European Demand for U.S. Exchange-Listed Equity Options

June 2018
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Executive Summary

• European demand for U.S. listed options has been stable in recent years, with order flow from Europe accounting for an estimated 9% of trading, relatively unchanged from 2013.

• Although investments in U.S. equities are at record levels and have supported the greater adoption of strategies incorporating U.S. options, low volatility and persistent price appreciation has limited hedging and overall trading activity.

• European investors using U.S. options generally focus on income generation, capital appreciation, and volatility strategies. However, low volatility has reduced trading by high volume trading accounts including hedge funds and proprietary trading firms.

• Recent volatility will cause increased demand from European investors, as hedging activities will increase and volatility strategies from sophisticated investors return.

• Demand from European retail investors continues to grow, with ease of execution, screen liquidity, and price transparency important factors contributing to demand.

• U.S. exchanges devote limited marketing resources in Europe, with the exception of Cboe Global Markets, which has seen significant interest in its proprietary VIX® and SPX options.

• Static volumes limit efforts by U.S. broker-dealers to target European accounts, however, global banks see opportunity to expand activity especially to high-net-worth investors.
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Report Methodology

• Burton-Taylor conducted 36 interviews with U.S. and European market participants from 31 different firms that provide services for U.S. listed options trading.
  • All interviews were conducted on an anonymous basis and included 13 firms located in the U.S. and 18 firms located in the U.K or continental Europe.
  • Interviews were conducted in the first quarter of 2018 and focused on changing perceptions of market participants since 2014.
  • Five interviews included participants from multiple firms with responses aggregated for the analysis.

• Responses from the interviews are presented within the report and are supplemented with industry statistics and Burton-Taylor estimates.
  • Interviews were unstructured and may include multiple responses to a single question with totals adding up to more than 100%.
  • Percentages are calculated based on the total number of responses for each question.

• This analysis defines European trading of U.S. listed options as a trade executed by a firm domiciled in the U.K. or continental Europe.
  • Trading within a U.S.-based subsidiary of a European firms is excluded.
  • The analysis does not attempt to identify the beneficiary of fund investors interviewed for the study.

• This report represents the fourth OIC-sponsored research report examining the use of U.S. listed equity options by European investors. The reports can be downloaded from the Options Industry Council website at www.OptionsEducation.org.
The firms interviewed included broker-dealers, retail brokers, data and execution management system providers, options exchanges, hedge funds, and asset managers located in the U.S., U.K., and continental Europe.

**Respondent Profile – Total Sample**

- Retail Broker, 12.9%
- Vendor, 9.7%
- Hedge Fund, 22.6%
- Exchange, 9.7%
- Broker-Dealer/Bank, 32.3%
- Asset Manager, 12.9%

**Respondent Profile – By Region**

- Europe:
  - 11%
  - 6%
  - 39%
  - 22%
- U.S.:
  - 8%
  - 23%
  - 23%
  - 46%

Source: Burton-Taylor International Consulting

European Respondents: 18
U.S. Respondents: 13
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Overview of European Demand

- European investors remain an important source of U.S. Exchange-listed equity options demand, with order flow originating in Europe accounting for an estimated 9% of total trading in 2017.

- Hedge funds account for the largest share of European order flow with demand influenced by both size and strategy.
  - Large global hedge funds develop local strategies, but often have U.S.-based execution desks.
  - Strategy focus dictates demand with a shift to U.S. products increasing demand for U.S. options.

- Large institutional investment funds use options to generate income and hedge portfolio risk.
  - Pension funds require large notional size and have traditionally used OTC markets in Europe but are exploring the use of index and ETF products as part of strategies.
  - Investment funds use strategies focused on income generation and hedging with index products and sector ETF options seeing greater adoption.

- Private wealth accounts are attracted to U.S. options with strategies targeted at specific underlying equity holdings.
  - Covered call strategies to generate income.
  - Risk management strategies for protection from adverse price movements.

- There is significant opportunity to expand retail investor activity, yet costs to provide services can be prohibitive, especially for infrastructure and data management requirements.
  - Retail traders attracted to liquidity and price transparency in U.S. markets.
  - Countries with sophisticated retail investors are most active including the U.K., Netherlands, and Italy.
U.S. Options Order Flow from Europe by Segment

- Strategies focusing on European exposure diverted demand away from U.S. assets; lower volatility from 2013 to 2016 also reduced demand for aggressive trading strategies in U.S. listed equity options.
- Private wealth demand remains important, but is less active, focusing on income and hedging strategies.

![Proportion of Total European Trading Volume by Segment](image)

Source: Burton-Taylor estimates, OIC, TABB Group
Investor Demand Characteristics

- European demand for U.S. exchange-listed equity options remains strong, with the level of activity dampened by low volatility in the 2013 to 2017 period and an emphasis on non-U.S. markets.
- European retail demand remains buoyant with access challenges the biggest impediment to growth.

