



The Program on International Financial Systems (PIFS) is a 501(c)(3) organization that conducts research on issues impacting the global financial system. PIFS also hosts international symposia, executive education programs and special events that foster dialogue and promote education on these issues. PIFS was founded in 1986, by Hal S. Scott, now Professor Emeritus of Harvard Law School. Over thirty years later, Hal Scott continues to lead PIFS.

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International Review of Equity Market Structure Regulation

Phase II: Quantitative Analysis

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International Review of Equity Market Structure Regulation

Quantitative Analysis

Executive Summary

Phase II of PIFS' international review of equity market structure regulation sets forth a quantitative analysis of equity markets in the People's Republic of China (including both the Mainland market and the Hong Kong Special Administrative Region),¹ the European Union, Japan, and the United States.

In Part I: Market Characteristics, we present summary statistics as to trading volume in each market, including recent trends and the share of on-exchange and off-exchange trading from 2011 until the end of 2019. We also address the relative share of trading volume attributable to institutional investors as compared to retail investors and compare trade sizes in each market. We find that on-exchange trading volumes and the share turnover ratio in Mainland China have significantly increased since 2011, as compared to the other four markets. We also find that a significant percentage of trades are executed off-exchange in the E.U. and U.S. but not in Hong Kong or Mainland China.

In Part II: Comparative Analysis of Trading Costs, we review non-public datasets from Virtu Financial and AbelNoser, two leading global providers of transaction cost analysis, to assess the performance of global equity markets for institutional investors. We have not been able to identify data to compare retail trading costs across markets, however, as demonstrated in Part I, the majority of trading volume in the E.U., Hong Kong, Japan and U.S. markets is institutional. In Part II, we evaluate changes from 2015-2019 in each of the markets as to institutional order size, brokerage commissions, price impact and overall trading costs. Three key findings are apparent from our review. First, price impact costs are the primary driver of overall trading costs for institutional investors across all five markets. Second, brokerage commission costs have significantly declined across all five markets and overall trading costs have also generally declined in recent years. Third, the United States has the lowest overall trading costs of the five major markets.

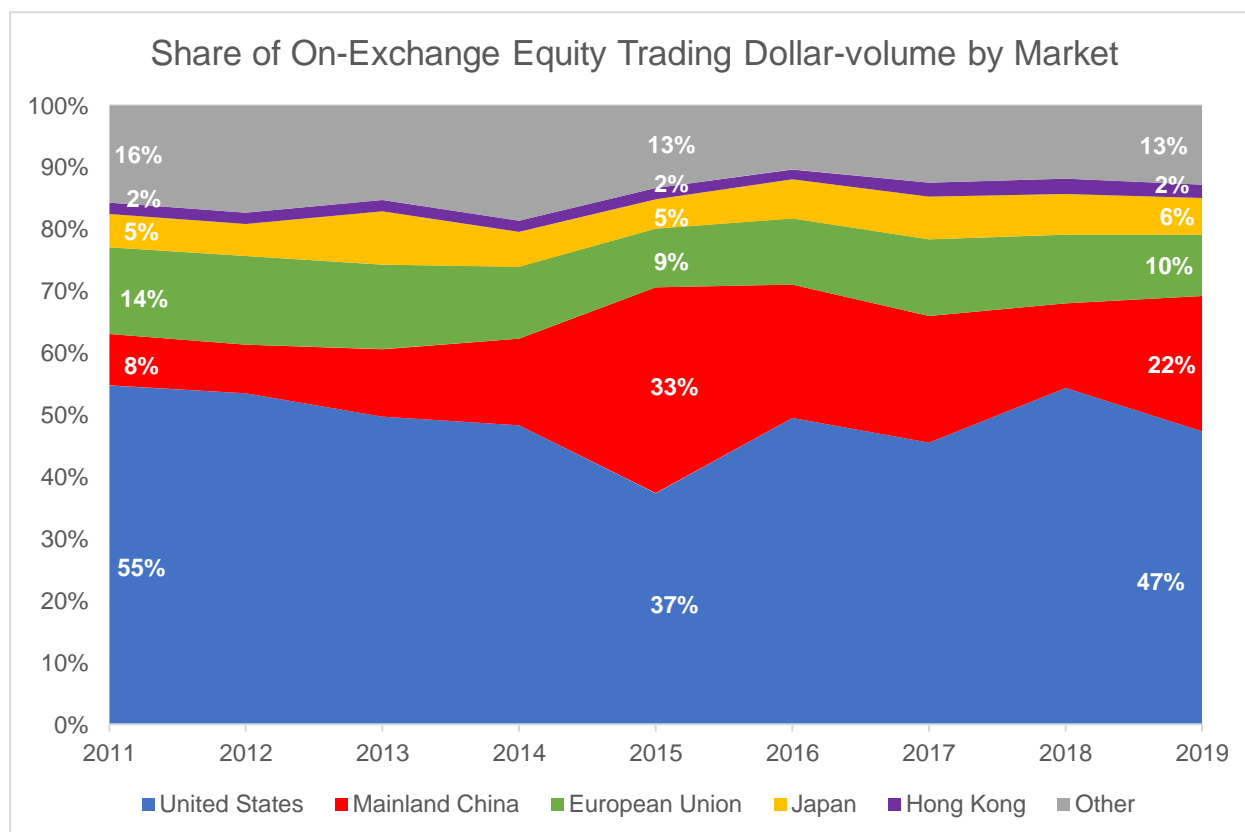
¹ For ease of reference, this report refers to (i) the People's Republic of China as "China"; (ii) the Hong Kong Special Administrative Region of the People's Republic of China as "Hong Kong"; and (iii) the rest of China as "Mainland China."

Part I: Market Characteristics

On-Exchange Trading

On-exchange trading volume in global equity markets are dominated by five markets: the E.U. (including the U.K.);² Hong Kong; Japan; Mainland China; and the United States. As demonstrated by **Figure 1**, these markets accounted for approximately 87 percent of on-exchange global public equity trading in 2019 by dollar volume.³

Figure 1 ⁴



² For the purposes of this section, E.U.-level statistics include United Kingdom market data unless stated otherwise.

³ Throughout this report, “dollar-volume” refers to statistics measured in U.S. dollars. Figures 1, 2 and 3 are generated using a World Federation of Exchanges dataset that provides trading volume and trade size metrics across most major global equity exchanges. WORLD FEDERATION OF EXCHANGES, *Statistics Portal* (2015-2019 data), <https://statistics.world-exchanges.org/> (“WFE Dataset”). Trading data from the following E.U. exchange groups is included in the WFE Dataset and used to tabulate E.U. on-exchange trading metrics: Athens Stock Exchange, BME Spanish Exchanges, Bucharest Stock Exchange, Budapest Stock Exchange, CBOE Europe, Cyprus Stock Exchange, CEESG - Vienna, Deutsche Borse AG, Euronext, Irish Stock Exchange, Ljubljana Stock Exchange, LSE Group, Luxembourg Stock Exchange, Malta Stock Exchange, Nasdaq Nordic and Baltics, Warsaw Stock Exchange, and Zagreb Stock Exchange. Hong Kong has one licensed exchange, the Hong Kong Exchange (“HKEx”), and it is included in the WFE Dataset. For Japan, only data from the Japan Exchange Group is included in the WFE Dataset. Japan Exchange Group exchanges accounted for approximately 99 percent of 2018 on-exchange trading dollar-volume. DAIWA INSTITUTE OF RESEARCH, (2019). Mainland China has two exchange groups for public equity trading – the Shanghai Stock Exchange and the Shenzhen Stock Exchange – and 2015-2019 data for boards across these exchanges is included in the WFE Dataset. Data from the following U.S. exchange groups is included in the WFE Dataset and used to tabulate U.S. on-exchange trading metrics: BATS, NASDAQ, and NYSE.

³ WFE Dataset, *supra* note 3; PIFS analysis.

⁴ WFE Dataset, *supra* note 3; PIFS analysis.

As demonstrated by **Figure 2**, total annual on-exchange global trading volume across all markets rose by 9 percent between 2011 and 2019, from \$80.2 trillion to \$87.2 trillion.⁵ **Figure 2** also shows a significant increase in overall on-exchange trading volume in Mainland China from 2011 to 2015 followed by a significant decline from 2015 to 2019. The surge in volume coincided with a bull market in Chinese equities that peaked in June 2015, with the Shanghai Composite Index exceeding 5,100 before declining below 2,800 by January 2016.⁶

