Dimensional

RESEARCH

Global Trading Price Advantages of Flexible Equity Portfolios

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Equity strategies allowing for a flexible approach to trading generally provide price advantages over strategies that demand immediacy in trading. In this paper, we measure the price advantage of Dimensional's flexible approach in the global equity markets from 2017 to 2020.

INTRODUCTION

Dimensional designs and manages broadly diversified portfolios to systematically pursue reliable drivers of expected returns, such as company size, relative price, and profitability. Broad diversification and continual monitoring of aggregate portfolio characteristics allow us to consider securities with similar characteristics as close substitutes for one another. This, combined with the ability to spread turnover over time through our daily investment process, creates flexibility in portfolio implementation, which in turn allows us to participate in the available liquidity in the market and avoid demanding immediacy when trading.

In this paper, we examine the trading price advantages of our flexible approach over the 2017–2020 period across almost 50 stock markets. We find Dimensional's trading prices are 10.5 basis points (bps)[1] more favorable on average than those obtained by market participants that demand immediacy. The price advantages increase as much as 100% in times of extreme return volatility, like March 2020.

1. One basis point equals one-hundredth of a percentage point (0.01%).

BACKGROUND

The global equity market is a vast network spanning more than 100 countries with approximately $211 trillion in nominal traded value in 2020.[2] Nearly all trades and quotes are recorded and distributed by exchanges globally. Dimensional has collected this data in a proprietary in-house tick data set since 2010. Every day we process about 100 million trade updates and 600 million quote updates across 20,000 distinct securities in 170 venues from 47 countries.[3] This tick data set allows us to study global market microstructure,[4] design and test customized trading algorithms, and conduct comprehensive trading cost analysis.

PRICE ADVANTAGE OF FLEXIBLE TRADING

In most equity markets, trading between buyers and sellers is facilitated through a price-time priority queue called the limit order book. Buy orders are ranked from highest price to lowest price, and if two buy orders offer the same price, the one that arrived earlier has priority. Sell orders are ranked from lowest price to highest price, and if two sell orders ask for the same price, the one that arrived earlier has priority. The difference between the most competitive (highest) bid price and the most competitive (lowest) offer price in the limit order book is referred to as the spread. The spread can be thought of as the execution price difference between supplying and demanding immediacy.

In **Exhibit 1**, a buyer who demands immediacy could "cross the spread" and place a marketable order to trade against the pre-existing shares at $10.02 from the limit order book. In contrast, a flexible buyer could place a limit order at the prevailing best bid of $10.00, waiting for a seller to execute against the buy order. The price advantage from flexibility is $0.02 per share, which is equal to the magnitude of the spread ($10.02–$10.00).

EXHIBIT 1: Limit Order Book and Spread

The price difference (spread) between the supply and demand sides of the market is the difference between the highest bid price and the lowest ask price.

For illustrative purposes only.

To measure the price advantage of our flexible trading over demanding immediacy, we conduct trading cost analysis by benchmarking our trade price to the immediately executable price, which is the prevailing bid price for a sell and offer price for a buy. This benchmark is called SBBO (sell at the bid and buy at the offer).

EXHIBIT 2: Summary Statistics of Aggregate Market and Dimensional Trades by Region and Market Capitalization, *2017–2020*

				Market		Dimensional Trades		
Region	Market Capitalization	Number of Stocks	Number of Countries	Nominal Traded Value ($ trillions)	Average Bid-Ask Spread (bps)	Total Amount Traded ($ billions)	Price Advantage over SBBO (bps)	% of Value Bought at Bid and Sold at Offer
US	Large	1,454	1	$191	4.7	$118	4.3	87%
	Small	3,867	1	$42	19.2	$97	13.6	88%
Developed ex US	Large	1,951	22	$138	7.2	$97	5.5	79%
	Small	7,129	23	$17	22.1	$54	15.6	80%
Emerging	Large	1,794	24	$23	15.3	$63	14.8	87%
	Small	7,037	22	$13	29.8	$27	24.8	83%
Total		19,931	46	$424	13.3	$456	10.5	84%

Source: Dimensional Fund Advisors. Stock universe includes all cap securities in the US, developed ex US, and emerging markets. Small cap is defined as approximately the bottom 8% of market cap within the US, bottom 12.5% of market cap within each non-US developed market country, and bottom 15% of market cap within each emerging market country. Small cap stocks with the lowest profitability and lowest book-to-market ratios are excluded.