What are the biggest changes with respect to U.S. options markets over the past 2 years?

- More Demand: 71.4%
- Use of New Products: 25.0%
- Greater Use of Weekly Options: 17.9%
- More Retail Demand: 17.9%
- Increased Use of High Touch: 14.3%
- More Regulatory Burdens: 10.7%
- Greater Use of Listed Products: 7.1%
- Capital Constraints: 7.1%
- Improved Pricing: 7.1%
- Less Liquidity in Volatility Products: 7.1%
- Consistent Demand: 7.1%
- Increased Use of Index: 7.1%

Source: Burton-Taylor International Consulting
Institutional Assets Under Management in Europe

• Institutional accounts in Europe have seen portfolio valuations expand dramatically in recent years as global equity markets recover.

• High-net-worth accounts continue to be a large segment of demand as professionally managed assets tend to be more conservative and remain focused on wealth preservation.

• Large asset managers with high notional requirements are generally focused on OTC instruments as notional requirements are difficult to trade in European listed markets.

• Demand for U.S. options exposure has waned as volatility declined in the 2013 to 2017 period, resulting in less hedging activity due to a lesser sense of urgency.

“There was a significant shift in hedging demands in 2017 as investors were more interested in participating in upside moves instead of protecting gains.” —Global broker-dealer

<table>
<thead>
<tr>
<th>Total European Assets Under Management – By Institution Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Net Worth, $16.4</td>
</tr>
<tr>
<td>Asset Managers, $12.4</td>
</tr>
<tr>
<td>Pension Funds, $7.8</td>
</tr>
<tr>
<td>Hedge Funds, $0.8</td>
</tr>
</tbody>
</table>

All amounts in USD trillions.

Source: Morningstar, Capgemini, Pensions Europe, Burton-Taylor estimates
European Investments in U.S. Equity Assets

- Demand for U.S. options is concentrated in countries with significant U.S. equity holdings.
- European holdings of U.S. equities increased 16.0% in the 12 months ending June 30, 2017 and 52.8% since 2013. The U.K., Luxembourg, Switzerland, and Ireland lead in terms of overall growth.

```
Holdings of U.S. Equity Securities by Country – 2017 and 2013

<table>
<thead>
<tr>
<th>Country</th>
<th>2017</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>584.1</td>
<td>531.5</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>377.6</td>
<td>266.0</td>
</tr>
<tr>
<td>Switzerland</td>
<td>295.7</td>
<td>263.5</td>
</tr>
<tr>
<td>Ireland</td>
<td>142.6</td>
<td>120.6</td>
</tr>
<tr>
<td>Netherlands</td>
<td>253.5</td>
<td>238.9</td>
</tr>
<tr>
<td>Norway</td>
<td>2017</td>
<td>197.6</td>
</tr>
<tr>
<td>Germany</td>
<td>111.2</td>
<td>107.6</td>
</tr>
<tr>
<td>France</td>
<td>153.5</td>
<td>149.5</td>
</tr>
<tr>
<td>Sweden</td>
<td>130.4</td>
<td>121.4</td>
</tr>
<tr>
<td>Denmark</td>
<td>82.7</td>
<td>77.7</td>
</tr>
<tr>
<td>Channel Islands</td>
<td>47.5</td>
<td>35.2</td>
</tr>
<tr>
<td>Belgium</td>
<td>38.1</td>
<td>29.1</td>
</tr>
<tr>
<td>Finland</td>
<td>27.6</td>
<td>21.2</td>
</tr>
<tr>
<td>Italy</td>
<td>27.1</td>
<td>21.3</td>
</tr>
<tr>
<td>Spain</td>
<td>17.9</td>
<td>8.3</td>
</tr>
<tr>
<td>Austria</td>
<td>11.0</td>
<td>7.1</td>
</tr>
<tr>
<td>All Other</td>
<td>19.6</td>
<td>15.0</td>
</tr>
</tbody>
</table>
```

All amounts in USD billions.

Source: U.S. Treasury Department

“"We are seeing growing demand in countries where there are significant concentrations of high-net-worth investors."”
—Retail broker-dealer

“"Almost 90% of our volume comes from the U.K., Switzerland and the Netherlands, with France and Germany making up most of the remainder.””
—Global broker-dealer

“"We see a lot of index options trading from accounts in the U.K. and France, while accounts in the Netherlands, Italy and Spain are more interested in Single stock and ETF products."”
—U.S. broker-dealer
Global Equity Market Returns

- European demand for U.S. equity exposure has fluctuated since 2014, but net investment in 2017 totaled $460.7 billion.