Figure 2⁷

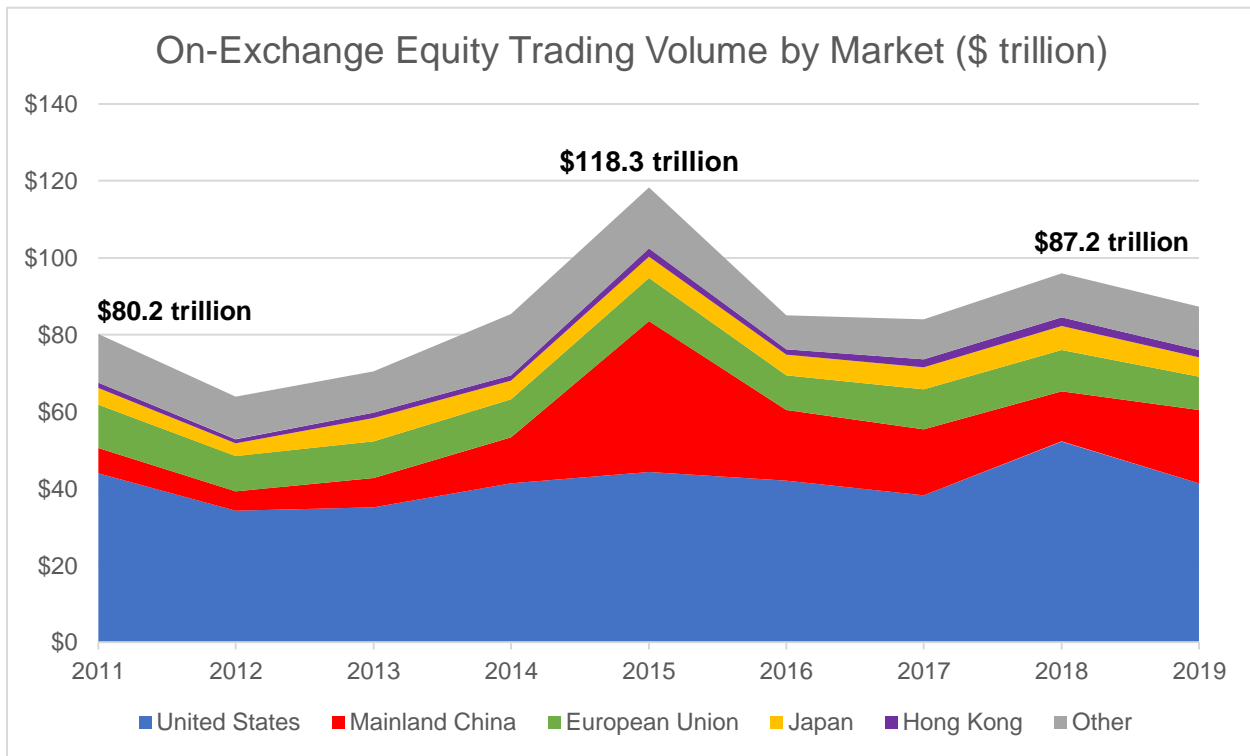


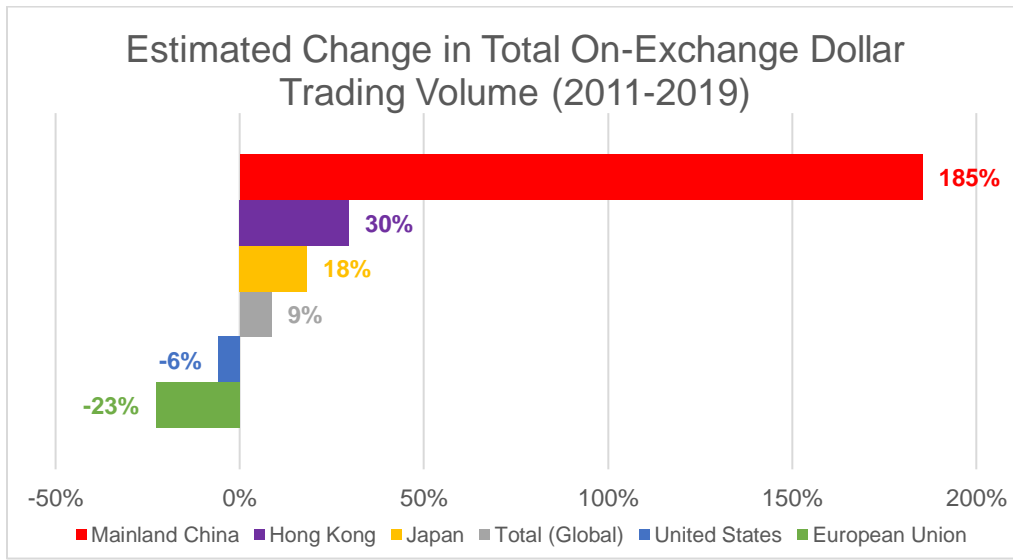
Figure 3 shows that from 2011 to 2019 on-exchange trading volumes in Mainland China increased by 185%, whereas the E.U., Hong Kong, Japan and the United States experienced comparatively modest changes. On-exchange trading volumes in Hong Kong and Japan were up 30% and 18% respectively. And on-exchange trading volumes in the E.U. and United States were down 23% and 6% respectively.

⁵ WFE Dataset, *supra* note 3; PIFS analysis.

⁶ Shen Hong, *How Chinese Stocks Fell to Earth: 'My Hairdresser Said It Was a Bull Market'*, THE WALL STREET JOURNAL (July 6, 2015); Gregor Stuart Hunter, *China's Stock Market Still a Draw After Tumultuous Year*, THE WALL STREET JOURNAL (Dec. 28, 2015); YAHOO FINANCE, *SSE Composite Index* (last accessed May 19, 2020), <https://finance.yahoo.com/quote/000001.SS/>.

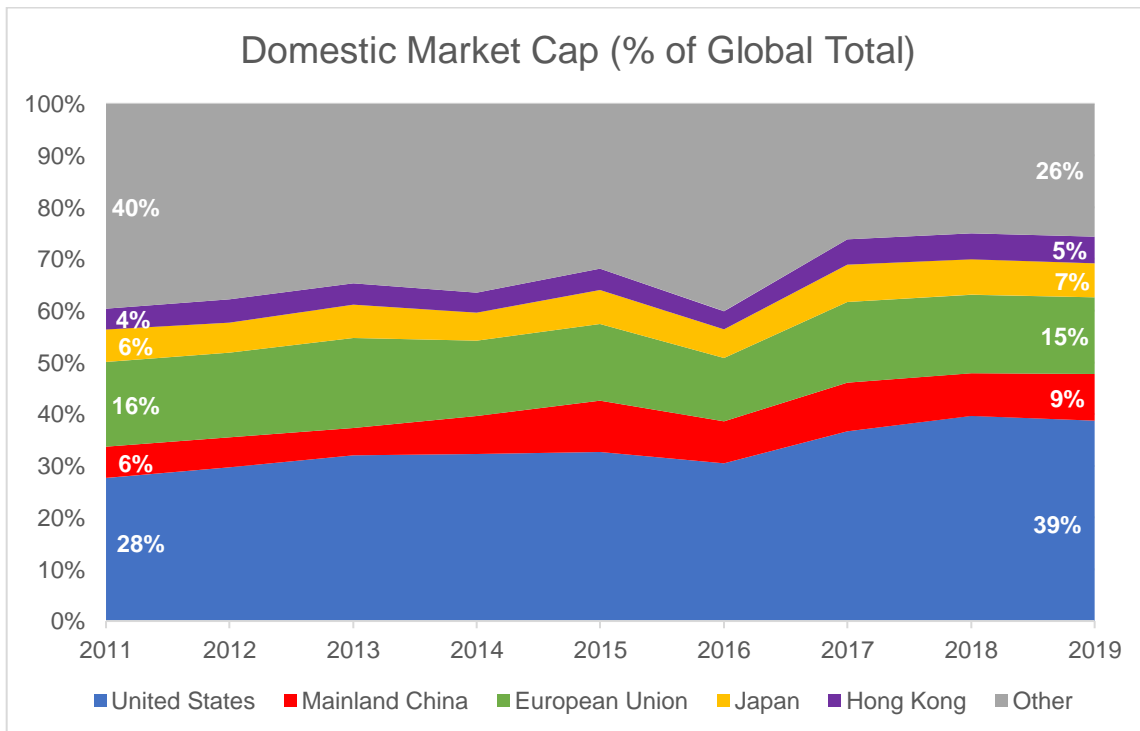
⁷ WFE Dataset, *supra* note 3; PIFS analysis.

Figure 3⁸



As demonstrated by **Figure 4**, the E.U., Hong Kong, Japan, Mainland China, and United States account for 74% of global public equity market capitalization as of end-2019.

Figure 4⁹

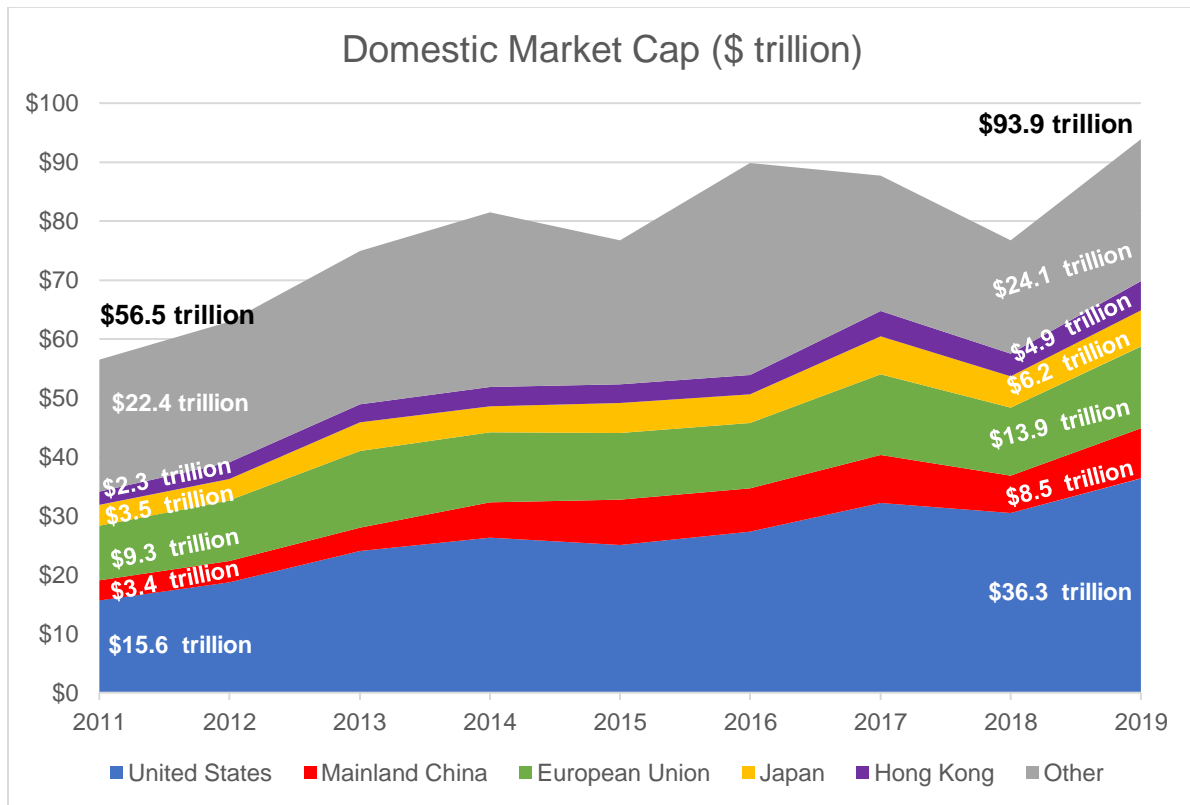


⁸ WFE Dataset, *supra* note 3; PIFS analysis.

⁹ WFE Dataset, *supra* note 3; PIFS analysis.

Figure 5 shows that from 2011 to 2019, the combined market capitalization of the E.U., Hong Kong, Japan, Mainland China and the U.S. rose from \$34.1 trillion to \$69.8 trillion, even as market capitalization in the rest of the world rose only slightly from \$22.4 trillion to \$24.1 trillion.¹⁰ Most of the increase among these five markets is attributable to the United States, where market capitalization rose from \$15.6 trillion in 2011 to \$36.3 trillion in 2019. The capitalization of U.S. equity markets exceeds the capitalization of the E.U., Hong Kong, Japan and Mainland China markets combined.

