, e.g., http://www.world-exchanges.org the official web site of The World Federation of Exchanges.

14. See, e.g., http://www.iosco.org, the official web site of the International Organization of Securities Commissions.

Table 2. Comparison tests for market capitalization of jurisdictions included versus excluded from data

Panel A: Number of respondents by Region

Region	Number of exchange respondents	Number of securities commissions respondents
Asia	5	3
Africa	0	1
South America	2	0
Central America	1	0
North America	2	0
Western Europe	4	1
Eastern Europe	2	4

Panel B: Comparison tests

		(1) Included in data	(2) Excluded from data	Ratio values (1)/(2)	*P*-value for difference tests for means and medians
Americas	Mean	449,992.06	1,726,331.01	0.26	$P \leq 0.52$
	Median	—	—	4.98	$P \leq 0.36$
Asia	Mean	419,236.59	505,181.51	0.83	$P \leq 0.85$
	Median	—	—	4.06	$P \leq 0.30$
Europe/Africa	Mean	253,935.18	145,153.08	1.75	$P \leq 0.25$
	Median	—	—	0.56	$P \leq 1.00$
Total sample	Mean	339,430.95	477,033.61	0.71	$P \leq 0.88$
	Median	—	—	3.98	$P \leq 0.16$

Panel A summarizes the jurisdictions in the data. In total, there are twenty-five jurisdictions. Securities regulators provided the data from some jurisdictions and exchanges provided the data in others. There is no overlap in the data from securities commissions and exchanges in the same jurisdiction. More precise exchanges or countries are not indicated due to confidentiality restrictions to obtain the data. Panel B presents the means and medians of the equity market capitalization of the exchanges included versus excluded from the sample. Values expressed in millions of 2005 US dollars. Mean and median tests are based on procedures given at http://www.fon.hum.uva.nl/Service/Statistics.html. Market capitalization data are from the World Federation of Exchanges http://www.world-exchanges.org/. Regions are grouped to enable comparisons across a greater number of exchanges or securities commissions for the comparison tests. There are five jurisdictions in the data from the Americas, eight from Asia, and twelve from Europe/Africa. The difference tests are provided for each category, but statistical significance is difficult to interpret given the small number of observations in each category. Median values and other more precise details or categories are not provided in order to maintain the confidentiality of the respondents that provided the surveillance data used in the subsequent tables.

our sample nearly impossible. We note that on one hand, one possible concern with our sample is that those respondents that were relatively pleased with their surveillance activities returned questionnaires and the ones that thought they were not doing so well declined to return them. On the other hand, however, an incentive to potential respondents was that they were provided a free report (i.e., this paper), which indicated the full scope of possible surveillance activities so that they could assess their surveillance activities, which might suggest that potential respondents that were less pleased with their surveillance activities were more inclined to return the survey. However, we note that all potential respondents knew no respondent would be identified, and did not know the data would be presented in a way that showed differences between exchanges and commissions, differences across regions, or anything that might potentially influence anything to do with revealing matters to do with connecting their exchange (or securities commission) with quality or performance indicators.

Table 2, panel B presents the characteristics of the survey respondents versus nonrespondents. Table 2, panel B indicates that the mean market capitalization for the exchanges in the Americas in our sample is 0.26 the size of the mean for the nonincluded exchanges, but the median is 4.98 times larger for the exchanges in our sample. Similarly, the mean value of the market capitalization of the exchanges in Asia is 0.83 of the mean value of the exchanges in Asia not included in our sample, while the median market capitalization is 4.06 times larger than the median market capitalization of exchanges not included in the data. Finally, in Europe/Africa the mean value of the market capitalization is 1.75 times the mean value of the exchanges in Asia not included in our sample, while the median market capitalization is 0.56 of the value of the median market capitalization of exchanges not included in the data. These differences between means and medians for the exchanges included versus excluded from our sample are attributable to the non-normal distribution of market capitalization of exchanges. For instance, in North, Central, and South America there are a few very large exchanges and many small exchanges. The same applies to the other regions around the world.

While the small samples do not enable especially statistically accurate comparison of mean and median tests in table 2, panel B, we nevertheless provide these tests (of course, the most appropriate test is for the full

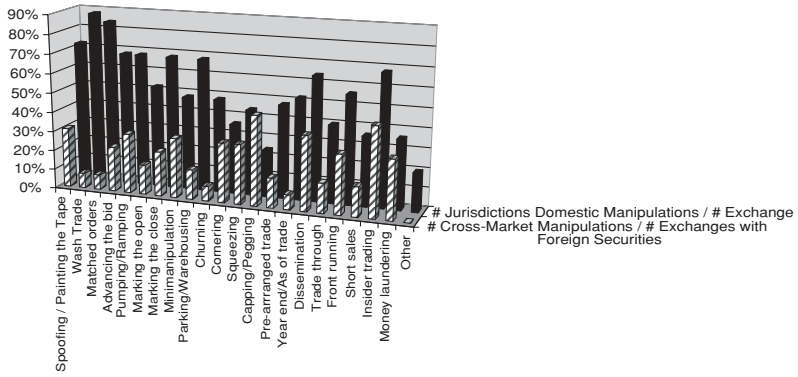

Figure 1. Summarizes the scope of single- and cross-market surveillance suspected or detected for all twenty-five jurisdictions in the sample. The scope of surveillance is defined as follows: for each type of manipulation (summarized in table 1), a dummy variable of 0 or 1 is assigned depending on whether or not this issue is investigated by the regulator and these variables are summed across the market. The scope of single-market surveillance is indicated by solid bars in the back row and is expressed as a percentage of the twenty-five jurisdictions in the data. The scope of cross-market surveillance is indicated by hatched bars in the front row and is expressed as a percentage of the thirteen jurisdictions with a non-trivial number of foreign-based companies listed on their exchange. Note that cross-market also refers to cross-product and as such the scope of cross-market surveillance is if anything overstated relative to the need for cross-market surveillance in this figure as all twenty-five exchanges traded more than one product.

sample where there are twenty-five observations in the group of included jurisdictions). In the regression analyses below, we control for proxies for exchange size and consider the robustness of the results to outliers. We recognize potential limitations with the data and have presented as much information as possible, subject to not violating confidentiality to obtain the data. But as this is the first time this type of study has been carried out, we also recognize that the data are exploratory in nature and hope there will be further studies on the topic, as we discuss in Section 5.

Figure 1 presents the scope of single- and cross-market surveillance analyzed by the exchanges. In view of the fact that the potential respondents are from both developed and emerging markets around the world, a definition of each manipulative practice was provided in the survey to ensure uniformity in identifying the "standard" manipulative practices, which may not necessarily be the same or as commonplace across markets. Note also that while

there may be other more contemporary or enlightened ways to manipulate markets, we limited our analysis to the twenty-two we have listed as they are deemed to be more recognizable and the more universal forms of manipulation (as vetted by the above-mentioned organizations). We then asked the respondents to indicate whether for each type of manipulative practice surveillance is carried out on a single-market or cross-market level. Figure 1 shows that the most common types of manipulation subject to single-market surveillance include wash trades, matched orders, spoofing/painting the tape, pumping and dumping, and marking the close for exchanges (defined in table 1). Cross-market surveillance is more intensive for capping/pegging, insider trading and dissemination of false and misleading information.

The scope of cross-market surveillance in figure 1 is indicated as a percentage of the jurisdictions with foreign companies listed on the local exchange (thirteen jurisdictions in total), and not as a percentage of the total number of jurisdictions (twenty-five). Note that all jurisdictions in the sample comprised exchanges that traded a multitude of products, and hence cross-market surveillance is relevant for all exchanges. However, cross-border surveillance is less applicable to some of the exchanges. Hence, figure 1 presents the extent of cross-market surveillance in a way that provides a favorable view (that is, favorable to the surveillance authorities) as to the degree of importance of the issue of cross-market surveillance in relation to what is actually monitored, in comparison to the extent of single-market surveillance. The data clearly indicate that there is a dearth of cross-market surveillance relative to the need for such cross-market surveillance, even when the scope of cross-market surveillance is perhaps overstated relative to its need as in figure 1.