- U.S. equity markets outperformed both the U.K. and European equity markets since 2010, recording a 136.0% return from January 4, 2010 to December 31, 2017.

- European markets reported lesser gains, with the FTSE 100 increasing 39.8% since 2010, while the MSCI Europe index increased 22.0% over the same period.

![European Purchases of U.S. Equities – Net Annual Totals](chart)

All amounts in USD billions.

Source: U.S. Treasury Department

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**European Purchases of U.S. Equities – Net Annual Totals**

- **2011**: $480
- **2012**: $66
- **2013**: $335
- **2014**: $589
- **2015**: $226
- **2016**: -$122
- **2017**: $461

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**Equity Market Returns – January 2010 to December 2017**

Source: ICE Data Services

- **S&P 500**
- **FTSE 100**
- **MSCI Europe**
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Opportunities for Growth

- The broad range of U.S. listed option products appeal to investors executing a variety of investment strategies.
  - Hedge funds seeking liquidity.
  - Private wealth accounts seeking to hedge and generate income.

- Short-term expirations offer broad flexibility.
  - Premium strategies executed more frequently.
  - Hedging activity within targeted time frames.

- ETF and index options provide exposure to targeted segments.
  - Hedging holdings within a specific industry.
  - U.S. segments with large capitalization such as technology, health care and manufacturing.

- Volatility products will see significant activity as market uncertainty returns.

“Our decision to trade U.S. options is based off equity positions, and only increases or decreases based on changes in the underlying portfolio.”
—Large asset manager

Where do you see the most potential for U.S. options in strategies?

- Short-Term Options: 41.7%
- ETFs: 41.7%
- Single Stock: 33.3%
- Volatility Products: 16.7%
- Index: 16.7%
- Extended Hours: 8.3%
- Dividend Products: 8.3%
- Large Cap Names: 8%

Source: Burton-Taylor International Consulting
The Importance of Education for European Investors

- European investors benefit from educational materials on U.S. options markets in order to gain a better understanding of market structure.
- Seminars and webinars focusing on market structure and how markets operate would support demand.

What would help increase demand from European investors?

- Better Understanding: 30.0%
- Higher Volatility: 20.0%
- Change in Strategy: 15.0%
- Margin Efficiencies: 15.0%
- Less Regulation: 15.0%
- Lower Fees: 15.0%
- Better Trading Systems: 10.0%
- Lower Data Costs: 10.0%

Source: Burton-Taylor International Consulting

What types of material would benefit your understanding of U.S. options markets?

- Seminars and Webinars: 73.3%
- Market Structure Topics: 53.3%
- Newsletters: 46.7%
- Focused Presentations: 40.0%
- White Papers: 33.3%
- Brokers Operations: 20.0%

Source: Burton-Taylor International Consulting
Factors Driving Demand for U.S. Listed Options

- Changing market conditions will drive demand for U.S. options, especially as hedge funds and proprietary trading accounts increase their activity.
- Transparency and liquidity are key factors supporting U.S. options demand from European investors.

### What will cause trading activity from Europe to increase?

<table>
<thead>
<tr>
<th>Factor</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatility</td>
<td>53.6%</td>
</tr>
<tr>
<td>Change in Strategy</td>
<td>39.3%</td>
</tr>
<tr>
<td>More Education</td>
<td>10.7%</td>
</tr>
<tr>
<td>Market Events</td>
<td>10.7%</td>
</tr>
<tr>
<td>Less Regulation</td>
<td>3.6%</td>
</tr>
<tr>
<td>Lower Costs</td>
<td>3.6%</td>
</tr>
</tbody>
</table>

### What factors drive your strategies in U.S. option markets?

<table>
<thead>
<tr>
<th>Factor</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquidity</td>
<td>100.0%</td>
</tr>
<tr>
<td>Transparency</td>
<td>50.0%</td>
</tr>
<tr>
<td>Market Structure</td>
<td>30.0%</td>
</tr>
<tr>
<td>Product Selection</td>
<td>30.0%</td>
</tr>
<tr>
<td>Price Discovery</td>
<td>20.0%</td>
</tr>
</tbody>
</table>

Source: Burton-Taylor International Consulting
Product Innovation by U.S. Options Exchanges

- U.S. option exchanges compete for order flow through trading protocols, fee structures, and by offering new products to appeal to shifting investor demands.
  - Short-term options with weekly expirations now include expirations in the first five weeks of the month, excluding standard expirations.
  - Proprietary index options are created and designed to meet specific investor requirements.
- NYSE is launching a new proprietary options product based on its FANG+ index, which provides exposure to popular technology stocks.
  - The Index includes 10 liquid technology stocks with significant retail demand in the U.S. and Europe.
  - FANG+ options will appeal to European retail investors due to the focus on liquid technology stocks.
- Cboe Global Markets (Cboe) is the U.S. exchange most active in marketing U.S. listed equity options products in Europe, focusing efforts on its proprietary VIX® and SPX index options products.
  - Global trading hours include 2 a.m. to 8:15 a.m. central time, which covers active European trading hours.
  - Cboe is launching a set of sector index options designed to comply with European UCITS regulations.
- OCC offers a range of educational resources.