Figure 5¹¹

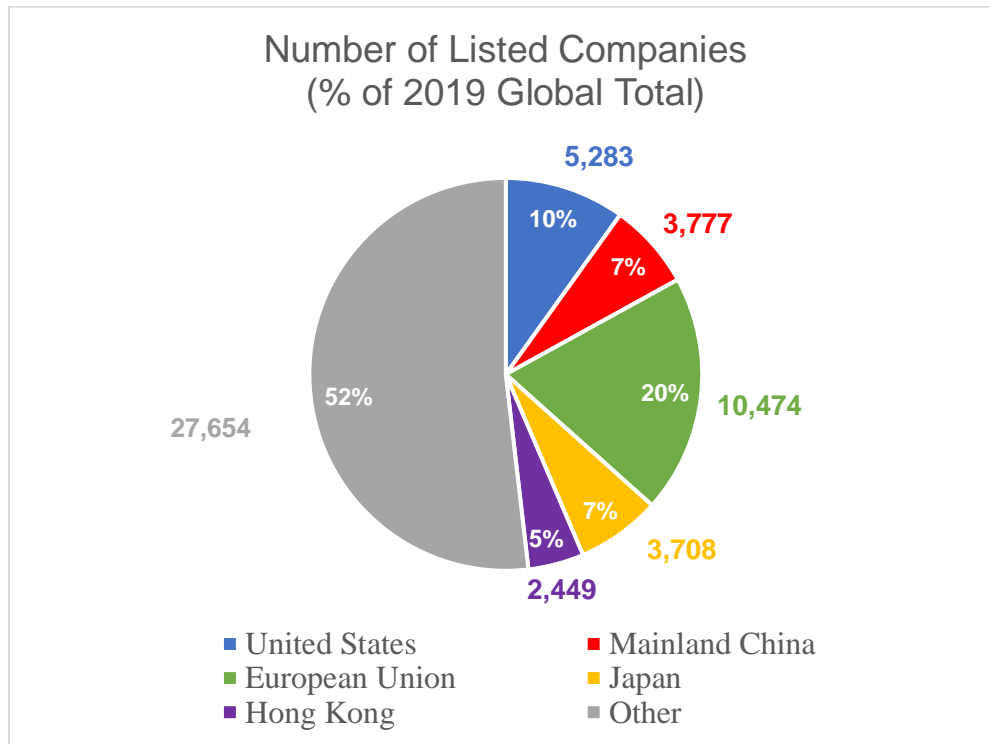


However, as shown in **Figure 6**, the E.U., Hong Kong, Japan, Mainland China, and the U.S., collectively accounted for only 48% of listed companies by year-end 2019, indicating that public companies in these five markets tend to be larger by market capitalization as compared to public companies in the rest of the world.

¹⁰ World Federation of Exchanges; PIFS analysis.

¹¹ World Federation of Exchanges; PIFS analysis.

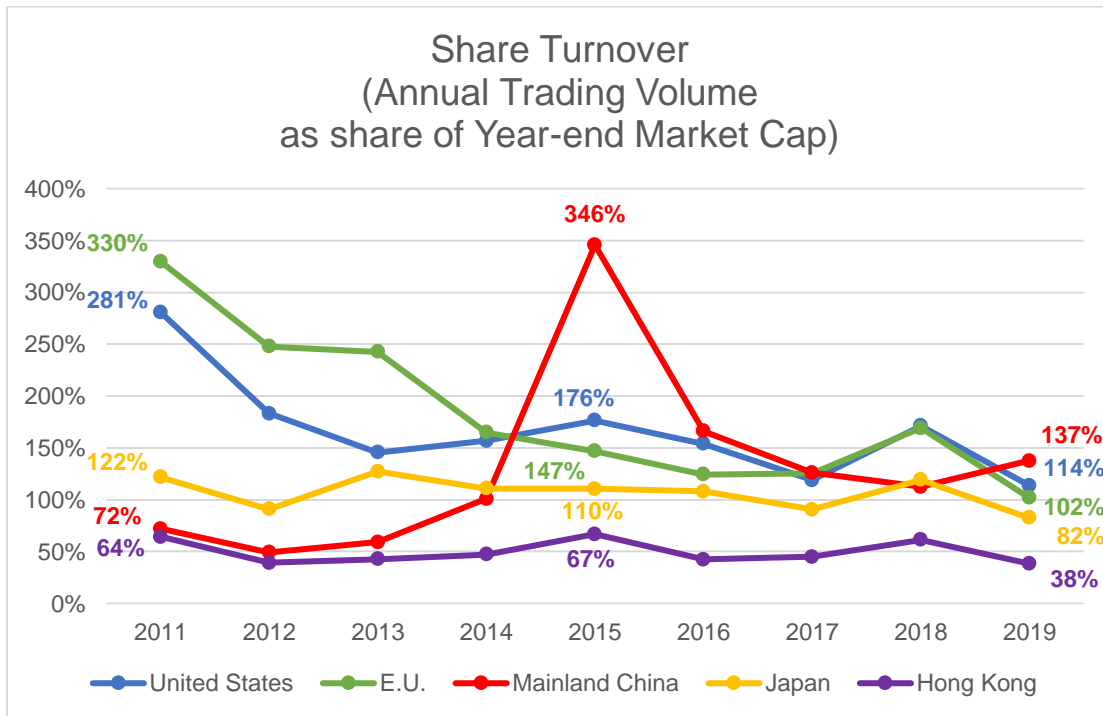
Figure 6¹²



The share turnover ratio, or annual trading volume as a percentage of year-end market capitalization, varied widely by market in 2019, as high as 137% in Mainland China and as low as 38% in Hong Kong. As shown in **Figure 7**, the share turnover ratio in the E.U., Hong Kong, Japan and the United States substantially declined from 2011 to 2019. On the other hand, the share turnover ratio in Mainland China nearly doubled over that time.

¹² WFE Dataset, *supra* note 3; PIFS analysis.

Figure 7¹³



Off-Exchange Trading

As to off-exchange trading volumes, we find that only in the E.U. and the U.S. does off-exchange trading constitute a sizable share of overall equity trading volume. As demonstrated by **Figure 8**, off-exchange trading volume represents 46 percent of overall trading volume in the E.U. as of September 2020,¹⁴ and 35 percent of overall trading volume in the U.S. (approximately \$28.4 trillion in annual trading volume in 2019).¹⁵ In Japan, off-exchange trading volumes represent only 15% of overall trading volume¹⁶ and in Hong Kong off-exchange trading volumes represent only 1% of overall trading volumes.¹⁷ Off-exchange trading is prohibited in Mainland China.

¹³ WFE Dataset, *supra* note 3; PIFS analysis.

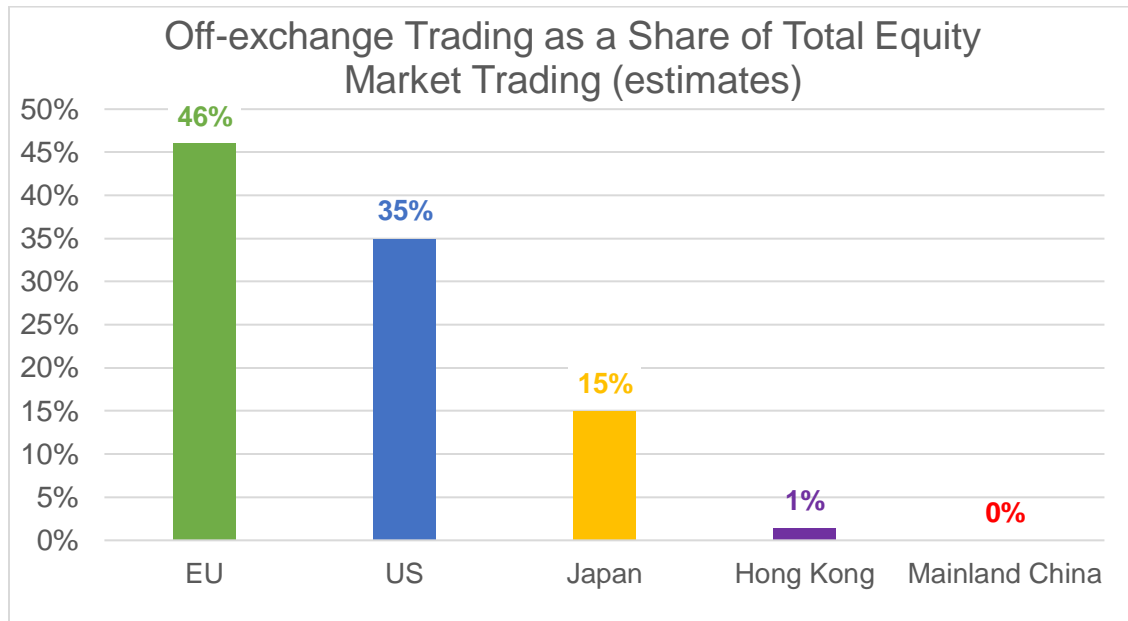
¹⁴ Rosenblatt Securities.

¹⁵ SECURITIES INDUSTRY AND FINANCIAL MARKETS ASSOCIATION, *US Equity Issuance and Trading Volumes, U.S. Stock Market Average Daily Trading Volume by Exchange Parent* (2019), <https://www.sifma.org/resources/research/us-equity-stats/>.

¹⁶ JAPAN SECURITIES DEALERS ASSOCIATION, *Monthly PTS Trading Values of Shares Listed on Financial Instruments Exchanges* (Oct. 2019), <http://www.jsda.or.jp/en/statistics/pts-for-equity/index.html>.

¹⁷ See HONG KONG SEC. & FUT. COMM'N, *Report on the Thematic Review of Alternative Liquidity Pools in Hong Kong* (April 2018) 4, [https://www.sfc.hk/web/EN/files/ER/Reports/ALP%20Report%20\(Eng\)%20-%206Apr2018%20\(Clean\)%20\(002\).pdf](https://www.sfc.hk/web/EN/files/ER/Reports/ALP%20Report%20(Eng)%20-%206Apr2018%20(Clean)%20(002).pdf).

Figure 8¹⁸



Multilateral trading facilities (“MTFs”) in the E.U. and alternative trading systems (“ATs”) in the U.S. execute trades off-exchange. Like exchanges, MTFs and ATs match buyers and sellers, but they are not registered as exchanges and they are not the primary listing venue for public equities. Regulated market makers also execute off-exchange trades. These regulated market makers are referred to as systematic internalizers (“SIs”) in the E.U. and broker-dealer internalizers in the U.S. They do not match buyers and sellers but instead act as principals and execute customer orders against their own inventory of stocks on a systematic basis.¹⁹ As in the E.U. and U.S., off-exchange trading in Hong Kong and Japan takes place primarily on “automated trading systems” and “proprietary trading systems,” respectively, and through regulated market makers.²⁰

In the U.S., broker-dealer internalization accounted for approximately 70 percent of off-exchange trading by share volume in Q4 2019, with ATs accounting for the remaining share.²¹ In the E.U., according to Rosenblatt Securities, SI trading accounted for just 14.3

¹⁸ SECURITIES INDUSTRY AND FINANCIAL MARKETS ASSOCIATION, *US Equity Issuance and Trading Volumes, U.S. Stock Market Average Daily Trading Volume by Exchange Parent* (2019), <https://www.sifma.org/resources/research/us-equity-stats/>; Rosenblatt Securities; JAPAN SECURITIES DEALERS ASSOCIATION, *Monthly PTS Trading Values of Shares Listed on Financial Instruments Exchanges* (Oct. 2019), <http://www.jsda.or.jp/en/statistics/pts-for-equity/index.html>; See HONG KONG SEC. & FUT. COMM’N, *Report on the Thematic Review of Alternative Liquidity Pools in Hong Kong*, 4 (April 2018), [https://www.sfc.hk/web/EN/files/ER/Reports/ALP%20Report%20\(Eng\)%20-%206Apr2018%20\(Clean\)%20\(002\).pdf](https://www.sfc.hk/web/EN/files/ER/Reports/ALP%20Report%20(Eng)%20-%206Apr2018%20(Clean)%20(002).pdf).