Table 3 provides definitions of the different variables considered, categorized by surveillance, exchange, and jurisdiction variables. The scope of single-market surveillance is the sum of dummy variables equal to 1 where surveillance in the jurisdiction involves considering the market matters in table 1. This means for each type of manipulation a dummy variable of 0 or 1 is assigned depending on whether this issue is investigated by the regulator and that these variables are then summed across the market. Similarly, for the scope of cross-market surveillance, it is the sum of dummy variables equal to 1 where surveillance in the jurisdiction involves considering the market matters in table 1 either on a cross-product, cross-exchange, or cross-jurisdiction basis. As explained in the text accompanying table 1 in

Table 3. Definitions of variables

Surveillance variables	
Scope of single-market surveillance	The sum of dummy variables equal to 1 where surveillance is carried out over each of the market manipulative practices identified (e.g., spoofing, painting the tape, wash sales, etc.) on a single-market basis. The manipulative practices are as defined in table 1.
Scope of cross-market surveillance	The sum of dummy variables equal to 1 where surveillance is carried out over each of the market manipulative practices identified in the jurisdiction (e.g., spoofing, painting the tape, wash sales, etc.) on a cross-market basis (including cross-product, cross-exchange, and international). The manipulative practices are as defined in table 1. Any type of single-market manipulation can also be a cross-market manipulation (e.g., for a security that is listed on more than 1 exchange.)
Exchange versus commission surveillance—establish rules	The average ranking (5 = exchange, 1 = securities commission) for establishing listing standards, establishing market trading rules, establishing rules on cross-product trading, establishing rules on cross-market trading, and establishing rules on cross-border trading. Where appropriate, the subcomponent of the ranking is used.
Exchange versus commission surveillance—monitoring	The average ranking (5 = exchange, 1 = securities commission) for monitoring listing standards, real-time surveillance, post-trade surveillance, monitoring of rules on cross-product trading, monitoring of rules on cross-market trading, and monitoring of rules on cross-border trading. Where appropriate, the subcomponent of the ranking is used.
Exchange versus commission surveillance—enforcement	The average ranking (5 = exchange, 1 = securities commission) for enforcing listing standards, enforcement of market trading rules, enforcement of rules on cross-product trading, enforcement of rules on cross-market trading, and enforcement of rules on cross-border trading. Where appropriate, the subcomponent of the ranking is used.
Exchange versus commission real-time surveillance	Ranking of exchange's role (5 = exchange 1 = securities commission) in carrying out real-time surveillance
Exchange versus commission post-trade surveillance	Ranking of exchange's role (5 = exchange 1 = securities commission) in carrying out post-trade surveillance

(*continued*)

Table 3. (*Continued*)

Exchange	A dummy variable equal to 1 where the exchange was responsible for primary market surveillance in the jurisdiction as an SRO.
Number of departments	The number of departments deemed to have at least some responsibility for carrying out market trading and surveillance.
Effectiveness of surveillance	Ranking of ability (1 = unable 5 = excellent) to carry out surveillance on the following matters: real-time surveillance, cross-product trading surveillance, cross-market trading surveillance, cross-border trading surveillance, OTC trading surveillance, ability to replay the market, ability to track changes in price or volume of a particular security or derivatives and underlying, ability to track changes in price or volume of a related scurrility or derivatives and underlying, identify concentration of ownership, provide alerts and information concerning suspicious transactions, provide alerts and information concerning suspicious cross-market transactions, provide alerts and information concerning cross-border transactions, identify potentially large market losses/gains incurred by members or large market participants, ability to share data with other markets, ability to share system with other markets, identify parties to the transaction, provide analysis or relations between parties to the suspicious transactions, ability to analyze/study alerts and reports with other markets.
Information-sharing arrangements	Sum of dummy variables equal to 1 for types of information contained in information sharing arrangements: (1) identity of the member/intermediary, (2) identity of the dealer, (3) identities of the member/intermediary, (4) trading activity, (5) positions held by the member/intermediary, (6) details of investigation of the member/intermediary, (7) details of investigation of dealers or clients of the member/intermediary, (8) details of disciplinary action against the member/intermediary, (9) details of disciplinary action against the dealers or clients of the member/intermediary.

(*continued*)

Table 3. (*Continued*)

Specifics in information-sharing arrangements	Dummy variables equal to 1 where the jurisdiction has information-sharing arrangements on each of the following categories: real-time trading information provided electronically, end of day trading information provided electronically, delayed trading information provided electronically, daily market surveillance reports (electronic), daily market surveillance reports (hard copy), regular market surveillance reports (electronic), regular market surveillance reports (hard copy), market surveillance reports (electronic) on request, market surveillance reports (hard copy) on request, obtaining information/documents relating to a product traded through the other organization, obtaining information/documents on current and former intermediaries, obtaining information/documents on current members, obtaining information/documents on former members, obtaining other general information/documents, onsite inspection of books/records, ability to carry out separate yet coordinated investigation, participate in joint investigations, share investigatory information on request, ability and assistance to proceed with civil enforcement, ability and assistance to proceed with criminal enforcement, assistance in freezing/sequestration of assets, and others.
Market variables	
Turnover velocity	The turnover velocity is the ratio between the turnover of domestic shares and their market capitalization. The value is annualized by multiplying the monthly moving average by 12, according to the following formula: $\left[\frac{\text{Monthly Domestic Share Turnover}}{\text{Month = end Domestic Market Capitalization}}\right]$ Only domestic shares are used in order to be consistent. Turnover velocity is calculated in 2 steps: step 1: we first calculate for each month the annualized ratio between the domestic share turnover and the domestic market capitalization, multiplied by 12; step 2: then, we add together, using a moving average methodology, the percentage ratios obtained in step 1, divided by 12.
Number of shares traded	The number of equity shares traded in 2005.

(*continued*)

Table 3. (*Continued*)

Average turnover	The average daily equity turnover in 2005.
Average value of trades	The average value of equity trades in 2005, expressed in US dollars.
Total value of trades	The total value of equity trades in 2005, expressed in US dollars.
Number of companies	The number of companies listed on the stock exchange as at December 2005.
Market capitalization	The equity market capitalization of the stock exchange as at December 2005, expressed in US dollars.
Proportion of foreign companies	The proportion of foreign companies listed on the domestic stock exchange as at December 2005.
Proportion of foreign trades	The proportion of trades of foreign listed firms on the domestic stock exchange in 2005.
Proportion of US cross-listings	Proportion of companies cross-listed in USA.
Number of products	The number of products offered by the exchange, among the following categories: shares, corporate bonds, government bonds, convertible bonds, warrants, units in collective undertakings, mutual funds, exchange traded funds, forward interest rate agreements, interest rate, currency and/or equity swaps, exchange-traded options, futures, asset-backed securities, money-market instruments, derivatives on commodities, and other exotic instruments.
Country variables	
Civil law	A dummy variable equal to 1 for civil law jurisdictions and 0 for common law jurisdictions.
GDP/capita	The GDP per capita in 2005 of the country in which the exchange is based, expressed in 2005 US dollars.

This table defines the variables used in the empirical analyses. Values are from 2005 and measured in 2005 US dollars. Data were provided by sixteen stock exchanges and nine securities commissions from North, Central, and South America, Western and Eastern Europe, Africa, and Asia (see table 2). Market variables data source: World Federation of Exchanges.

Section 2, the different types of manipulation can be carried out on a single- or cross-market basis.

Figures 2a and 2b present a graphical analysis of the scope of market surveillance in relation to the number of trades per year and the turnover velocity (defined in table 3), respectively. The data indicate that the scope of single-market manipulations suspected/detected is uncorrelated with the number of trades (the correlation is 0.13) and turnover velocity (the