“The U.S. options market is a model for other markets around the world to follow.”
—European hedge fund

“The range of ETF products offering access to specific sectors is a huge advantage for U.S. option markets.”
—Global broker-dealer

“There is steady demand for U.S. option products, especially as strategies shift among different market sectors.”
—Global broker-dealer

“There is growing demand for U.S. index options but there would be even more demand if the index products were UCITS compliant.”
—Global broker-dealer
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Greatest Challenges Facing European Investors

- Regulation, market structure, and insufficient electronic trading functionality represent challenges for European investors trading U.S. listed options.
- Better education and shifts in investment strategies would support increased trading activity.

What challenges do European investors face trading U.S. options?

- Regulation: 27.3%
- Market Structure: 22.7%
- Electronic Trading Limitations: 13.6%
- Time Zones: 9.1%
- High Fees: 9.1%
- Latency: 4.5%
- Lack of Size: 4.5%
- Liquidity: 4.5%

Source: Burton-Taylor International Consulting
Impact of Regulation on Broker-dealers and Investors

- Regulatory mandates have raised costs for the industry by compelling it to build systems and create compliance protocols.
  - The regulatory burden is generally more onerous for broker-dealers as they build systems to support reporting requirements.
  - MiFid II has had the greatest impact as brokers invest resources to comply with the mandate.
  - Brexit remains a distraction, with contingency planning to address the final agreements regulating cross-border banking activity.

- The U.S. Internal Revenue Service has aggressively targeted tax avoidance schemes resulting in reduced demand for U.S. assets and higher costs for broker-dealers.
  - FATCA has forced European-domiciled banks to implement stricter KYC initiatives and report tax information to the U.S. IRS.
  - Section 871M requires broker-dealers to implement systems to withhold tax on certain derivatives transactions and remit to the IRS.

"The biggest factors constraining growth in our U.S. options business are regulation and capital constraints."
—Large global bank

Have European regulatory initiatives had an impact on U.S. options trading activity?

- Impact 90.0%
- Little Impact 10.0%
- Impact 90.0%
- Little Impact 10.0%

Source: Burton-Taylor International Consulting
Regulatory Mandates and Initiatives

- Regulatory mandates have impacted demand as focus has been on compliance, diverting attention away from strategy expansion into non-core investment mandates.
- Although regulatory mandates are not specific to U.S. options, they require broker-dealers to focus on systems to support new mandates and diminish focus on client engagement.

<table>
<thead>
<tr>
<th>Mandate</th>
<th>Overview</th>
<th>Implications</th>
<th>Impact on Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Markets in Financial Instruments Directive</td>
<td>Framework for E.U. legislation that regulates firms providing services to clients linked to financial instruments.</td>
<td>The legislation does not directly impact U.S. options, but has had global implications as it mandates new requirements for transparency, research distribution, and governance requirements.</td>
<td>Firms operating in Europe have been scrambling to implement procedures and protocols to meet the new regulatory requirements. The intense focus has precluded implementing new systems or strategies outside of existing activities.</td>
</tr>
<tr>
<td>(MiFID)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Section 871M of U.S. Internal Revenue Code</td>
<td>U.S. regulation restricting non-U.S. persons from using derivatives to avoid taxation on U.S. equity dividends.</td>
<td>Broker-dealers and firms that have control of income payments need to create procedures to track and withhold taxes when required.</td>
<td>The costs to monitor and facilitate transactions have forced firms to rationalize whether or not to provide services. Uncertainty with the tax rules and costs for systems to support reporting requirements have reduced demand to provide services.</td>
</tr>
<tr>
<td>Foreign Account Tax Compliance Act</td>
<td>U.S. tax regulation designed to prevent tax evasion by U.S. investors.</td>
<td>Requires foreign financial institutions to identify U.S. account holders and provide the IRS with information on trade and income activity.</td>
<td>Firms have strengthened KYC controls and now report data to the IRS or to local tax authorities which provide data to the IRS. Costs to develop systems to support reporting requirements have reduced demand for broker-dealers to provide services.</td>
</tr>
<tr>
<td>(FATCA)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brexit</td>
<td>The U.K. voted to leave the European Union effective March 29, 2019.</td>
<td>Brexit will force broker-dealers to establish multiple locations to support the regulatory requirements of the E.U. and U.K.</td>
<td>Uncertainty with the process has raised costs for market participants that are preoccupied with contingency planning as final rules and agreements are negotiated between the E.U. and U.K.</td>
</tr>
</tbody>
</table>
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U.S. Options Markets Volume and VIX® Levels

- Recent U.S. options volume have remained at record levels but renewed volatility is resulting in sharp growth, with volumes up 35.3% in the first quarter of 2018.