¹⁹ Definitions based on those set forth in the first PIFS report of this series. PROGRAM ON INTERNATIONAL FINANCIAL SYSTEMS, *International Review of Equity Market Structure Regulation* (Oct. 2019), <https://www.pifsinternational.org/wp-content/uploads/2019/10/PIFS-International-Review-of-Equity-Market-Structure-Reg-for-website.pdf>

²⁰ PROGRAM ON INTERNATIONAL FINANCIAL SYSTEMS, *International Review of Equity Market Structure Regulation*, 3 (Oct. 2019), <https://www.pifsinternational.org/wp-content/uploads/2019/10/PIFS-International-Review-of-Equity-Market-Structure-Reg-for-website.pdf>.

²¹ Based on SIFMA data regarding off-exchange trading and FINRA data regarding ATS trading volumes. SECURITIES INDUSTRY AND FINANCIAL MARKETS ASSOCIATION, *US Equity Issuance and Trading Volumes* (June 2, 2020), <https://www.sifma.org/resources/research/us-equity-stats/>; FINANCIAL INDUSTRY REGULATORY AUTHORITY, *ATS*

percent of trading by value as of September 2020, while 18.7 percent of trading was conducted via MTFs and 21 percent of trading was over-the-counter, meaning that trades were non-systematic, ad-hoc, irregular and infrequent.²² It is important to note that there are doubts as to the reliability of E.U. statistical data as it pertains to SI trading volumes and off exchange trading more generally. SI trading volume data particularly, as acknowledged by ESMA themselves, may have been artificially inflated by the misreporting of some financial market participants due to a lack of clarity in the current regulatory framework requirements. This has resulted in a somewhat distorted picture and difficulty in ascertaining the genuine extent of SI trading volumes in the E.U markets which clearly also suffer from the lack of a consolidated tape. However, the real amount of off-exchange trading volume in the E.U. is likely to fluctuate substantially over the coming years as these issues get fixed, and a consolidated tape is implemented.²³

One additional note is that off-exchange trading often takes place in the “dark,” meaning that there is no public display of order interest or pre-trade transparency.²⁴ As noted in PIFS’ *International Review of Equity Market Structure Regulation*, exchanges and off-exchange trading venues can execute trades in the dark, however all trades in each of the five markets are subject to post-trade transparency.²⁵ In the United States, ATSS and broker-dealer internalizers typically execute trades without pre-trade transparency.²⁶ However, in the E.U., 64% of trading on MTFs is “lit,” meaning that the trading venue provides pre-trade transparency.²⁷

Institutional and Retail Trading Volume

As demonstrated by **Figure 9**, trading volume in the U.S., Japan and Hong Kong is predominantly related to large institutional orders, rather than trading by retail investors. According to the TABB Group, institutional trading volume in the U.S. accounted for approximately 85 percent of 2018 trading volume.²⁸ Japan Exchange Group data shows that

Transparency Data Quarterly Statistics (last accessed June 29, 2020), <https://www.finra.org/filing-reporting/otc-transparency/ats-quarterly-statistics>.

²² Rosenblatt Securities.

²³ EUROPEAN SECURITIES AND MARKETS AUTHORITY, *MiFID II* (last accessed Sept. 2020), <https://www.esma.europa.eu/policy-rules/mifid-ii-and-mifir>.

²⁴ PROGRAM ON INTERNATIONAL FINANCIAL SYSTEMS, *International Review of Equity Market Structure Regulation*, 4-5 (Oct. 2019), <https://www.pifsinternational.org/wp-content/uploads/2019/10/PIFS-International-Review-of-Equity-Market-Structure-Reg-for-website.pdf>. See also, CFA INSTITUTE, *Dark Pool Trading & Finance* (last accessed Sept. 15, 2020), <https://www.cfainstitute.org/en/advocacy/issues/dark-pools>.

²⁵ PROGRAM ON INTERNATIONAL FINANCIAL SYSTEMS, *International Review of Equity Market Structure Regulation*, 4 (Oct. 2019), <https://www.pifsinternational.org/wp-content/uploads/2019/10/PIFS-International-Review-of-Equity-Market-Structure-Reg-for-website.pdf>

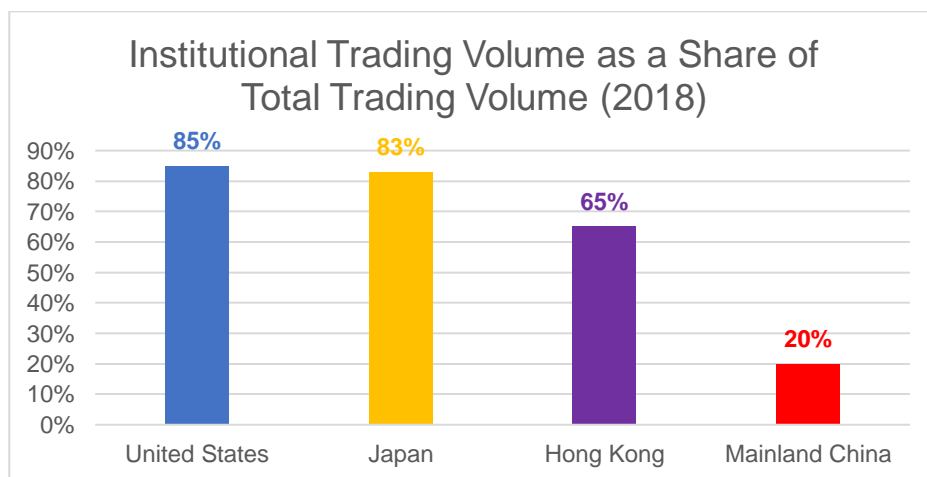
²⁶ *Id.* at 86.

²⁷ Rosenblatt Securities. See also EUROPEAN CENTRAL BANK, *Dark pools in European equity markets: emergence, competition and implications*, 12-13 (July 2017), <https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op193.en.pdf> (“While the largest MTFs in Europe are “lit” order books operating in similar ways to primary exchanges[.]”). See also FEDERATION OF EUROPEAN SECURITIES EXCHANGES, *The design of equity trading markets in Europe*, 38, 45 (March 2019), <https://fese.eu/app/uploads/2019/03/190321-The-design-of-equity-trading-markets-in-Europe-full-report.pdf>; See, e.g., LONDON STOCK EXCHANGE GROUP, *Turquoise Trading Services* (last access Sept. 3, 2020), <https://www.lseg.com/markets-products-and-services/our-markets/turquoise/turquoise-trading-services>

²⁸ See Alexander Osipovich, *Exchanges Vie With Ultrafast Traders for Mom-and-Pop Stock Orders*, WALL STREET JOURNAL (Sep. 18, 2019), <https://www.wsj.com/articles/exchanges-vie-with-ultrafast-traders-for-mom-and-pop-stock-orders-11568808000> (citing TABB Group data).

institutional investors accounted for approximately 83 percent of 2018 trading by value.²⁹ And a 2019 Schroders analysis reports that 65 percent of Hong Kong trading volume is attributable to institutional investors.³⁰ However, in Mainland China, a 2019 FTSE Russell report finds that over 80 percent of trading volume is retail.³¹ PIFS staff has thus far been unable to identify estimates of the relative share of trading in the E.U. attributable to institutional or retail investors.

Figure 9



Trade Sizes

Figure 10 shows the average on-exchange trade size by dollar volume in each of the five markets. Average trade sizes are significantly higher in the U.S., Japan and Hong Kong—predominantly institutional markets—as compared to Mainland China’s retail-heavy market.³² We note that the average trade size by dollar volume in the E.U. is consistent with average trade sizes in the U.S., Japan and Hong Kong, which suggests that trading volume in E.U. markets may also be predominantly related to larger institutional orders.³³ However, an evaluation of average trade sizes must also note other factors that are not necessarily reflected in the data. First, broker-dealers break up large institutional orders into many smaller orders (often referred to as “child” orders) to achieve the best execution price for their clients.³⁴ As a result, average trade sizes are smaller than the original “parent” order from the

²⁹ Based on data reported by the Japan Exchange Group, PIFS subtracted the 2018 Japanese Yen (“JPY”) total of stock trades across all Tokyo Stock Exchange and Nagoya Stock Exchange markets by individuals (JPY 261,072,352,293) from overall 2018 trading volume on those markets (JPY 1,549,855,267,604). We then divided that difference by overall 2018 trading volume on those markets. Japan Exchange Group, *Total Trading Value of Stocks in Tokyo & Nagoya Markets by Investor Type -- All 50 Trading Participants* (2018) 5, https://www.jpjx.co.jp/english/markets/statistics-equities/investor-type/b5b4pj000002n69q-att/stock_val_1_y18.pdf.

³⁰ Louisa Lo, *Where next for China A-shares?*, Schroders (Jul. 2019), <https://www.schroders.com/en/insights/economics/where-next-for-china-a-shares/>.

³¹ Alex Chen, *China's retail investment market: Implications for minimum variance*, FTSE Russell (Mar. 2019), <https://www.ftserussell.com/blogs/chinas-retail-investment-market-implications-minimum-variance>.