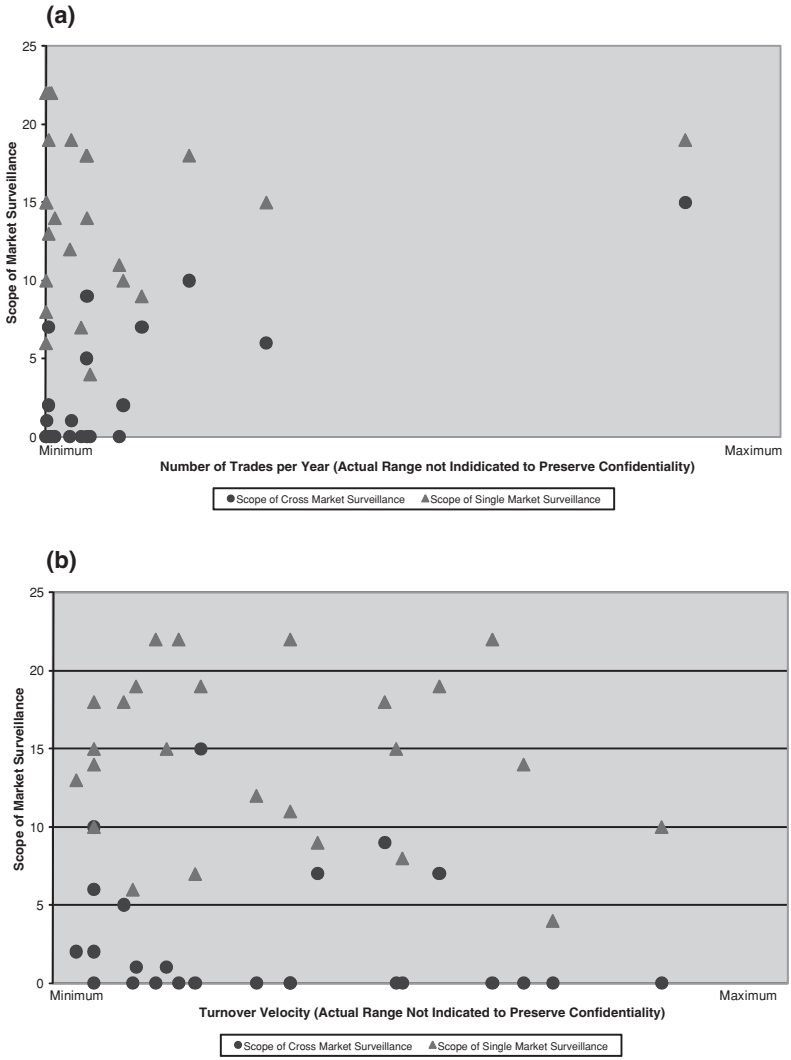

Figure 2. (a) Scope of single- and cross-market surveillance (the sum of dummy variables equal to 1 for each type of manipulation in table 1 for each jurisdiction) against the annual number of trades in the jurisdiction. The minimum and maximum values for trading activity are not indicated to maintain the confidentiality of the exchanges. (b) Scope of single- and cross-market surveillance (the sum of dummy variables equal to 1 for each type of manipulation in table 1 for each jurisdiction) against the annual turnover velocity in the jurisdiction. The minimum and maximum values for trading activity are not indicated to maintain the confidentiality of the exchanges.

correlation is −0.16).[15] However, the data quite clearly depict a positive relation between the scope of cross-market surveillance and the number of trades (the correlation is 0.77) and turnover velocity (the correlation is 0.65). One interpretation of the data is that larger jurisdictions with richer exchanges are more inclined to invest in cross-market surveillance, and also have more intensive trading activity. A second interpretation is that cross-market surveillance facilitates increased confidence in the market's integrity and thereby enhances trading activity (Hypothesis 2). Causality is considered in the multivariate empirical analyses provided in Section 4.

Table 4 indicates the average exchange in the data carries out surveillance on fourteen or fifteen different types of manipulation on a single-market basis, but only two or three different types of manipulations on a cross-market basis. As indicated above and in table 3, these numbers are derived by adding up the dummy variables equal to 1 where surveillance for each type of manipulation is carried out on a single-market or cross-market basis.

Table 5 provides data on the extent to which exchanges versus securities commissions are involved in surveillance. The data are provided on a ranking scale of 1–5, where 1 indicates the securities commission is primarily responsible and 5 indicates the exchange is primarily responsible. For the average jurisdiction, the responsibility is shared in terms of establishing rules, monitoring, and enforcement. In most jurisdictions the exchange has the primary role for real-time surveillance as well as post-trade surveillance. The typical exchange shares information on four of nine dimensions (these nine dimensions are defined in table 3), has 1 surveillance department, and provides a self-ranking of 2.15 out of 5 for effectiveness on the different dimensions of surveillance (the effectiveness dimensions are also defined in table 3).

The data were provided on a completely confidential basis and as such, median minimum and maximum values are not indicated in table 4 for market variables in order to maintain confidentiality. We are nevertheless able to indicate averages, medians, and standard deviations. Table 4 indicates

15. Note, however, that this does not refer to the quality of single-market surveillance. We may expect that exchanges with higher quality surveillance (in terms of technology and people, for example) are better able to facilitate market confidence and thereby enhance trading activity, etc. See, e.g., Aitken and Siow (2003). In this paper, we also provide some evidence about the quality of surveillance.

Table 4. Summary statistics for full sample

Variable	Mean	Median	Standard deviation	Minimum	Maximum	Number of jurisdictions
Surveillance characteristics						
Scope of single-market surveillance	14.48	15	5.39	4	22	25
Scope of cross-market surveillance	2.60	0	4.11	0	15	25
Exchange versus commission surveillance—establish rules	2.59	2.67	0.87	1.17	4.17	25
Exchange versus commission surveillance—monitoring	2.68	2.86	0.89	0.71	4.71	25
Exchange versus commission surveillance—enforcement	2.49	2.60	1.19	0.53	5	25
Exchange versus commission–real-time surveillance	3.96	4	1.06	1	5	25
Exchange versus commission post-trade surveillance	3.56	4	1.23	1	5	25
Information-sharing arrangements	4.16	4	3.29	0	9	25
Number of departments	1.60	1	1.32	1	7	25
Average effectiveness ratings for surveillance	2.15	2.38	1.25	0	3.75	24
Market variables						
Turnover velocity	73.81		47.53			25
Number of shares traded (millions)	367558.79		1146934.03			25
Average daily turnover (millions)	2286.20		4661.17			25
Average value of trades (thousands)	32.82		84.31			25
Total value of trades (millions)	337568.13		516366.54			25
Number of listed companies	565.96		773.54			25
Market capitalization (millions USD)	339430.95		429486.28			25

(*continued*)

Table 4. (*Continued*)

Variable	Mean	Median	Standard deviation	Minimum	Maximum	Number of jurisdictions
Proportion of foreign shares	0.05	0.00	0.12			25
Proportion of foreign shares traded	0.03	0.00	0.05			25
Proportion of companies cross-listed in USA	0.02	0.02	0.03			25
Number of products traded on the exchange	7.36	8.00	2.72			25
Country variables						
Civil law	0.68	1.00	0.48			25
GDP/capita	17568.00		11852.77			25
	Exchanges	Securities commissions				

This table presents the mean, median, standard deviation, and minimum and maximum value for variables as defined in table 3. Data were provided on a confidential basis from twenty-five jurisdictions around the world. To maintain this confidentiality, medians, minimums, and maximums are not indicated for selected variables. For certain variables, data are only available for twenty-four of the twenty-five jurisdictions. Variables are as defined tables 1 and 3.

that the average exchange in the data is small relative to the trading activity on the US exchanges, as expected since the data are from a broad array of exchanges from emerging and developed markets from around the world. The average exchange in the data has 567 listed companies, of which 5 percent are foreign and 2 percent are cross-listed on the US exchanges. As well, the average [median] number of products traded (see table 3 for the definition of the scope of the number of products) is 7.36 [8], thereby giving rise to a significant need for cross-product surveillance (e.g., as between derivatives and stocks, etc.).

Table 5 provides evidence about the scope of single- and cross-market surveillance as it differs between exchanges and securities commissions. Exchanges as SROs engage in a greater range of different types of single-market surveillance than securities commissions, but the scope of cross-market surveillance activity is very similar among exchanges and securities commissions. Table 5 also presents evidence in which the surveillance authorities were asked to provide a self-evaluation in respect of their effectiveness in the various aspects of their surveillance. On average, exchanges are more confident than securities commissions in respect of their effectiveness.

Further to table 5, we asked respondents to provide similar evidence of actual manipulations detected (excluding false positives) in relation to the number of trades in the jurisdiction. In the following table, we summarize the median number of manipulations detected in each jurisdiction as a percentage of the number of trades in the jurisdiction for each year between table 2002 and 2005.[16]

	2002	2003	2004	2005
Exchanges	2.71%	2.14%	1.74%	1.29%
Securities Commissions	0.34%	0.57%	0.62%	0.61%

16. Note that "detected" reflects trades that are flagged as falling outside the established alert parameters, not trades that are later determined to be manipulative in a legal sense. This is a function of how the alert parameters are set, which is a choice variable for the exchange. Nevertheless, we asked the exchanges and commissions to indicate not all alerts that fired but rather only those that were reasonably believed to be manipulative and lead to nontrivial further examination or investigation (e.g., due to pattern activity and/or egregious behavior).

Table 5. Summary statistics for exchanges versus securities commissions

	Exchanges			Securities Commissions		
	Mean	**Median**	**Number of jurisdictions**	**Mean**	**Median**	**Number of jurisdictions**
Surveillance characteristics						
Scope of single-market surveillance	15.00	15.00	16	13.70	12.00	9
Scope of cross-market surveillance	2.80	0.00	16	2.30	0.00	9
Exchange versus commission surveillance—establish rules	2.78	3.00	16	2.32	2.42	9
Exchange versus commission surveillance—monitoring	2.99	2.86	16	2.21	2.50	9
Exchange versus commission surveillance—enforcement	2.73	2.80	16	2.12	2.10	9
Exchange versus commission—real-time surveillance	4.40	4.00	16	3.30	3.00	9
Exchange versus commission–post-trade surveillance	4.00	4.00	16	2.90	3.00	9
Information-sharing arrangements	3.80	4.00	16	4.70	4.50	9
Number of departments	1.93	1.00	16	1.10	1.00	9
Average effectiveness ratings for surveillance	2.45	2.65	16	1.66	1.85	8

(*continued*)

Table 5. (*Continued*)

	Exchanges			Securities Commissions		
Variable	**Mean**	**Median**	**Number of jurisdictions**	**Mean**	**Median**	**Number of jurisdictions**
Market variables						
Turnover velocity	84.10		16	58.38		9
Number of shares traded (millions)	170425.72		16	663258.40		9
Average daily turnover (millions)	3305.53		16	757.20		9
Average value of trades (thousands)	50.69		16	7.82		9
Total value of trades (millions)	446803.15		16	173715.60		9
Number of Listed Companies	520.60		16	634.00		9
Market capitalization (millions USD)	370038.70		16	293519.31		9
Proportion of foreign shares	0.07	0.01	16	0.03	0.00	9
Proportion of foreign shares traded	0.04	0.00	16	0.01	0.00	9
Proportion of companies cross-listed in USA	0.03	0.02	16	0.02	0.00	9
Number of products traded on the exchange	8.53	9.00	16	5.60	5.50	9
Country variables						
Civil law	0.80	1.00	16	0.50	0.50	9
GDP/capita	19493.33		16	14680.00		9

This table presents the mean and median values for variables as defined in table 3 for the sixteen exchange based jurisdictions and nine securities commission based jurisdictions. To maintain confidentiality, medians are not indicated for certain variables. There is no overlap of exchanges and securities commissions in the same jurisdiction. Variables are as defined in tables 1 and 3.