U.S. Listed Options Volume – 2005 to 2017 and Q1 2017 to Q1 2018

All amounts in USD millions.  
Source: OCC

CBOE VIX® Index – January 2005 to April 2018

Source: Cboe Global Markets
Concentration of Liquidity in U.S. Option Markets

- Trading is concentrated in large capitalization companies.
- ETF and index options are among the most actively traded products with demand surging as investors manage exposure in market volatility.
- Large technology company stocks have seen considerable interest from retail investors both in the U.S. and internationally.
- Options with weekly expirations are popular in most actively traded issues, resulting in further liquidity concentration.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>2017 Contract Volume</th>
<th>2016 Contract Volume</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPY</td>
<td>634,508,023</td>
<td>671,661,453</td>
<td>-5.5%</td>
</tr>
<tr>
<td>SPX</td>
<td>292,029,953</td>
<td>257,953,004</td>
<td>13.2%</td>
</tr>
<tr>
<td>VIX</td>
<td>181,311,346</td>
<td>148,246,402</td>
<td>22.3%</td>
</tr>
<tr>
<td>QQQ</td>
<td>160,178,790</td>
<td>111,873,109</td>
<td>43.2%</td>
</tr>
<tr>
<td>IWM</td>
<td>127,378,520</td>
<td>140,662,647</td>
<td>-9.4%</td>
</tr>
<tr>
<td>AAPL</td>
<td>125,438,770</td>
<td>138,727,437</td>
<td>-9.6%</td>
</tr>
<tr>
<td>BAC</td>
<td>95,720,731</td>
<td>93,557,840</td>
<td>2.3%</td>
</tr>
<tr>
<td>VXX</td>
<td>76,890,416</td>
<td>74,118,316</td>
<td>3.7%</td>
</tr>
<tr>
<td>EEM</td>
<td>75,607,260</td>
<td>87,941,483</td>
<td>-14.0%</td>
</tr>
<tr>
<td>FB</td>
<td>57,925,005</td>
<td>70,277,952</td>
<td>-17.6%</td>
</tr>
</tbody>
</table>

“Our volumes have increased over the last few years, but have shifted away from single stock options to index options as we increase our hedging activity.”
—Large asset manager

“The U.S. markets are significantly more liquid compared to the European markets, in Europe you can not find liquidity on the screens.”
—European hedge fund

Concentration of Trading by Symbol – 2017

Source: OCC
• Trading in ETF options has grown considerably in recent years as investment management focuses on passive investment strategies.
• Seven of the top 10 most active U.S. listed options represent ETF or broad market indexes.
• European UCITS funds’ usage of ETF options is limited by restrictions on index constituents and index construction.
• Cboe is seeking to build adoption by funds by building out a range of index products that meet UCITS regulatory requirements.
U.S. Weekly Expiration Options Volumes

- Strategies employing short-term expirations have grown sharply in recent years, with premium and risk strategies driving demand.
- Weekly expirations accounted for 28% of total volume in 2017, representing a 5-year CAGR of 17.9%.
- There are 526 stocks (11% of the 4,638 total) with weekly expirations representing a range of index, ETF and single stock instruments.

“We like weekly options; we have strategies requiring short-term exposure and we need as short-dated as possible.”
—U.K. hedge fund

Proportion of Volume – Standard & Short-term Expirations – 2017

Weekly, 28%

Standard, 72%

Source: Hanweck, OCC

Short-Term Expiration Option Volumes – 2010 - 2017

Source: Hanweck, OCC

All amounts in USD millions.

— Burton-Taylor International Consulting
U.S. Option Market Exchange Landscape

- The U.S. options market consists of 15 different exchanges, operated by 5 different holding companies. Each market has different allocation models and trading protocols.
- Order flow, access to liquidity, and clearing and settlement are facilitated through specialized order routing and technology capabilities managed by the exchanges, broker-dealers and the OCC.