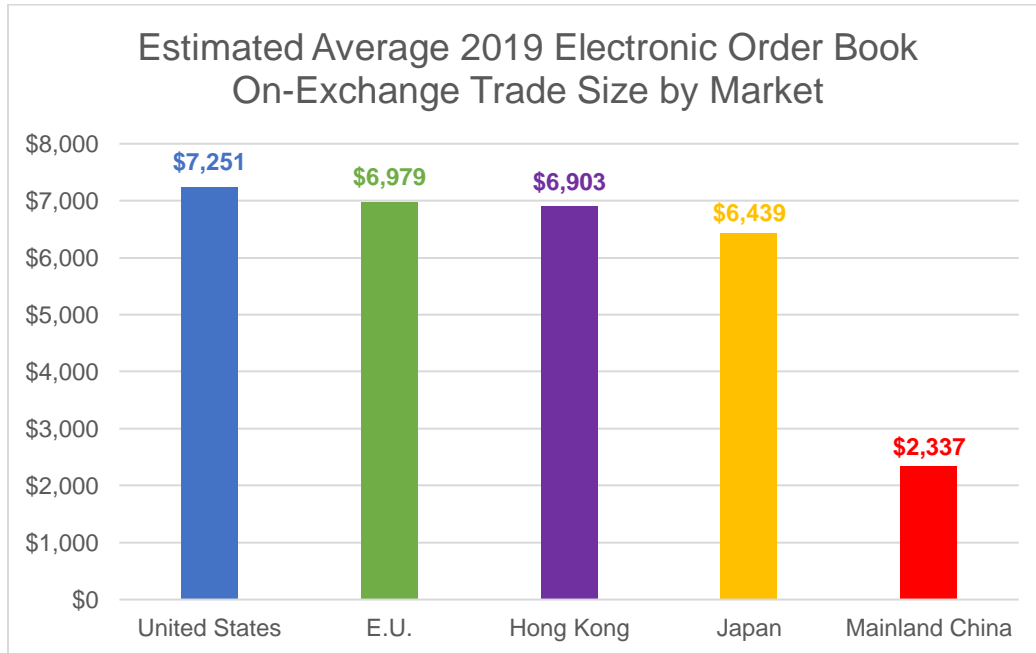
³² See Figure 8.

³³ See Figure 8.

³⁴ See, e.g., Munhee Han, Sanghyun (Hugh) Kim, Vikram K. Nanda, *Institutional Brokerage Networks: Facilitating Liquidity Provision* (April 29, 2019), http://people.stern.nyu.edu/jhasbrou/SternMicroMtg/SternMicroMtg2019/Papers/broker_networks_20190409.pdf.

investor. In addition, in the U.S. approximately 90% of retail orders, which are generally smaller than institutional orders, are executed through broker-dealer internalization and, therefore, are not included in the average on-exchange trade size data.³⁵

Figure 10³⁶



³⁵ U.S. SEC. & EXCH. COMM'N, *Certain Issues Affecting Customers in the Current Equity Market Structure*, 2, n. 2 (Jan. 26, 2016), <https://www.sec.gov/spotlight/equity-market-structure/issues-affecting-customers-emsac-012616.pdf> ("Internalization is believed to account for almost 100% of all retail marketable order flow.").

³⁶ WFE Dataset, *supra* note 3; PIFS analysis.

Part II: Comparative Analysis of Institutional Trading Costs

In Part II, we assess the performance of each market for investors based on institutional trading costs. We rely on data provided by Virtu Financial³⁷ and AbelNoser³⁸—two leading global providers of transaction cost analysis data. We have not been able to identify data to compare retail trading costs across markets. We begin Part II by explaining the components of transaction costs for retail and institutional investors. We then summarize the Virtu and AbelNoser datasets and conclude by observing key similarities.

Components of Transaction Costs

For retail investors, transaction costs include brokerage commissions and the bid-ask spread. Brokerage commissions entail the direct fees charged by brokers for executing an investor's order. These fees can vary widely both within markets and across markets, particularly with U.S. brokerage commissions approaching zero for many retail orders.³⁹ The cost associated with the bid-ask spread is slightly less straight-forward and best described with an example. Suppose that Security X is trading on an exchange with a best bid price of \$9.99 and a best offer (or ask) price of \$10.01. The midpoint of the best bid and offer is \$10.00, which is the implied "fair value" of Security X. Next, suppose that Retail Investor A places a market order to buy 100 shares of Security X. This market order will execute on the exchange at \$10.01, the current best offer, because given the small size of retail orders there is typically sufficient available liquidity at the best offer price. The cost associated with the bid-ask spread is the difference between the mid-point of \$10.00 and the execution price of \$10.01. However, as noted in Part I, in the U.S., more than 90% of retail orders are executed off-exchange through broker-dealer internalization.⁴⁰ These retail orders typically receive "price improvement," meaning that they are executed at a price better than \$10.01 in this example (i.e. closer to the "fair value" of \$10.00).⁴¹

For institutional investors, transaction costs associated with price impact are higher as there is typically insufficient liquidity at the best bid or offer to execute an order. The price impact for institutional orders is best described with an example. Suppose that Security X is still trading with a best bid of \$9.99 and a best offer of \$10.01. Further suppose that only 2,500 shares are offered at \$10.01, while another 5,000 shares are offered at \$10.02 and 2,500 shares offered at \$10.03. For illustrative purposes, suppose that Institutional Investor B

³⁷ Virtu Financial is a global, technology-driven market-maker that also operates a client services business that provides execution improvement solutions, workflow technology, liquidity sourcing, and trade analytics. Virtu Financial (accessed Oct. 30, 2019), <https://www.virtu.com/>. Seventy-five percent of the world's largest asset managers use its transaction cost analysis intelligence. Virtu Financial, Trading Analytics (accessed Oct. 30, 2019), <https://www.virtu.com/solutions/analytics/>. Prior to Nov. 2018, the trading cost data was collected by Investment Technology Group ("ITG"), which subsequently became part of Virtu upon Virtu's acquisition of ITG. See Virtu Press Release, Nov. 7, 2018 available at <https://ir.virtu.com/press-releases/press-release-details/2018/Virtu-Financial-Inc-Agrees-to-Acquire-ITG-a-Leading-Provider-of-Agency-Execution-Services-and-Trading-Analytics/default.aspx>.

³⁸ AbelNoser is an industry-leader in providing transaction cost analysis services to investment managers, consultants, and brokers. AbelNoser, *About AbelNoser* (accessed Oct. 2019), <https://www.abelnoser.com/about-abel-noser.html>.

³⁹ See James Royal, *In the race to zero-fee broker commissions, here's who the big winner is*, BANKRATE.COM (Oct. 4, 2019), <https://www.bankrate.com/investing/zero-fee-broker-commissions-long-term-investors-win/>.

⁴⁰ U.S. SEC. & EXCH. COMM'N, *Certain Issues Affecting Customers in the Current Equity Market Structure*, 2, n. 2 (Jan. 26, 2016), <https://www.sec.gov/spotlight/equity-market-structure/issues-affecting-customers-emsac-012616.pdf>.

⁴¹ See, e.g., PROGRAM ON INTERNATIONAL FINANCIAL SYSTEMS, *International Review of Equity Market Structure Regulation*, 96 (Oct. 2019), <https://www.pifsiinternational.org/wp-content/uploads/2019/10/PIFS-International-Review-of-Equity-Market-Structure-Reg-for-website.pdf>

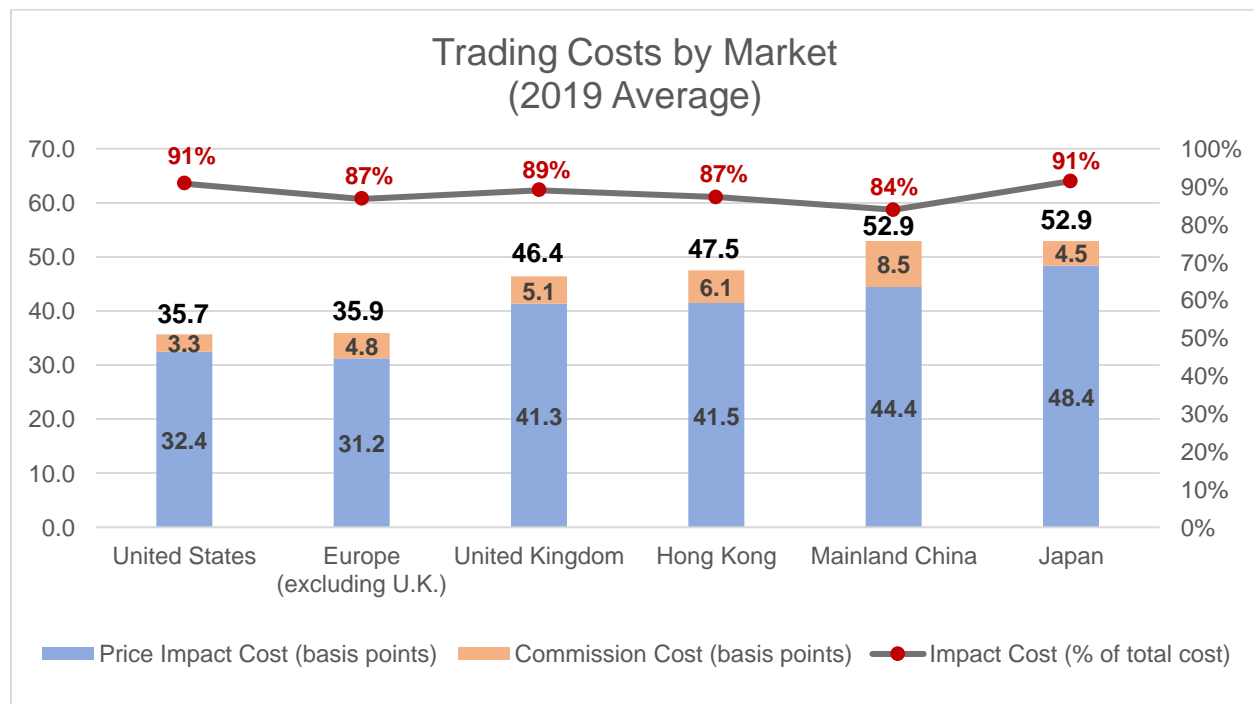
places a market order to buy 10,000 shares of Security X. Given the shares available, the order will be executed at \$10.01 for 2,500 shares, \$10.02 for 5,000 shares and \$10.03 for 2,500 shares, resulting in an average execution price of \$10.02 for the full order. The \$10.02 execution price is 1 cent or 10 basis points (“bps”) higher than the \$10.01 best offer that prevailed at the time of the order. This 10-bp difference is the *additional* price impact (often referred to as slippage) that occurs as a result of the relatively large buy order (i.e. the 10,000 share order is large relative to the size of offers in the market). Price impact costs are included in the Virtu and AbelNoser datasets.

Virtu Analysis

Virtu estimates brokerage commissions and price impact cost by collecting trading data from over 180 asset managers on over \$13 trillion in trades per year.⁴² Virtu trading costs and order size are a weighted average based on the value of shares traded.⁴³ We note that for the Virtu data we review six markets rather than five, as Virtu separates trading cost data for the U.K. from the E.U.

Figure 11 sets forth overall institutional trading costs in each of the six markets in 2019 measured in basis points. One basis point is equivalent to 1/100th of 1% or 0.01%. The U.S. has the lowest total trading costs at 35.7 bps, followed by E.U. (35.9 bps), the U.K. (46.4 bps), Hong Kong (47.5 bps), Mainland China (52.9 bps), and Japan (52.9 bps). **Figure 11** also shows that price impact contributes between 84 and 91 percent of total trading costs.