These data were provided by seven exchanges (two North/South American, two Asian, and three European) and six securities commissions (three Asian and three European) (these extremely detailed data could not be obtained from the other jurisdictions). Consistent with table 5 these data indicate exchanges typically have more success in detecting manipulations than securities commissions, although this difference has been narrowing over the period 2002–2005.[17]

Table 5 also presents data in regard to information-sharing arrangements across jurisdictions, and differences as between exchanges and securities commissions. The data clearly indicate securities commissions are much more likely to have information-sharing arrangements than exchanges, and share a greater amount of information. The types of information shared are graphically illustrated in figure 3, and there are clear, pronounced differences in the willingness of exchanges to coordinate information sharing relative to securities commissions.

Table 6 provides correlations across a number of the surveillance and market variables in the data. The correlations indicate that jurisdictions with exchanges responsible for surveillance are typically engaged in a greater scope of single-market surveillance, but not cross-market surveillance. Jurisdictions whereby there are a greater number of departments involved in trading and surveillance, are more likely to be engaged in cross-market surveillance. Exchanges that are more directly involved than securities commissions in establishing trading rules and monitoring and enforcing rules, are more likely to provide a self-evaluation of greater effectiveness in terms of quality of surveillance. This evidence is consistent with the somewhat related research on new listings and the ineffectiveness of public enforcement of securities regulation around the world (La Porta *et al*., 2006).

In terms of the relations between surveillance variables and market variables, the correlations in table 6 indicate jurisdictions that engage in a greater scope of single-market surveillance are not more likely to have a higher

17. While the use of subjective assessments in table 5 is not ideal, the use of a 5-point scale is widely regarded as the most appropriate (see, e.g., Kidd, 1975). As well, note that the information pertaining to detected manipulations (supra note 16 and accompanying text) is very consistent with the rankings regarding the effectiveness of surveillance across securities commissions versus exchanges in table 5 (a greater proportion of manipulations are detected by exchanges and exchanges ranked their effectiveness higher in table 5), which suggests the rankings are consistent with practice in the jurisdictions.

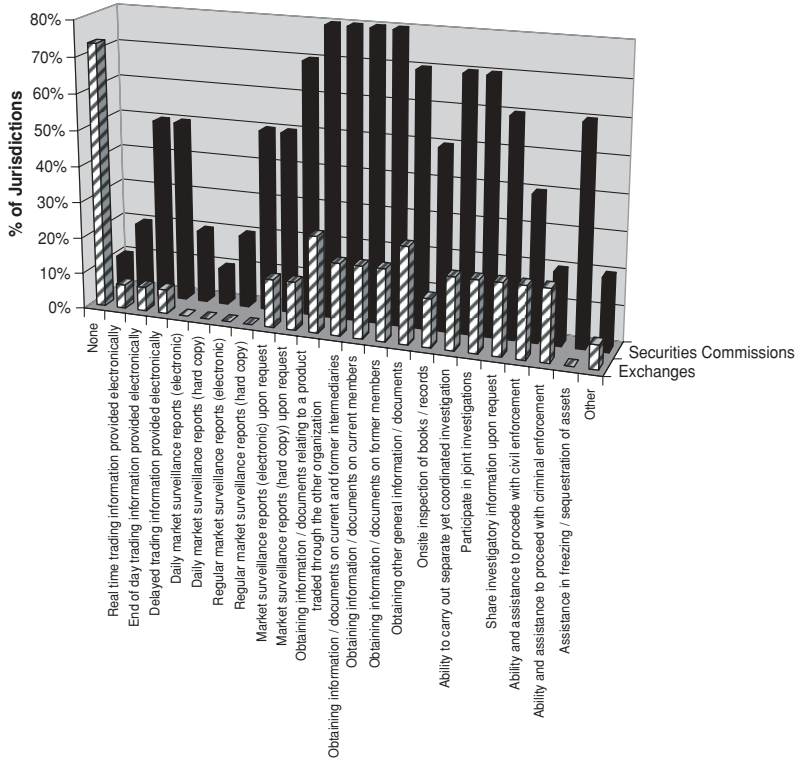

Figure 3. Summarizes the types of information sharing arrangements for each of the twenty-five jurisdictions in the data. The data are expressed as a percentage of the number of exchanges (sixteen in the data) and securities commissions (nine in the data).

turnover velocity (the correlation is −0.16 and statistically insignificant). Nevertheless, there is a statistically significant correlation of 0.65 between the scope of cross-market surveillance and turnover velocity. Note that the turnover measure controls for different numbers of shares. Regardless, in terms of the absolute number of trades for trading volume, the results are extremely similar. The correlation (not reported in table 6) between single-market surveillance and trading volume is 0.13 and statistically insignificant, while the correlation with cross-market surveillance is 0.77 and statistically significant at the 1% level (which is graphically illustrated in figure 2). Also, the scope of cross-market surveillance is positively and significantly correlated with the total value of trades (correlation equal to 0.62), the number of listed companies (0.51), market capitalization (0.58), the proportion of

Table 6. Correlation matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	Surveillance characteristics																						
(1)	Scope of single-market surveillance	1.00																					
(2)	Scope of cross-market surveillance	0.22	1.00																				
(3)	Average effectiveness ratings for surveillance	0.02	−0.03	1.00																			
(4)	Exchange versus commission surveillance—establish rules	−0.07	0.02	0.48	1.00																		
(5)	Exchange versus commission surveillance – monitoring	0.20	0.10	0.55	0.80	1.00																	
(6)	Exchange versus commission surveillance—enforcement	0.09	0.03	0.54	0.80	0.91	1.00																
(7)	Exchange versus commission real-time surveillance	0.25	−0.01	0.23	0.54	0.74	0.60	1.00															
(8)	Exchange versus commission post-trade surveillance	0.46	0.11	0.23	0.36	0.63	0.44	0.82	1.00														
(9)	Information sharing	−.022	−0.15	0.09	−0.18	0.12	0.10	0.02	0.02	1.00													
(10)	Number of departments	0.23	0.47	0.16	0.12	0.07	0.06	0.12	0.18	−0.24	1.00												
	Market characteristics																						
(11)	Civil law	0.11	−0.01	0.26	0.21	0.45	0.31	0.37	0.29	0.19	−0.08	1.00											
(12)	GDP/capita	−0.29	0.27	0.28	0.52	0.42	0.27	0.09	0.11	0.13	−0.05	0.31	1.00										
(13)	Turnover velocity	−0.16	0.65	0.11	0.38	0.35	0.23	0.37	0.43	0.24	0.37	0.04	0.54	1.00									

(*continued*)