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BOX</td>
<td>Price/time</td>
<td>Electronic</td>
<td>Taker/Maker &amp; Traditional</td>
<td>2.07%</td>
</tr>
<tr>
<td>Cboe BZX</td>
<td>Price/time</td>
<td>Electronic</td>
<td>Maker/Taker</td>
<td>9.78%</td>
</tr>
<tr>
<td>Cboe EDGX</td>
<td>Pro-rata</td>
<td>Electronic</td>
<td>Traditional</td>
<td>1.26%</td>
</tr>
<tr>
<td>Cboe Options Exchange</td>
<td>Hybrid</td>
<td>Hybrid</td>
<td>Traditional</td>
<td>27.03%</td>
</tr>
<tr>
<td>Cboe C2</td>
<td>Pro-rata</td>
<td>Electronic</td>
<td>Maker/Taker</td>
<td>3.37%</td>
</tr>
<tr>
<td>MIAX</td>
<td>Pro-rata</td>
<td>Electronic</td>
<td>Maker/taker &amp; Traditional</td>
<td>4.56%</td>
</tr>
<tr>
<td>MIAX Pearl</td>
<td>Price/time</td>
<td>Electronic</td>
<td>Maker/Taker</td>
<td>0.98%</td>
</tr>
<tr>
<td>Nasdaq ISE</td>
<td>Pro-rata</td>
<td>Electronic</td>
<td>Maker/taker &amp; Traditional</td>
<td>7.99%</td>
</tr>
<tr>
<td>Nasdaq GEMX</td>
<td>Pro-rata</td>
<td>Electronic</td>
<td>Maker/Taker</td>
<td>4.56%</td>
</tr>
<tr>
<td>Nasdaq MRX</td>
<td>Pro-rata</td>
<td>Electronic</td>
<td>Traditional</td>
<td>0.14%</td>
</tr>
<tr>
<td>Nasdaq Options Market</td>
<td>Price/time</td>
<td>Electronic</td>
<td>Maker/Taker</td>
<td>8.14%</td>
</tr>
<tr>
<td>Nasdaq BX Options</td>
<td>Hybrid</td>
<td>Electronic</td>
<td>Taker/Taker &amp; Maker/Taker</td>
<td>0.57%</td>
</tr>
<tr>
<td>Nasdaq PHLX</td>
<td>Pro-rata</td>
<td>Hybrid</td>
<td>Maker/Taker &amp; Traditional</td>
<td>15.32%</td>
</tr>
<tr>
<td>NYSE AMEX</td>
<td>Pro-rata</td>
<td>Hybrid</td>
<td>Traditional</td>
<td>7.01%</td>
</tr>
<tr>
<td>NYSE ARCA</td>
<td>Price/time</td>
<td>Hybrid</td>
<td>Maker/Taker &amp; Traditional</td>
<td>7.22%</td>
</tr>
</tbody>
</table>
An Overview of U.S. Market Structure

- U.S. options markets have a range of different trading rules and protocols that can be confusing for investors.
- Trading protocols are designed by exchanges to attract order flow from market makers, broker-dealers, and institutional customers.

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Functionality</th>
<th>BOX</th>
<th>Cboe BZX</th>
<th>Cboe EDGX</th>
<th>Cboe</th>
<th>Cboe C2</th>
<th>MIAX</th>
<th>MIAX Pearl</th>
<th>Nasdaq ISE</th>
<th>Nasdaq GEMX</th>
<th>Nasdaq MRX</th>
<th>Nasdaq</th>
<th>Nasdaq BX</th>
<th>Nasdaq PHLX</th>
<th>NYSE Arca</th>
<th>NYSE Amex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pro-Rata Allocation</td>
<td>Fills are assigned based on percentages Market Maker allocated.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Maker/Taker Pricing</td>
<td>Exchange fee structure that provides rebates to liquidity providers and charges per-contract fee for taking liquidity.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Taker/Maker Pricing</td>
<td>Exchange fee structure that rebates taking liquidity and charges a per-contract fee for removing liquidity.</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Customer Priority</td>
<td>Customer receives priority on pro-rata exchanges. First in line to be executed.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Price/Time Priority</td>
<td>Displayed limit orders are executed by price then time received on the book.</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X^1</td>
<td>X</td>
<td>X^2</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Price Improvement</td>
<td>Mechanism provides opportunity to obtain price improvement better than quoted NBBO.</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Complex Order Books</td>
<td>Involve more than one option series, typically with two or more legs.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Flash Auction Mechanism</td>
<td>Ability to source liquidity on exchange by sending orders to multiple market participants before routing out to another venue.</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

1) In complex order book
2) In non-penny names
OCC Services in U.S. Listed Equity Options Markets

- OCC provides horizontal clearing services that allows investors to open and close positions in multi-listed securities on any of the 15 options exchanges.
- Order routing technology optimizes value of order flow based on customer type and execution destination and directs orders to exchanges with best price and available liquidity.

Source: OCC
The Role of OCC in U.S. Listed Derivatives Markets

• OCC issues and clears U.S. listed options and certain futures, operates under the jurisdiction of the U.S. Securities and Exchange Commission and the U.S. Commodity Futures Trading Commission and has been designated as a systemically important financial market utility under Title VIII of the Dodd-Frank Act.