Figure 11⁴⁴



⁴² Based on conversations with Virtu Financial staff.

⁴³ Based on conversations with Virtu Financial staff.

⁴⁴ In this graph, inconsistency between total and component figures for Europe and Hong Kong are due to rounding.

However, the overall trading cost by value (measured in USD) for institutional investors depends on the size of the institutional order on which the basis point cost is applied. The Virtu data set considers parent orders rather than their constituent “child orders.” As described in Part I, broker-dealers divide parent orders into many smaller orders to minimize transaction costs and achieve best execution. **Table 1** below sets forth the average order size in each market in 2019 (based on the Virtu data set) and the average dollar trade cost for each market. The average dollar trade cost is derived by simply multiplying the average order size by the average basis point cost. For example, the average order size in the U.S. is \$327,463. A 35.7 bp (or 0.357%) transaction cost would represent a cost of \$1,170 to an institutional investor for executing an average-sized order. And, in Mainland China, the average order size is \$329,478, so a 52.9 bp (or 0.529%) transaction cost would represent a cost of \$1,744 to an institutional investor.

Table 1
Implied Trade Cost

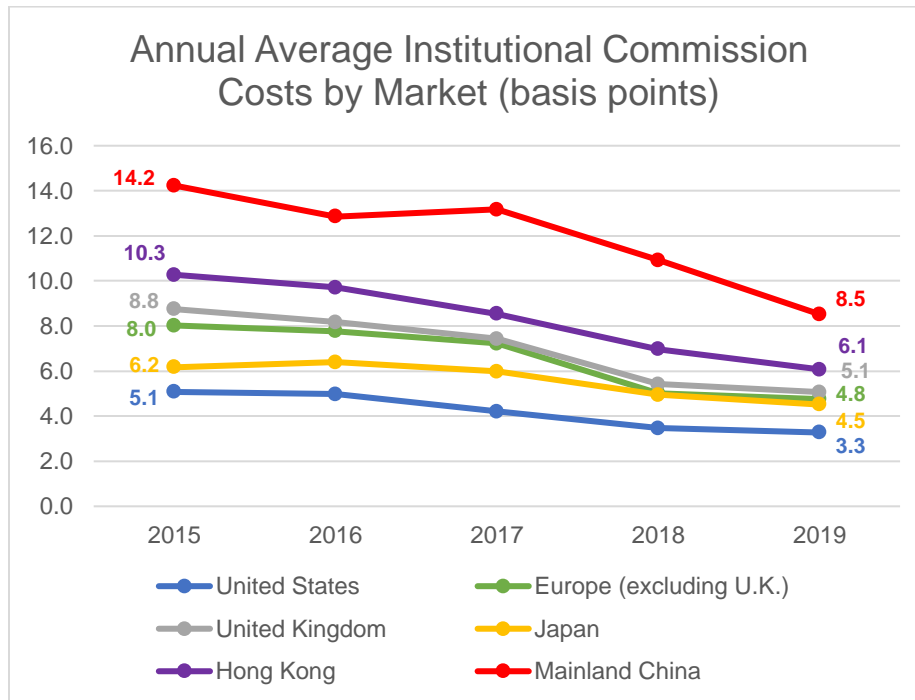
Market	2019	
	Average Order Size	Implied Average Trade Cost
United States	\$327,463	\$1,170
Mainland China	\$329,478	\$1,744
Japan	\$348,674	\$1,846
E.U. (excluding U.K.)	\$544,866	\$1,959
Hong Kong	\$508,807	\$2,419
United Kingdom	\$544,636	\$2,526

Recent Trends in Institutional Trading Costs and Order Sizes

a. Commission Costs

There was a substantial decrease in commission costs across all six major equity markets from 2015 to 2019. **Figure 12** illustrates that average commission costs dropped between 27 and 42 percent in each market during this time.

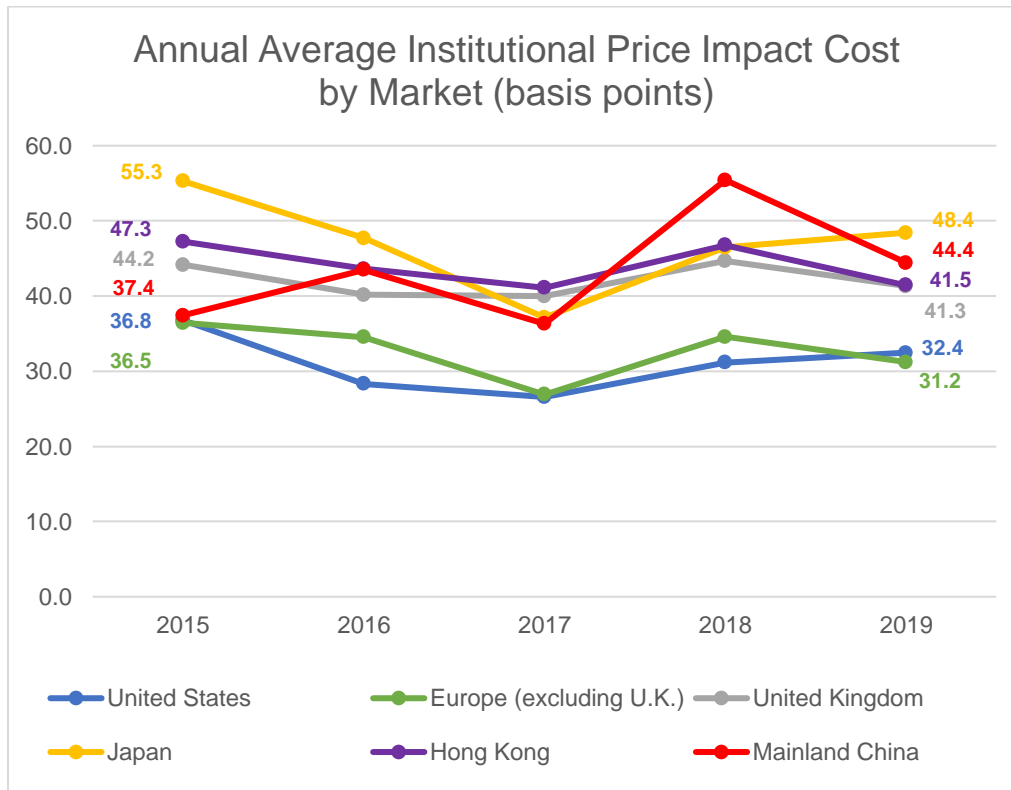
Figure 12



b. Price Impact Costs

Figure 13 demonstrates that from 2015 to 2019 price impact costs increased substantially in Mainland China (growing 19 percent) and declined substantially in Japan, Hong Kong, the E.U., and the U.S (dropping between 12 and 14 percent in each market). Price impact costs declined a more modest 6 percent in the UK. The increase in price impact cost in Mainland China is likely due to the substantial reduction in trading volume in Mainland China from 2015 to 2019 demonstrated by **Figure 2**. In general, price impact costs are higher when there is less liquidity. As noted in Part I, the decline in trading volume in Mainland China from 2015 to 2019 represented a reversion to historical trends, as trading volumes in Mainland China experienced a significant increase leading up to 2015.

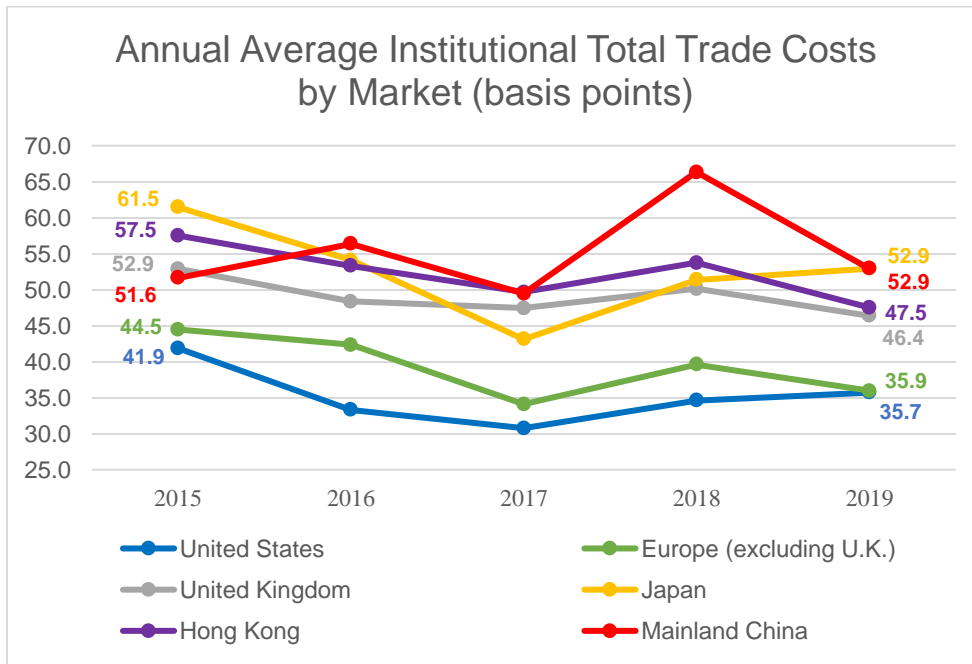
Figure 13



c. Overall Trading Costs

Figure 14 illustrates that from 2015 to 2019, overall institutional investor trading costs (commission costs + price impact costs) have fallen across major public equity markets other than Mainland China where they have slightly risen by three percent. The increase in trading costs in Mainland China is primarily driven by an increase in price impact costs (+16.8 basis points), which exceeded the decrease in commission costs (-5.6 basis points). As noted above, the increase in price impact costs in Mainland China is related to a decrease in trading volumes in Mainland China from 2015 to 2019 that itself represents a reversion to historical trends. Critically, this means that the recent spike in transaction costs is likely not due to a reduction in the efficiency of equity market structure.

Figure 14



d. Order Size

Figure 15 and **Table 2** illustrate that from 2015 to 2019, the average institutional order size in the Virtu data set increased moderately in the U.S. (10.5%) and the U.K. (1.9%), and increased significantly in the E.U. (ex-U.K.) (23.4%). Over the same time period, average order sizes decreased moderately in Japan (-9.8%) and Hong Kong (-17.0%), while dropping significantly in Mainland China (-70.1%).