Table 6. (*Continued*)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
(14)	Number of shares traded (millions)	0.04	0.30	−0.02	0.04	0.08	0.04	0.34	0.37	0.01	0.18	−0.31	−0.02	0.45	1.00								
(15)	Average daily turnover (millions)	0.24	0.14	−0.20	−0.04	0.09	−0.05	0.07	0.14	−0.25	−0.02	0.20	0.37	0.16	−0.10	1.00							
(16)	Average value of trades (thousands)	0.20	−0.10	0.23	−0.02	0.02	0.05	0.03	0.09	−0.24	0.02	0.20	−0.02	−0.12	−0.11	0.11	1.00						
(17)	Total value of trades (millions)	−0.13	0.62	0.36	0.39	0.49	0.42	0.16	0.19	0.00	0.18	0.17	0.65	0.72	0.06	0.29	−0.04	1.00					
(18)	Number of listed companies	−0.22	0.51	−0.24	−0.04	−0.25	−0.24	−0.48	−0.35	−0.19	0.22	−0.38	0.39	0.36	0.07	0.09	−0.06	0.46	1.00				
(19)	Market capitalization (millions USD)	−0.21	0.58	0.18	0.25	0.23	0.19	−0.11	−0.04	−0.07	0.09	−0.01	0.66	0.58	0.05	0.22	0.11	0.88	0.76	1.00			
(20)	Proportion of foreign shares	0.16	0.25	0.13	0.06	0.14	−0.01	0.03	−0.09	0.02	−0.03	0.24	0.11	−0.15	−0.19	−0.07	−0.01	0.02	−0.10	0.05	1.00		
(21)	Proportion of foreign shares traded	−0.01	0.03	0.48	0.60	0.58	0.38	0.32	0.30	0.17	−0.09	0.29	0.64	0.23	−0.19	0.03	−0.02	0.34	−0.12	0.23	0.47	1.00	
(22)	Proportion of companies cross-listed in USA	0.04	0.42	0.15	0.12	0.11	−0.06	0.01	0.00	−0.05	0.04	0.13	0.32	0.17	0.13	−0.05	0.16	0.26	0.23	0.39	0.79	0.38	1.00
(23)	Number of products traded on the exchange	0.11	0.40	0.50	0.61	0.58	0.43	0.39	0.42	−0.37	0.32	0.41	0.46	0.48	−0.01	0.01	0.17	0.57	0.15	0.47	0.28	0.49	0.41

This table presents correlation coefficients across selected variables defined in tables 1 and 3. Correlations statistically significant at the 5% level of significance are underlined.

companies cross-listed in USA (0.42), and the number of products traded on the exchange (0.40).

In addition to providing suggestive relations between variables of interest, the correlations in table 6 provide guidance as to potential problems for multicollinearity in the multivariate analyses in Section 4. The multivariate analyses presented in Section 4 consider, among other things, issues of causality between surveillance activity and trading.

4. Multivariate Analyses

Our multivariate analyses are separated into two parts. The first part, reported in Section 4.1, considers the scope of surveillance activity and impact on equity market activity. Thereafter Section 4.2 considers further evidence on the effectiveness surveillance.

4.1. The Scope of Market Surveillance and Impact on Equity Market Activity

Section 3 presented graphs and univariate correlations indicating a relationship between cross-market surveillance and trading activity, along with other variables in the data. The correlation evidence is suggestive, but does not get at the question of whether surveillance is caused by, and/or causes, trading activity. That is, an increase in surveillance should enhance market confidence and market participation thereby enhancing trading activity. Similarly, markets with greater trading activity have a greater interest in maintaining market integrity and greater revenues from which to invest in surveillance.

In order to address this issue of simultaneous causality between surveillance and trading, we employ three-stage least squares methods whereby trading and single- and cross-market surveillance are explained simultaneously. We control for proxies for exchange size and consider the robustness of the results to outliers in order to make sure the specifications do not pick up a spurious relation between cross-market surveillance and trading due to the sophistication of the market (due to the number of products and cross-listed securities, for example). As fully as possible, we control for market characteristics to observe the importance of surveillance over and above the

market characteristics. We focus our discussion on Model (1) in table 7, which comprises the following three models:[18]

(1) and (2) Scope of Surveillance [Single Market for (1) and Cross-Market for (2)] = *f* (GDP per capita, number of departments, number of products, the degree to which the exchange versus the securities commission is involved in post-trade surveillance, the role of the exchange versus securities commission in setting trading rules)

(3), (4), (5) Turnover Velocity (3), Number of Listed Companies (4), Market Capitalization (5) = *f* (the scope of single-market surveillance, the scope of cross-market surveillance, GDP per capita)

Models (1) and (2) are used to test Hypothesis 1 and the accompanying predictions are presented in Section 2.2. Note that we use a variety of instrumental variables in models (1) and (2) to account for potential endogeneity between surveillance and market activity. We would expect the number of departments, the role of an exchange versus a securities commission in engaging in surveillance, and the role of the exchange versus a securities commission in setting trading rules to impact the scope of surveillance for reasons explicitly indicated in Section 2.2. However, we would not expect a direct link between those variables and equity market activity (turnover velocity, number of listed companies, and market capitalization) except through actual surveillance efforts. Intuitively, simply changing the number of departments, or changing the role of the exchange versus the securities commission in rule setting or surveillance efforts should not directly impact market activity in equity trading unless investors perceive a material difference in market integrity brought about by actual surveillance efforts. Strictly speaking, these instruments should be correlated with the surveillance variables and uncorrelated with the equity market activity variables. Table 6 provides the correlation statistics. The variable for exchange versus the securities commission in post-trade surveillance is significantly positively correlated with the scope of single-market surveillance, and the

18. In an earlier draft of this paper, we also controlled for factors such as the extent of cross-listings on an exchange and various legal indices in the spirit of La Porta *et al*. (2006), but these variables were not material and did not affect the other variables reported. Given the limited number of observations, we report the more parsimonious specifications in table 6. Similarly, we considered simultaneous equations that accounted for causality to also run from trading activity to surveillance. Those results from the earlier draft are extremely similar and available on request.

Table 7. OLS and IV regression evidence of market surveillance, turnover velocity, listings and market capitalization

	First-stage estimates		Second-stage IV estimates			Standard OLS estimates		
	Model (1) Scope of single-market surveillance	**Model (2) Scope of cross-market surveillance**	**Model (3) Turnover velocity**	**Model (4) Number of listed companies**	**Model (5) Market capitalization**	**Model (6) Turnover velocity**	**Model (7) Number of listed companies**	**Model (8) Market capitalization Market capitalization**
Constant	8.687	−0714	−46.947)	2033.761	439009	32.383	672.213	−17293.944
	(4.116)***	(−0.393)	(−1.294)	(1.915)*	(0.951)	(0.914)	(1.948)*	(−0.095)
Surveillance characteristics								
Scope of single-market (fitted values for Models (3)–(5)) surveillance			4.647	−124.340	−34706.758	−0.701	−40.928	−7405.255
			(1.791)*	(−1.799)*	(−1.287)	(−0.420)	(−1.699)	(−0.713)
Scope of cross-market surveillance (fitted values for Models (3)–(5))			7.412	134.731	49800.504	9.163	101.715	48991.871
			(1.770)*	(3.975)***	(3.564)***	(2.764)**	(3.102)***	(2.922)***
Market characteristics								
GDP per capita	−1.417E-04	1.158E-04	1.947E-03	−1.005E-03	15.568	3.359E-04	1.263E-02	19.158
	(−1.522)	(1.843)*	(2.582)**	(−0.145)	(1.948)*	(0.370)	(1.527)	(3.100)***
Number of departments	0.485	1.349						
	(1.068)	(2.625)**						
Number of products	0.098	0.517						
	(0.202)	(1.841)*						
Exchange versus commission –post-trade surveillance	1.744	0.050						
	(2.937)***	(0.077)						

(*continued*)

Table 7. (*Continued*)

	First-stage estimates		Second-stage IV estimates			Standard OLS estimates		
	Model (1) Scope of single-market surveillance	**Model (2) Scope of cross-market surveillance**	**Model (3) Turnover velocity**	**Model (4) Number of listed companies**	**Model (5) Market capitalization**	**Model (6) Turnover velocity**	**Model (7) Number of listed companies**	**Model (8) Market capitalization Market capitalization**
Exchange versus commission surveillance – establish rules	−3.586 (−2.299)**	−1.874 (−2.164)**						
Diagnostics								
Number of observations	25	25	25	25	25	25	25	25
Adjusted R^2	0.195	0.247	0.261	0.383	0.488	0.226	0.329	0.586
F statistic	2.26*	2.57*	3.82**	5.97***	8.64***	3.34**	4.92***	12.33***
Log-likelihood	−71.427	−63.852	−130.823	−193.531	−349.174	−135.291	−194.579	−346.528
Akaike information statistic	6.194	5.588	7.951	15.802	28.254	11.143	15.886	−359.222

This table presents OLS and IV regression analyses of the determinants of the scope of single- and cross-market surveillance activities, in conjunction with turnover velocity (Models 3 and 6), number of listed companies (Models 4 and 7), and market capitalization (Models 5 and 8). Models 1 and 2 are the first-stage estimates of the scope of single-market surveillance and cross-market surveillance, respectively. Models (3)–(5) are the IV estimates. Models (6)–(8) are the standard OLS estimates. Variables are as defined in tables 1 and 3. The *t*-statistics are presented in parentheses. *, **, *** denote statistically significant at the 10%, 5%, and 1% level, respectively. White's (1980) heterockedasticity consistent covariance matrix estimator is used in all regressions.

number of departments is significantly positively correlated with the scope of cross-market surveillance. While turnover velocity is significantly correlated with the exchange versus the securities commission in establishing rules and the exchange versus the securities commission in post-trade surveillance, the instruments are otherwise not significantly correlated with the dependent variables for turnover velocity, the number of listed companies or market capitalization. In short, the instruments are not perfect in terms observed correlations, but they do offer the best available mechanisms to control for reverse causality and intuitively do seem plausible.