• OCC’s clearing membership consists of approximately 115 of the largest U.S. broker-dealers, U.S. futures commission merchants and non-U.S. securities firms representing both professional traders and public customers.

• OCC serves other securities markets including commodity futures, commodity options, and security futures. OCC clears futures contracts traded on Cboe Futures Exchange, LLC and Nasdaq Futures, Inc., as well as security futures contracts traded on OneChicago, LLC.

• The Options Industry Council (OIC) is an industry resource provided by OCC that educates market participants and the public about the benefits and risks of exchange-listed U.S. equity options.
Agenda

1. Executive Summary
2. Report Methodology
3. Overview of European Demand
4. Opportunities for Growth
5. Challenges Facing European Investors
6. U.S. Options Markets
7. Alternative Products
8. Reference
U.S. Equity Options and Alternative Products Compared

- European investors evaluate products based on a range of criteria including product characteristics, market access and overall transaction and clearing costs.
- U.S. listed options provide access to liquid markets with considerable price transparency, product diversity, efficient market infrastructure and reduced counterparty risk.

<table>
<thead>
<tr>
<th>Type of Product</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Listed Options</td>
<td>Deep liquidity and transparency</td>
<td>Complex market structure</td>
</tr>
<tr>
<td></td>
<td>Reduced counterparty risk</td>
<td>Access challenges</td>
</tr>
<tr>
<td></td>
<td>Efficient central clearing</td>
<td>Currency exposure</td>
</tr>
<tr>
<td></td>
<td>Technological sophistication</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Product diversity</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European Listed Options</td>
<td>Local company exposure</td>
<td>Fragmented market structure</td>
</tr>
<tr>
<td></td>
<td>Local currency exposure</td>
<td>Limited liquidity and price transparency</td>
</tr>
<tr>
<td></td>
<td>Product diversity</td>
<td>Fragmented clearing structure</td>
</tr>
<tr>
<td>Futures</td>
<td>Capital efficiency</td>
<td>Lack of granular exposure</td>
</tr>
<tr>
<td></td>
<td>Deep liquidity</td>
<td>Limited strategy selection</td>
</tr>
<tr>
<td></td>
<td>Broad index exposure</td>
<td></td>
</tr>
<tr>
<td>Options on Futures</td>
<td>Capital efficiency</td>
<td>Lack of granular exposure</td>
</tr>
<tr>
<td></td>
<td>Deep liquidity</td>
<td>Limited strategy selection</td>
</tr>
<tr>
<td></td>
<td>Broad index exposure</td>
<td></td>
</tr>
<tr>
<td>OTC</td>
<td>Deep liquidity</td>
<td>Margin inefficiencies</td>
</tr>
<tr>
<td></td>
<td>Flexible structure</td>
<td>Large transaction size</td>
</tr>
<tr>
<td></td>
<td>Large notional size</td>
<td>No central clearing. Counterparty risk</td>
</tr>
<tr>
<td>Structured Products</td>
<td>Targeted exposure</td>
<td>Limited liquidity and price transparency</td>
</tr>
<tr>
<td></td>
<td>Flexible structure</td>
<td>Small notional size</td>
</tr>
<tr>
<td></td>
<td>Tax advantages</td>
<td>Challenge of unwinding</td>
</tr>
<tr>
<td>Listed Contracts for Difference (CFDs)</td>
<td>Targeted exposure</td>
<td>Limited liquidity</td>
</tr>
<tr>
<td></td>
<td>Tax efficiencies</td>
<td>Small notional size</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Regulatory attention and initiatives</td>
</tr>
</tbody>
</table>

“The lack of liquidity on European exchanges forces us to call upstairs to the OTC market to find true prices for the sizes we want to trade.”

—Large asset manager
Listed Equity Options Volume by Exchange

- U.S. listed equity options markets represent the largest equity options markets in the world, with 2017 contract volume almost 5 times as much as trading on all European options exchanges combined.
- Sector index and ETF options have supported growth in both U.S. and European listed option markets.