Figure 15

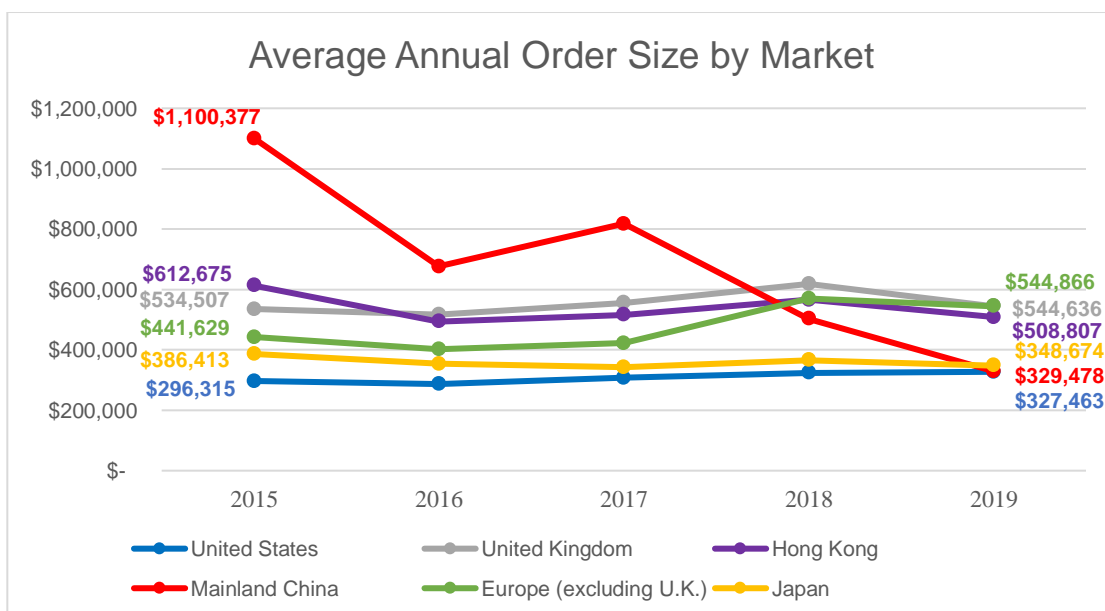


Table 2
Average Institutional Order Size

Market	2015	2016	2017	2018	2019
United States	\$296,315	\$286,834	\$306,991	\$324,109	\$327,463
E.U. (excluding U.K.)	\$441,629	\$402,107	\$422,360	\$569,976	\$544,866
United Kingdom	\$534,507	\$516,742	\$556,197	\$618,422	\$544,636
Japan	\$386,413	\$354,016	\$342,707	\$365,589	\$348,674
Hong Kong	\$612,675	\$493,571	\$516,524	\$565,640	\$508,807
Mainland China	\$1,100,377	\$676,159	\$817,458	\$502,476	\$329,478

In general, changes in the average order size in each market over time should be considered alongside changes in average trading costs in each market. Holding all else equal, as the size of an order increases, so does the cost to execute that order, and vice-versa.⁴⁵ However, in the U.S., E.U. (excluding UK), and United Kingdom, Virtu data shows that overall trading costs are generally falling despite increases in order sizes. Therefore, other market factors (such as higher liquidity, improved competition or execution technology and strategies by broker-dealers) likely account for lower trading costs in those markets. As to Japan, trading costs have fallen by 14% from 2015 to 2019 whereas average order size has only decreased by 9.8% over the same period of time, which also suggests that market factors other than changes in average order size are contributing to lower transaction costs. In Hong Kong both trading costs and order size have fallen by 17% from 2015 to 2019. It is therefore possible that the fall in trading costs in Hong Kong is partially explained by the similar decrease in average order size.

Mainland China, however, has experienced a contrasting relationship between order size and trading costs over the past five years. Even though the average order size has more than halved since 2015, trading costs have increased 3%, suggesting that factors other than order size are causing trading cost increases in Mainland China. Indeed, the increase in transaction costs is likely driven by the significant fall (52%) in trading volumes in Mainland China from 2015 to 2019, as demonstrated in **Figure 2** in Part 1. Less market-wide liquidity is typically associated with higher trading costs.

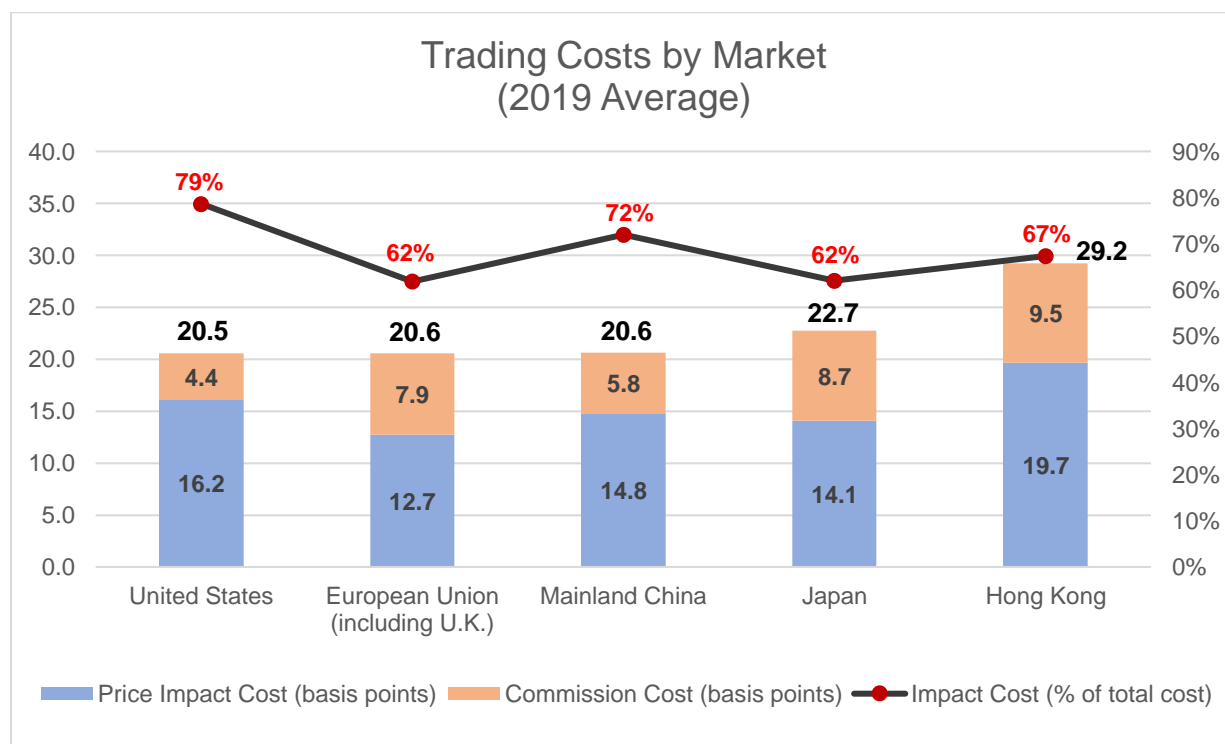
⁴⁵ Andrew Frazzini, Ronen Israel & Tobias Moskowitz, *Trading Costs* (Apr. 2018).

AbelNoser Analysis

AbelNoser calculates trading costs by collecting data from over 200 asset managers and analyzing approximately \$7.5 trillion in trading volume annually.⁴⁶ AbelNoser trading costs and order sizes represent the *median* by value of shares traded.⁴⁷ Also, AbelNoser aggregates transaction costs for the U.K. and the E.U., so we review five markets: E.U. (incl. U.K.), Hong Kong, Japan, Mainland China and the U.S. We observe similarities between the Virtu and AbelNoser data sets at the end of our analysis.

Figure 16 sets forth overall institutional trading costs in each of the five markets in 2019 measured in basis points. The U.S. has the lowest total costs for institutional investors at 20.5 bps, followed by the E.U. and Mainland China (each 20.6 bps), Japan (22.7 bps), and Hong Kong (29.2 bps). **Figure 16** also shows that price impact contributes between 62 and 79 percent of total trading costs.

Figure 16



⁴⁶ October 2019 e-mail correspondences with AbelNoser.

⁴⁷ October 2019 e-mail correspondences with AbelNoser.

Table 3 sets forth the average parent order size in each market in 2019 and the average dollar trade cost implied by multiplying the average order size by the median trade cost in basis points.

Table 3
Implied Trade Costs

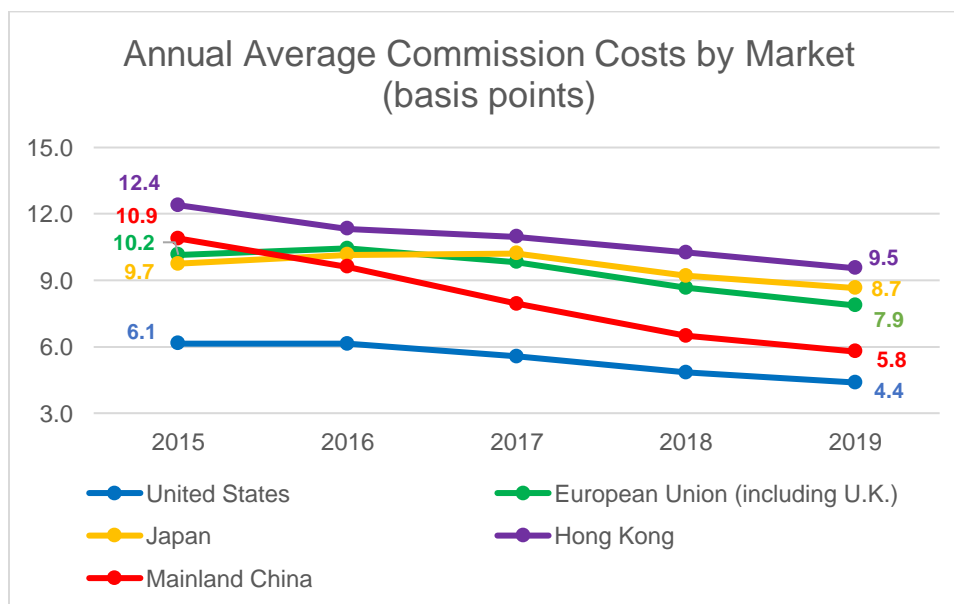
Market	2019	
	Average Order Size	Implied Average Trade Cost
United States	\$220,312	\$453
Japan	\$227,093	\$516
Mainland China	\$323,876	\$667
European Union (including U.K.)	\$411,955	\$848
Hong Kong	\$348,162	\$1,018

Recent Trends in Institutional Trading Costs and Order Sizes

a. Commission Costs

Figure 17 shows that commission costs fell across all five major equity markets between 2015 and 2019. Commission costs fell the most in Mainland China (-47%), followed by the U.S. (-29%), Hong Kong (-23%), the E.U. (-23%), and Japan (-11%). For the period as a whole, commissions in the U.S. remained the lowest, and those in Hong Kong remained the highest.