Note that we also include the number of products traded on the exchange in Models (1) and (2), in order to account for the possibility that a positive relation between the number of departments and scope of surveillance is attributable to a greater number of products. Exclusion of the number of products from Models (1) and (2) does not materially affect the results reported in table 7). We are unable to include the number of products as a variable in Models (3)–(5) as the number of products is too highly correlated with GDP to include in the same regression.

The dependent variable in Models (3), (4), and (5) are turnover velocity, the number of listed companies, and market capitalization, respectively.[19] Single- and cross-market surveillance in Models (3)–(5) are considered endogenous. For comparison, Models (6)–(8) in table 7 report similar regressions where the two surveillance variables are treated as exogenous (without instruments).

The evidence in table 7 Model (1) indicates a strong positive association between the role of an exchange versus a securities commission in post-trade surveillance and the scope of single-market surveillance. The economic significance is such that a 20 percent increase in the role of the exchange versus the securities commission (an increase in the ranking by 1 point out of 5) is associated with surveillance of approximately two additional types of single-market manipulations, and this effect is significant at the 1% level of significance. We note that exchanges are not more likely to engage in cross-market surveillance relative to securities commissions in Model (2).

19. In an alternative specification to Equation (3) (not reported, but available on request), we used the number of trades (as in figure 2a). That regression indicated a positive association between cross-market surveillance and the number of trades, but not with single-market surveillance. The findings were robust with and without the use of instruments.

This difference is most likely attributable to different incentives to engage in information sharing among exchanges versus securities commissions. Overall, the data are therefore very consistent with Hypothesis 1 (Section 2.2) based on the evidence presented in table 7 Models (1) and (2).

We noted in Section 2.2 that predictions were possible either way in terms of the effect of delegation of establishing trading rules to exchanges versus securities commissions on the scope of surveillance. Some jurisdictions have vaguely defined securities laws that indicate broadly based definitions of manipulation, while other jurisdictions make use of extremely detailed business rules as to what constitutes manipulation. The evidence in table 7 Models (1) and (2) show that a greater delegation to securities commissions in establishing business rules is associated with more surveillance. As discussed in Section 2.2, when securities commissions write exchange business rules, such rules tend to be vague, while exchanges that create business rules write very detailed rules. We may infer from the evidence in table 7 that surveillance is used by securities commissions as a substitute for (i.e., to make up for) trading rules that are vague in terms of what constitutes market manipulation.

The other variables in Model (1) are statistically insignificant, but statistically significant in Model (2). Jurisdictions with a higher GDP per capita engage in more cross-market surveillance, as might be expected since such jurisdictions have a greater proportion of cross-listings (see table 6 for correlations) and financial resources to implement cross-market surveillance technology.[20] A greater number of departments are associated with more cross-market surveillance, as expected (Section 2.2), since surveillance duties are better defined and segregated by department. One extra department is associated with an increase in the scope of cross-market surveillance by approximately 1.3. Exchanges that offer more products also naturally engage in more cross-market surveillance, such that an increase by one product increases cross-market surveillance by approximately 0.5.

Model (3) makes use of the first-stage regressions in Models (1) and (2) to estimate the effect of surveillance on turnover velocity. The data indicate the extent of both single- and cross-market surveillance has a significant and positive impact on turnover velocity. Model (3) shows that an extra element of single-market surveillance gives rise to higher turnover velocity

20. As mentioned above (note 18), separate control variables for these various factors were immaterial to the results of interest.

by approximately 4.6 percent, which is economically significant in view of the fact that the average turnover velocity is 73.8 percent for the twenty-five exchanges in the data. This result is statistically significant at the 10% level of significance. We note, however, that when we do not treat surveillance as endogenous in Model (6), we find no statistically significant relation between single-market surveillance and turnover velocity.

Model (3) shows that cross-market surveillance has a more pronounced positive impact on turnover velocity. An extra element of cross-market surveillance increases turnover velocity by 7.4 percent, and this effect is statistically significant at the 10% level of significance. Note that the magnitude of increase on turnover associated with expanding the scope of cross-market surveillance is approximately 60 percent larger than that for single-market surveillance. As well, note that in Model (6) when we do not use instrumental variables, the effect of expanding cross-market surveillance has a significant and robust positive impact on turnover velocity. In Model (6), the economic significance is such that an increase in the scope of cross-market surveillance increases turnover velocity by approximately 9.2 percent. The data therefore provide extremely strong support for Hypothesis 2 (Section 2.2).

Model (3) in table 7 includes a control variable for GDP per capita. GDP per capita is positively associated with turnover velocity. Additional control variables were considered but immaterial to the results pertaining to the surveillance variables of interest. In some cases, as discussed, it was not possible to include additional variables in Model (3) due to collinearity. For example, the number of products is excluded in Model (3) since that variable is too highly correlated with GDP. Alternative specifications in an earlier draft of this paper are available on request.

Models (4) and (7) are very similar to Models (3) and (6), respectively, with the exception that the dependent variable in Model (4) is the number of listed companies. The data indicate that cross-market surveillance has a statistically significant and economically large impact on the number of listed companies. An extra scope of cross-market surveillance is associated with an increase in the number of listed companies by 135 (Model 4; and 102 in Model (7)). Similarly, market capitalization (Models (5) and (8)) is significantly and positively associated with cross-market surveillance but not with single-market surveillance. The scope of single-market surveillance is statistically insignificant in Models (5), (7), and (8). Note that single-market

surveillance is negative and significant at the 10% level in Model (4), which suggests more single-market surveillance could discourage (presumably) lower quality listings (see also Harris, 2006), although this effect is not robust (the result is marginally insignificant in Model (7)). GDP per capita is a significant control variable in Models (5) and (8) but not in Models (4) and (7).

In sum, the evidence in table 7 provides strong support for Hypotheses 1 and 2 from Section 2.2. Single-market surveillance is greater where exchanges engage in surveillance activity instead of securities commissions due to the financial interests of exchange. Exchanges, however, do not engage in more cross-market surveillance than securities commissions due to conflicts of interest in information sharing. Cross-market surveillance is more closely connected with the number of departments due to a segregation of tasks across departments and departmental autonomy, while in single departments that carry out both trading and surveillance, there is a potential conflict of interest. Further, the data indicate single-market surveillance is positively associated with turnover velocity, but the statistical significance of this association depends on the use of instrumental variables. Cross-market surveillance has a larger and more robust effect on turnover velocity, and this effect holds regardless of the use of instrumental variables. Cross-market surveillance is significantly and positively associated with a greater number of listed companies and a higher level of market capitalization, unlike single-market surveillance. The regressions are quite robust and have fairly high, adjusted R^2 values explaining up to 59 percent of the variation in the dependent variables.

Section 5 qualitatively discusses the limitations and extensions associated with the regression evidence on the scope of surveillance and related issues not addressed by the data. But before proceeding to that discussion, we first provide evidence on self-assessment of the effectiveness of surveillance in Section 4.2 to complement the analyses in table 7.

4.2. Self-Assessment of the Effectiveness of Market Surveillance

In this section, we provide OLS and ordered logit estimates of the effectiveness of market surveillance. The dependent variables in this section are the qualitative rankings on the 1 (low effectiveness)—5 (high effectiveness)

scale.[21] These data to some degree are of course subject to a self-reporting bias, but nevertheless provide guidance as to the factors that affect the self-satisfaction of surveillance authorities with the quality of the work they carry out. We present seven models (labeled Models (9)–(15) in table 8) with different specifications of the dependent and explanatory variables.

Models (9)–(11) use the average ranking variable for all elements of effectiveness defined in table 3. In Models (12)–(15), the dependent variable is defined differently. Model (12) uses the ranking for real-time surveillance, while Models (13), (14), and (15) use the rankings for cross-product, cross-market, and cross-border surveillance, respectively. Models (12)–(15) use ordered logit models, not OLS, as the dependent variable is an ordinal ranking variable that takes on a finite number of discrete variables. Models (9)–(11) use an average ranking and hence can assume a continuous range of values such that OLS was used. Tobit regressions were also estimated for Models (9)–(11) (since the dependent variable is bounded), but since the regression results were not materially different, we only present the OLS estimates (Tobit estimates are available on request).

Table 8 Models (9)–(11) indicate jurisdictions are much more inclined to provide a higher effectiveness rating where the exchange is more directly involved in surveillance. While La Porta *et al*. (2006) do not examine market surveillance, the finding herein that exchanges are more effective at market surveillance than securities commissions is nevertheless consistent with evidence provided in La Porta *et al*. (2006) in regard to enforcement of securities laws. The data generally indicate a 1-point increase (out of 5) in the role of the exchange versus the association of securities commission with a 0.7 increase in the effectiveness rating.