### Option Contract Volume – U.S. & Selected European Exchanges 2017 and 2013

<table>
<thead>
<tr>
<th>Exchange</th>
<th>2017</th>
<th>2013</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Options Exchanges (15)</td>
<td>4,063,224,196</td>
<td>4,111,275,659</td>
<td>-1.2%</td>
</tr>
<tr>
<td>Eurex</td>
<td>582,247,393</td>
<td>523,541,151</td>
<td>11.2%</td>
</tr>
<tr>
<td>Euronext Derivatives Market</td>
<td>84,790,776</td>
<td>90,086,184</td>
<td>-5.9%</td>
</tr>
<tr>
<td>Moscow Exchange</td>
<td>40,216,789</td>
<td>49,725,924</td>
<td>-19.1%</td>
</tr>
<tr>
<td>Nasdaq Exchange Nordic Markets</td>
<td>28,700,353</td>
<td>4,502,925</td>
<td>537.4%</td>
</tr>
<tr>
<td>ICE Futures Europe</td>
<td>27,979,940</td>
<td>50,074,480</td>
<td>-44.1%</td>
</tr>
<tr>
<td>MEFF</td>
<td>24,620,055</td>
<td>32,117,037</td>
<td>-23.3%</td>
</tr>
<tr>
<td>Borsa Italiana (IDEM)</td>
<td>21,163,695</td>
<td>2,240,092</td>
<td>844.8%</td>
</tr>
<tr>
<td>The Order Machine</td>
<td>8,973,120</td>
<td>11,150,676</td>
<td>-19.5%</td>
</tr>
<tr>
<td>LSE Derivatives Market</td>
<td>4,353,595</td>
<td>16,096,180</td>
<td>-73.0%</td>
</tr>
<tr>
<td>Oslo Stock Exchange</td>
<td>3,520,095</td>
<td>4,502,925</td>
<td>-21.8%</td>
</tr>
<tr>
<td>Borsa Istanbul</td>
<td>3,120,268</td>
<td>54,378</td>
<td>5638.1%</td>
</tr>
<tr>
<td>Warsaw Stock Exchange</td>
<td>304,494</td>
<td>808,360</td>
<td>-62.3%</td>
</tr>
<tr>
<td>Athens Derivatives Exchange</td>
<td>119,775</td>
<td>212,936</td>
<td>-43.8%</td>
</tr>
</tbody>
</table>

Source: OCC, FIA, Exchanges

Knowledge Inspires™

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A division of TP ICAP
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## About the Authors

<table>
<thead>
<tr>
<th>Author</th>
<th>Biography</th>
</tr>
</thead>
</table>
| Andy Nybo       | Andy Nybo is a Director at Burton-Taylor International Consulting and, has more than 30 years’ experience in research and technology in global capital markets. Andy joined Burton-Taylor in March 2017 and is responsible for its Exchange vertical, focusing on how competitive pressures are forcing shifts in business models and strategic initiatives of exchanges as they seek to expand revenue across multiple business segments.  
Mr. Nybo joined Burton-Taylor from TABB Group where he was a managing director in its research practice. At TABB he was responsible for managing TABB’s listed derivatives practice focusing on listed and OTC securities markets examining how regulation, technology and shifting investor behaviors impact global derivatives market structure. Andy has written numerous studies on derivatives markets with a particular focus on technology, market structure and how the buy side and sell side are adapting to the changing environment.  
Mr. Nybo presents regularly at a wide range of industry conferences and provides commentary for media outlets including Bloomberg TV, CBS, CNBC, Fox Business News and Reuters TV. He also has been quoted extensively in major business publications such as The Wall Street Journal, The New York Times, and the Financial Times.  
Mr. Nybo is a member of the Board of Governors of the Security Traders Association and a member of its Listed Options Committee. He also has been a Board Member of the Carolina Securities Traders Association since 2012.                                                                                           |
| Jennifer Milton | Jennifer Milton is an analyst at Burton-Taylor International Consulting, a consulting organization created in 2006, that became the industry reference in the financial market data space, the media intelligence & PR space, and other important industry verticals. B-T clients include the world’s leading information companies, the largest exchange groups, key government organizations and regulatory bodies, the largest advisory firms, and dozens of private equity and investment companies...all of which using Burton-Taylor data as foundation for their strategy.  
Jennifer joined Burton-Taylor from the financial services industry where she previously worked for Bank of America Merrill Lynch and additional boutique financial services firms. Jennifer carries a BS in Finance from the College of Charleston.                                             |
Burton-Taylor International Consulting

• Burton-Taylor clients command an estimated 80% of global revenue share in the market data space and include the world’s largest Exchange groups, key government organizations and regulatory bodies on multiple continents, five of the six largest advisory firms serving the industry, and more than 30 of the most active private equity and investment companies around the world…all of which using Burton-Taylor data as their industry benchmark.

• While accomplished in the Americas, Europe and Asia, and with a strategic approach that remains generalist, B-T has developed substantial expertise in the global information, insurance, financial services and software industries, with deep focus in North America, China, India and Asia.

• B-T’s Hourglass Analysis™ process provides a proven, structured yet customizable, business consulting approach that helps companies clearly target new opportunities, define new strategy, and plan new actions to maximize growth.

• B-T completes custom research, varying in size from small single product or market detail reports to large global industry and competitor sizing and profiles.

• To learn more about how Burton-Taylor International Consulting can help your company improve performance through improved Market Intelligence, Strategic Planning and Revenue Generation activities, please call +1 646 201-4152, email: questions@burton-taylor.com or visit www.burton-taylor.com.
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