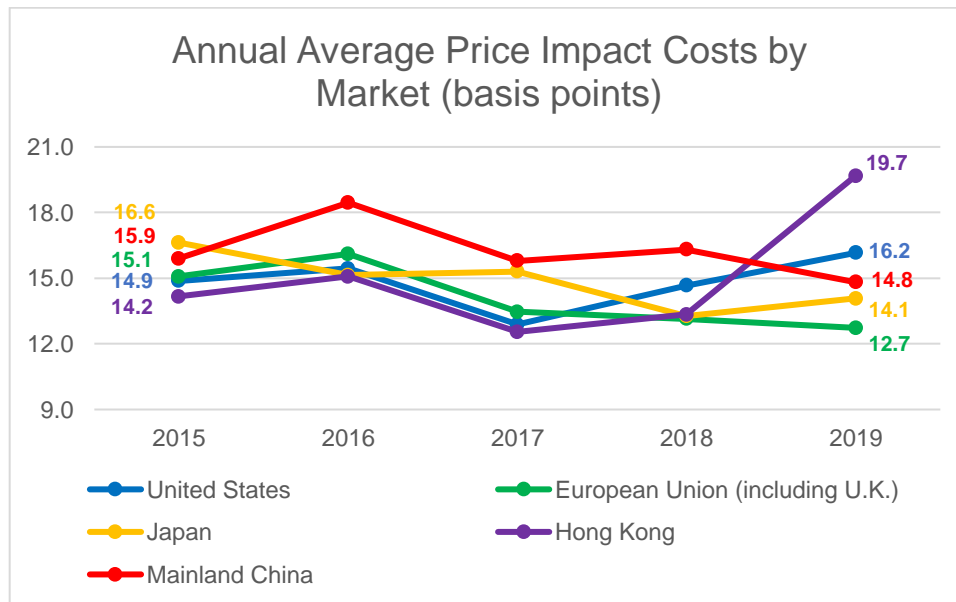
Figure 17



b. Price Impact Costs

Figure 18 shows that, between 2015 and 2019, price impact costs fell in the E.U. (-16%), Japan (-15%), and Mainland China (-7%), but they rose in Hong Kong (+39%) and the United States (+9%). The rise in Hong Kong is entirely attributable to a sharp increase in 2019.

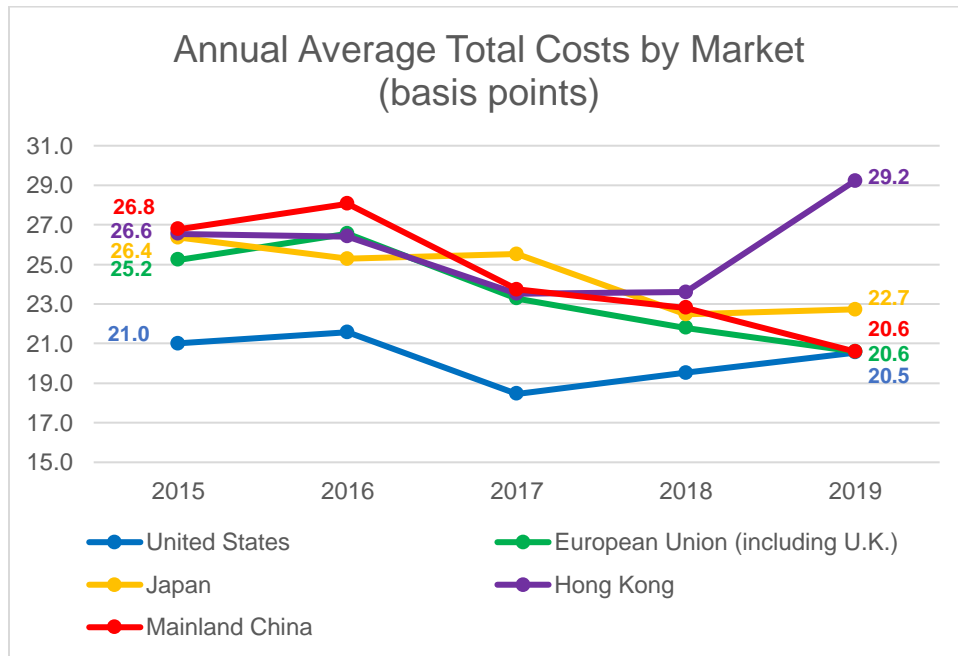
Figure 18



c. Overall Trading Costs

Figure 19 shows that, between 2015 and 2019, overall trading costs fell in all markets to varying degrees, except Hong Kong. Overall trading costs fell the most in Mainland China (-23%) and the E.U. (-18%), followed by Japan (-14%) and the United States (-2%). Overall trading costs rose 10% in Hong Kong. The U.S. had the lowest overall trading costs during the entire period.

Figure 19



d. Order Size

Figure 20 and **Table 4** on the next page illustrate that from 2015 to 2019, the average institutional order size in the AbelNoser data set decreased across all markets with significant declines in Mainland China (-56.7%), Japan (-42.2%), the E.U. (including the UK) (-27.9%), and the U.S. (-20.0%). Hong Kong dropped more modestly with only a 14.0% decline over the same time period. We note that overall trading costs dropped alongside declines in order size in four of the five markets from 2015 to 2019, as expected based on the relationship between order size and trading costs, except for Hong Kong, where trading costs rose and the decline in order size was slight.⁴⁸

⁴⁸ Andrew Frazzini, Ronen Israel & Tobias Moskowitz, *Trading Costs*, Apr. 2018.

Figure 20

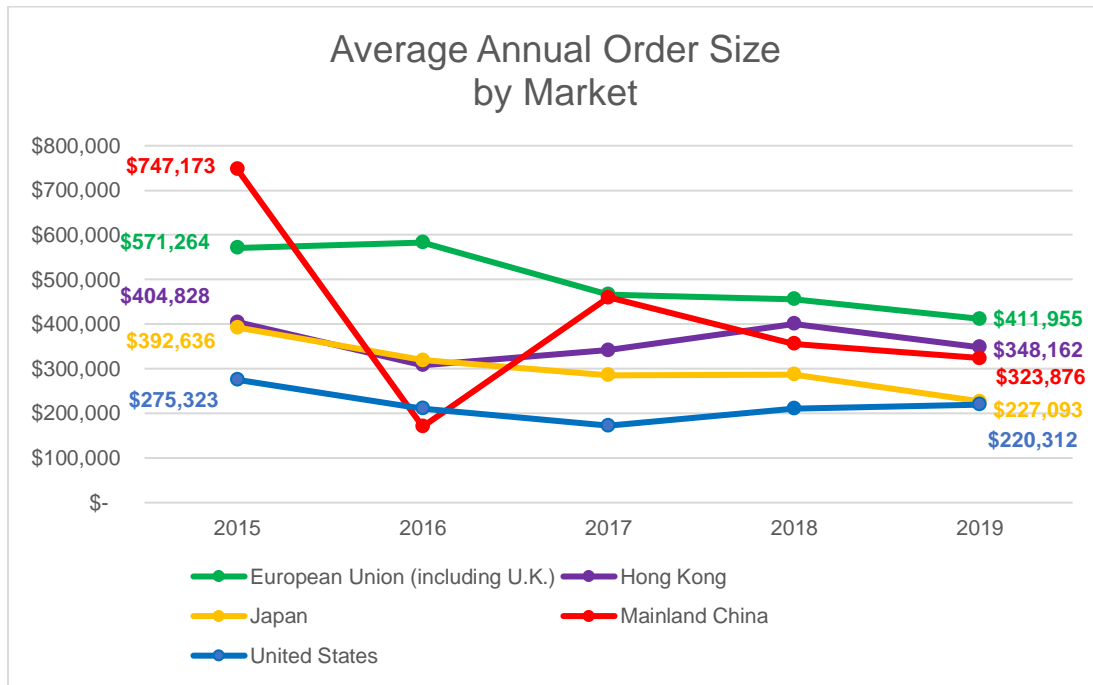


Table 4
Average Institutional Order Size

Market	2015	2016	2017	2018	2019
European Union (including U.K.)	\$571,264	\$582,892	\$466,297	\$456,414	\$411,955
Hong Kong	\$404,828	\$307,846	\$341,575	\$400,920	\$348,162
Japan	\$392,636	\$319,636	\$285,887	\$287,453	\$227,093
Mainland China	\$747,173	\$170,412	\$460,164	\$355,977	\$323,876
United States	\$275,323	\$211,384	\$172,600	\$210,759	\$220,312

Comparison of Virtu and AbelNoser Datasets

Our review illustrates three key patterns across both data sets. First, price impact costs constitute the majority of overall trading costs for institutional investors across all five markets. Second, brokerage commission costs have significantly declined across all five markets and overall trading costs have also generally declined in recent years. Third, the United States has the lowest overall trading costs of the five major markets.

One key difference is also apparent—trading costs (measured in bps or dollars) are substantially lower in the AbelNoser data, as compared to the Virtu data. However, this difference can be explained by the fact that the median order size in the AbelNoser data is significantly smaller than the average order size in the Virtu data. As noted earlier, smaller order sizes correlate with lower trading costs, and vice-versa.

Conclusion

In Phase I, PIFS' *International Review of Equity Market Structure Regulation*, we reviewed the regulatory structure in the five major equity markets, including China (including both the Mainland and the Hong Kong markets), the European Union, Japan, and the United States.⁴⁹ For each market, we summarized the regulation of trading venues, pre- and post-trade transparency, broker-dealers, exchange fees, tick-sizes, algorithmic and high-frequency trading, and volatility controls.

In Phase II, we set forth a quantitative analysis of trading in the same five equity markets. We summarized recent trends in trading volumes and market capitalization in each jurisdiction, including on-exchange and off-exchange trading, share turnover as well as institutional and retail trading. We then reviewed institutional trading data from Virtu Financial and AbelNoser to assess the performance of global equity markets between 2015 and 2019. We also surveyed changes over that period in order size, brokerage commissions, price impact and overall trading costs in each market.

In Phase III of our international review of equity market structure, we will assess the regulatory structure and performance of equity market structure in each jurisdiction to determine whether conclusions can be reached as to the impact of regulation on investor outcomes. Our focus will be on minimizing transaction costs for investors while ensuring resilient trading markets. In doing so, we will consider case studies on the impact of regulatory reforms on the performance of equity market structure. Our aim will be to set forth certain best practices that policymakers should adopt when regulating equity market structure, including in developing jurisdictions.

⁴⁹ PROGRAM ON INTERNATIONAL FINANCIAL SYSTEMS, *International Review of Equity Market Structure Regulation* (Oct. 2019), <https://www.pifsinternational.org/wp-content/uploads/2019/10/PIFS-International-Review-of-Equity-Market-Structure-Reg-for-website.pdf>.

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