Model (11) indicates a positive association between information sharing arrangements and effectiveness; however, that effect is not robust to the specifications in Models (9) and (10). Model (11) further indicates a positive association between effectiveness and the average value of trades and the number of products traded on the exchange. One possible explanation for

21. Above (*supra*, note 16 and accompanying text), we provided companion evidence on effectiveness of surveillance; however, as discussed, that data was limited in that only thirteen jurisdictions provided data and therefore those data are not used in the regression analyses in this section.

Table 8. OLS and ordered logit regression analyses of effectiveness of market surveillance

	Model (9): OLS, average of all effectiveness measures	**Model (10): OLS, average of all effectiveness measures**	**Model (11): OLS, average of all effectiveness measures**	**Model (12): Ordered logit, real time surveillance**	**Model (13): Ordered logit, cross-product surveillance**	**Model (14): Ordered logit, cross-market surveillance**	**Model (15): Ordered logit, cross-border surveillance**
Constant	−0.229	−0.021	−1.111	−0.141	−2.562	−1.415	−1.476
	(−0.240)	(−0.031)	(−1.516)	(−0.144)	(−2.660)***	(−1.425)	(−1.448)
Surveillance characteristics							
Exchange versus commission –establish trading rules	0.739	0.783	0.451	0.711	0.620	−0.020	−0.365
	(3.952)***	(3.477)***	(2.162)**	(2.490)**	(1.626)	(−0.058)	(−1.032)
Information-sharing arrangements	0.072	0.069	0.145			0.151	0.209
	(0.963)	(0.927)	(2.725)**			(1.940)*	(2.582)***
Scope of single-market surveillance	0.015			−0.063			
	(0.319)			(−1.403)			
Scope of cross-market surveillance	−0.011				−0.054	−0.063	−0.117
	(−0.204)				(−0.709)	(0.868)	(−1.417)
Number of departments				0.311	1.008	0.107	0.133
				(1.364)	(2.610)***	(0.536)	(0.590)
Exchange			−0.194				
			(−0.385)				
Market characteristics							
Turnover velocity		−0.220E-02	−0.482E-02				
		(−0.507)	(−1.200)				
Average value of trades (thousands)			0.330E-02				
			(3.004)***				

(*continued*)

Table 8. (*Continued*)

	Model (9): OLS, average of all effectiveness measures	**Model (10): OLS, average of all effectiveness measures**	**Model (11): OLS, average of all effectiveness measures**	**Model (12): Ordered logit, real time surveillance**	**Model (13): Ordered logit, cross-product surveillance**	**Model (14): Ordered logit, cross-market surveillance**	**Model (15): Ordered logit, cross-border surveillance**
Proportion of US cross-listings							−8.008 (−0.771)
Number of products traded on the exchange			0.259 (2.410)**		0.165 (1.294)	0.280 (2.227)**	0.431 (3.089)***
Ordered logit parameters							
Mu(1)				0.679 (2.688)***	1.877 (5.423)***	1.431 (4.738)***	2.158 (6.415)***
Mu(2)				1.127 (4.224)***	2.893 (7.061)***	1.956 (6.374)***	2.496 (7.302)***
Mu(3)				1.845 (5.614)***	5.986 (2.877)***	2.228 (6.739)***	3.117 (7.222)***
Diagnostics							
Number of observations	24	24	24	24	24	24	24
Adjusted R^2 (pseudo R^2 for ordered logits)	0.117	0.167	0.235	0.136	0.340	0.115	0.186
F-statistic (chi-square for ordered logits)	1.76	2.54*	2.12*	10.127**	23.203***	8.293	11.638***
Log-likelihood	−35.057	−34.976	−30.859	−32.141	−22.509	−31.828	−25.497
Akaike information statistic	3.338	3.248	3.292				

This table presents OLS and ordered logit regression analyses of the determinants of the scope of the effectiveness of single- and cross-market surveillance activities. Variables are as defined in tables 1 and 3. *, **, *** denote statistically significant at the 10%, 5%, and 1% level, respectively. White's (1980) heterockedasticity consistent covariance matrix estimator is used in all regressions.

these latter results is that those exchanges have greater operating budgets for surveillance technology and staff.

Consistent with Models (9)–(11), Model (12) indicates a positive association between the role of the exchange versus that of the securities commission and the effectiveness of real-time surveillance. However, note that the role of the exchange is not associated with effectiveness for cross-product, cross-market, or cross-border surveillance. Effectiveness of cross-market and cross-border surveillance is positively associated with the scope of information-sharing arrangements, and that effect is significant at the 10% level in Model (14) for cross-market and at the 1% level for cross-border in Model (15). Recall as well from table 5 and figure 3 that securities commissions are more likely than exchanges to engage in information-sharing arrangements and share a greater scope of information pertaining to surveillance.

In sum, the data introduced in this paper present a picture whereby jurisdictions are more satisfied with domestic single-market surveillance where the exchange plays a primary role in the surveillance. Exchanges, however, are less adept than securities commissions at establishing information-sharing arrangements. Likewise, jurisdictions with exchanges playing a primary role in surveillance over securities commissions are likewise less satisfied with the effectiveness of their cross-market surveillance than their single-market surveillance. Therefore, there appears to be ample scope for exchanges to expand their information-sharing arrangements; this in turn would thereby facilitate trading activity and market quality.

5. Further Robustness Checks and Extensions

This paper presented a first-ever direct comparison of market surveillance across financial markets around the world. The data are nevertheless limited in scope. In this study, we were able to obtain confidential private data from twenty-five jurisdictions from North, Central, and South America, Western and Eastern Europe, Africa, and Asia. Our empirical analyses presented a variety of robustness checks and controls for potential endogeneity and collinearity, among other things. Additional robustness checks were discussed and are available on request. For instance, we considered dropping certain exchanges from the data as potential outliers.

Any single exchange in the data did not materially influence the statistical significance of the results, although we did discuss cases in which economic significance was affected by the exclusion of the largest exchange in the data. As well, excluding groups of exchanges at the same time was not possible with the limited degrees of freedom.

In Section 4.2, we considered the possibility of self-reporting biases in regard to the respondent's perceptions of their own surveillance effectiveness. That type of self-reported information is nevertheless informative as it enables a qualitative assessment of where exchanges are at in terms of their self-satisfaction, and what drives differences in the level of satisfaction across exchanges. All of the exchanges were informed about, and assured of, the confidentiality of their data, which we believe minimizes self-reporting biases. Further, the respondents knew no respondent would be identified, and did not know the data would be presented in a way that showed differences between exchanges and securities commissions. We also noted that the perceptions were very consistent with other matched data provided by the exchanges and securities commissions. For example, table 5 data (note 16 and accompanying text) provide very robust findings about surveillance effectiveness in terms of self-assessment and the proportion of manipulations detected relative to trading activity.

Again, further to Section 4.2, the data are survey data and the data do indicate that exchanges that are responsible for their own surveillance tend to believe their surveillance is more effective relative to securities commissions that are responsible for surveillance. We acknowledge that it is possible that this result is strategic: an exchange has a strong incentive to report that its surveillance activities are sufficient because it wants investors to believe so and because surveillance is a cost center. But, for a securities commission, surveillance is a revenue center—the more surveillance it does, the larger a budget it can request from the government. A securities commission will want to argue that it needs more money so it can do more surveillance and it cannot simultaneously say that its current surveillance level is highly effective. To consider the possibility of response bias, we reran the regressions with modified dependent variables. Instead of using the raw ranking variables in table 8, we subtracted the average ranking for the securities commissions from these raw rankings for each securities commission, and similarly subtracted the average ranking for the exchanges from the raw rankings for each exchange. In view of the higher average ranking

provided by exchanges than securities commissions, this biases down the rankings by the exchanges relative to the securities commissions. The results, available on request, are very closely similar for each of the reported regressions in table 8. In short, we do not believe there is any response bias in view of confidentiality as discussed immediately above, but even if there is, plausible corrections continue to provide strong support for the reported results.

Ideally, one would like to expand the number of jurisdictions, but at this stage our data comprise all exchanges and securities commissions that were willing to participate given the extent and sensitivity of information that was sought. Future research could also examine issues in surveillance in relation to changes in technology and the structure of exchanges around the world.

For the purposes of this paper, we concentrated on an exchange's or securities regulator's surveillance of potentially manipulative trading practices on both a single-market and a cross-market level, which is usually carried out with the use of sophisticated computer surveillance systems. While we recognize that there are other factors that contribute to the effectiveness of surveillance activities, such as an educated and diligent surveillance staff, investigation and enforcement powers, and a management with political will and not subject to conflicts of interest (Pritchard, 2003), we believe that the extent to which trading is now wholly automated make surveillance activities very much dependent on system capabilities. It is therefore not within the scope of this paper to analyze exchange surveillance on the more general level, but our survey data provide many generalizable insights and a first look at an important issue in law and finance. Further research could shed more light on the international difference in surveillance effectiveness.

6. Conclusions

Market manipulation refers to a wide range of trading practices that distort prices and inhibit market integrity and efficiency, and the detection of such practices is carried out by market surveillance. This paper presented a first-ever direct comparison of the scope of single- and cross-market surveillance of such manipulative practices around the world. The data examined also enabled consideration of the effectiveness of single- and cross-market surveillance.

The new data introduced in this paper indicated a number of new insights about international differences in market surveillance in relation to market quality and integrity. On one hand, the data showed that jurisdictions of exchanges as SROs are more intensive in regard to single-market surveillance than securities commissions. On the other hand, SRO exchanges do not play a greater role in cross-market surveillance. Cross-market surveillance is more effective with information-sharing arrangements, and securities commissions are more likely to engage in information sharing than exchanges.

The empirical analyses in this paper provided some evidence of a positive relation between single-market surveillance and turnover velocity, but a much stronger and more robust relation between cross-market surveillance and turnover velocity. The relation between single- and cross-market surveillance held in regression specifications that accounted for endogeneity vis-à-vis surveillance and trading activity, but the impact of cross-market surveillance on turnover velocity was approximately 60 percent larger than that of single-market surveillance. Cross-market surveillance is significantly more complicated and less easily implemented by lower quality exchanges.

As at 2005, there is a dearth of cross-market surveillance in most jurisdictions around the world. The data in this paper are consistent with the view that there is ample scope for jurisdictions to expand their cross-market surveillance. Such a change would stimulate market integrity, enhance investor confidence, and facilitate trading activity. Future research could fruitfully examine issues involving market integrity alongside the expanding scope of cross-market surveillance, changes in the structure of exchanges, and the willingness to coordinate information sharing around the world.

References

Aitken, Mike, and Audris Siow. 2003. "Ranking World Equity Markets on the Basis of Market Efficiency and Integrity," *Hewlett-Packard Handbook of World Stock, Derivative & Commodity Exchanges*, xlix–lv, Mondo Visione Ltd.

Aggarwal, Rajesh K., and Guojun Wu. 2003. "Stock Market Manipulation—Theory and Evidence," AFA 2004 San Diego Meetings. Available at SSRN: http://ssrn.com/abstract=474582.

Allen, Franklin, and Douglas Gale. 1992. "Stock-Price Manipulation," 5 *Review of Financial Studies* 503–29.

Allen, Franklin, and Gary Gorton. 1992. "Stock Price Manipulation, Market Microstructure and Asymmetric Information," 36 *European Economic Review* 624–30.

Berkowitz, Daniel, Katharina Pistor, and Jean-Francois Richard. 2003. "Economic Development, Legality, and the Transplant Effect," 47 *European Economic Review* 165–95.

Carson, John W. 2003. Conflicts of Interest in Self-Regulation: Can Demutualized Exchanges Successfully Manage Them?" World Bank Policy Research Working Paper No. 3183.

Clayton, Matthew J., Bjorn N. Jorgensen, and Kavajecz A. Kavajecz. 2006. "On the Presence and Market-Structure of Exchanges around the World," 9 *Journal of Financial Markets* 27–48.

Comerton-Forde, Carole, and James Rydge. 2006. "Market Integrity and Surveillance Effort," 29 *Journal of Financial Services Research* 149–72.

Daouk, Hazem, Charles M. C. Lee, and David T. Ng. 2006. "Capital Market Governance: How Do Security Laws Affect Market Performance?" 12 *Journal of Corporate Finance* 560–93.

DeMarzo, Peter M., Michael J. Fishman, and Kathleen M. Hagerty. 2005. "Self-Regulation and Government Oversight," 72 *Review of Economic Studies* 687–706.

Easterbrook, Frank. 1986. "Monopoly, Manipulation, and the Regulation of Futures Markets," 59 *Journal of Business* 103–28.

Felixson, Karl, and Anders Pelli. 1999. "Day End Returns—Stock Price Manipulation," 9 *Journal of Multinational Financial Management* 95–127.

Fleckner, Andreas M. 2006. "Stock Exchanges at the Crossroads," 74 *Fordham Law Review* 2541–620.

Gerard, Bruno, and Vikram Nanda. 1993. "Trading and Manipulation around Seasoned Equity Offerings," 48 *Journal of Finance* 213–45.

Harris, Douglas. 2006. "Impact of Hot Issue Markets and Noise Traders on Stock Exchange Listing Standards," 56 *University of Toronto Law Journal* 223–80.

Harris, Larry. 2002. *Trading and Exchanges: Market Microstructure for Practitioners*. Oxford University Press, New York.

Hillion, Pierre, and Matti Suominen. 2004. "The Manipulation of Closing Prices," 7 *Journal of Financial Markets* 351–75.

Jarrow, Robert A. 1992. "Market Manipulation, Bubbles, Corners and Short Squeezes," 27 *Journal of Financial and Quantitative Analysis* 311–36.

Jarrow, Robert A. 1994. "Derivative Security Markets, Market Manipulation and Option Pricing Theory," 29 *Journal of Financial and Quantitative Analysis* 241–61.

Karmel, Roberta S. 2002. "Turning Seats into Shares: Causes and Implications of Demutualization Stock and Futures Exchanges," 53 *Hastings Law Journal* 367–430.

Kidd, John B. 1975. "Scoring Rules for Subjective Assessment," 26 *Operational Research Quarterly* 183–95.

Kumar, Praveen, and Duane J. Seppi. 1992. "Futures Manipulation with Cash Settlement," 47 *Journal of Finance* 1485–502.

La Porta, Rafael, Florencio Lopez-de-Silanes, and Andrei Shleifer. 1999a. "Corporate Ownership around the World," 54 *Journal of Finance* 471–517.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny. 1997. "Legal Determinants of External Finance," 52 *Journal of Finance* 1131–50.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny. 1998. "Law and Finance," 106 *Journal of Political Economy* 1113–55.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny. 1999b. "The Quality of Government," 15 *Journal of Law, Economics, and Organization* 222–79.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny. 2002. "Investor Protection and Corporate Valuation," 57 *Journal of Finance* 1147–70.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny. 2006. "What Works in Securities Laws?" 61 *Journal of Finance* 1–32.

Mahoney, Paul G. 1999. "The Stock Pools and the Securities Exchange Act," 51 *Journal of Financial Economics* 343–69.

Merrick, John J., Jr., Narayan Y. Naik, and Pradeep K. Yadav. 2005. "Strategic Trading Behavior and Price Distortion in a Manipulated Market: Anatomy of a Squeeze," 77 *Journal of Financial Economics* 171–218.

Ni, Sophie X., Neil D. Pearson, Allen M. Poteshman. 2005. "Stock Price Clustering on Option Expiration Dates," 78 *Journal of Financial Economics* 49–87.

O'Hara, Maureen, and Alfredo M. Mendiola. 2003. "Taking Stock in Stock Markets: The Changing Governance of Exchanges," Cornell University Working Paper.

Pirrong, Stephen C. 1993. "Manipulation of the Commodity Futures Market Delivery Process," 15 *Journal of Business* 335–70.

Pirrong, Stephen C. 1995. "Mixed Manipulation Strategies in Commodity Futures Markets," 15 *Journal of Futures Markets* 13–38.

Pirrong, Stephen C. 1999. "The Organization of Financial Exchange Markets: Theory and Evidence," 2 *Journal of Financial Markets* 329–57.

Pirrong, Stephen C. 2004. "Detecting Manipulation in Futures Markets: The Ferruzi Soybean Episode," 6 *American Law and Economics Review* 28–71.

Pistor, Katharina, Yoram Keinan, Jan Kleinheisterkamp, and Mark West. 2003. "The Evolution of Corporate Law: A Cross-Country Comparison," 23 *Journal of International Economic Law* 791–871.

Pistor, Katherina, and Chenggang Xu. 2003. "Incomplete Law—A Conceptual and Analytical Framework and Its Application to the Evolution of Financial Market Regulation," 35 *Journal of International Law and Politics* 931–1013.

Pritchard, Adam C. 2003. "Self-Regulation and Securities Markets," 26 *Regulation* 32–39.

Reiffen, David, and Michel A. Robe. 2007. "Ownership Structure and Enforcement Incentives at Self-Regulatory Financial Exchanges," Working Paper. Available at SSRN: http://ssrn.com/abstract=967396.

Romano, Roberta. 1993. *The Genius of American Corporate Law*. Washington, DC: AEI Press.

Romano, Roberta. 2002. *The Advantage of Competitive Federalism for Securities Regulation*. Washington, DC: AEI Press.

Vitale, Paolo. 2000. "Speculative Noise Trading and Manipulation in the Foreign Exchange Market," 19 *Journal of International Money and Finance* 689–712.