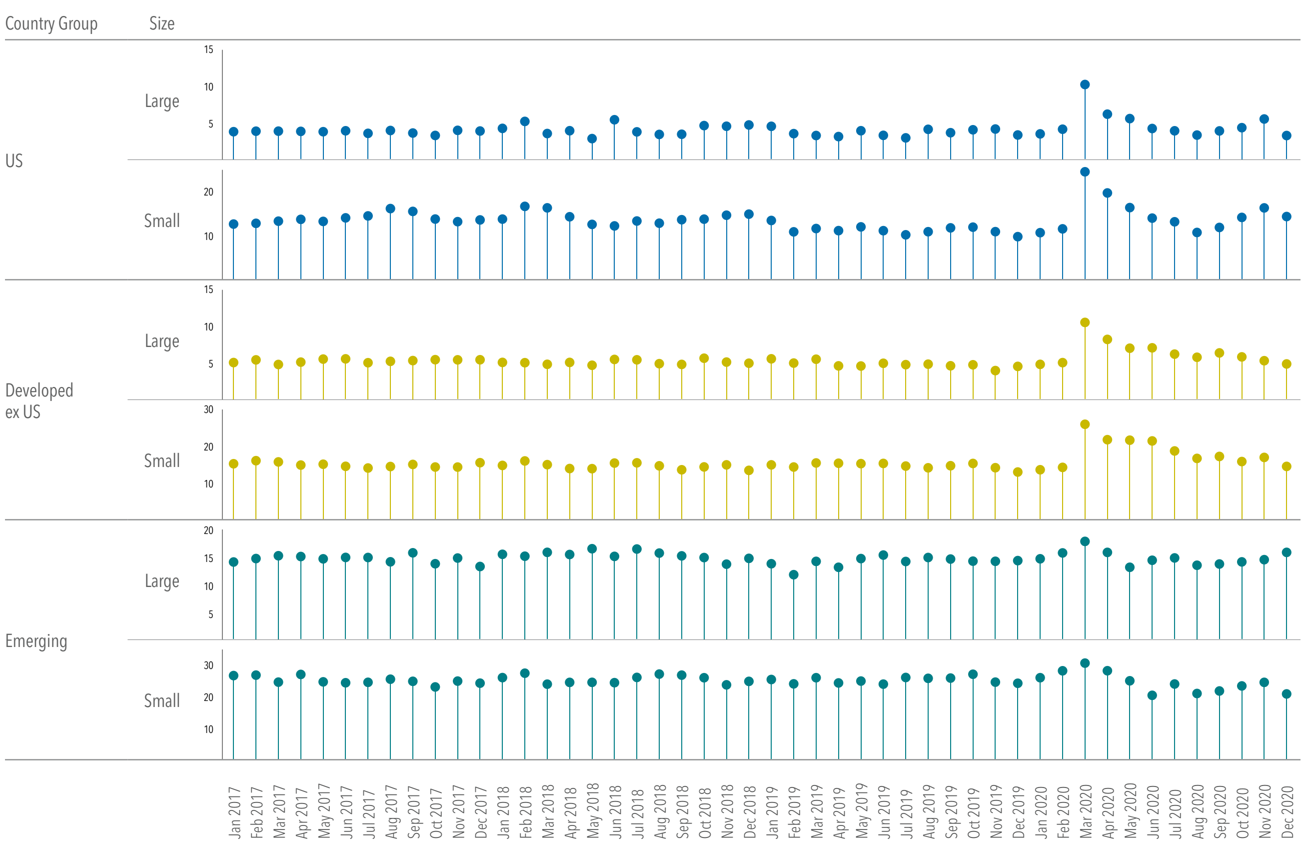
2. Source: Refinitiv DataScope Equities.
3. As of December 2020.
4. See, for example, Marco Di Maggio, Jerry Liu, Savina Rizova, and Ryan Wiley, "Exchange Fees and Overall Trading Costs" (available at SSRN: 3625801, 2020).

Exhibit 2 summarizes the statistics of the aggregate market and Dimensional trades by region and market capitalization. From January 1, 2017, to December 31, 2020, Dimensional traded more than $450 billion of equities across nearly 50 countries, and the trade-value-weighted average price advantage over SBBO was 10.5 bps. In the meantime, the corresponding average market bid-ask spread (weighted by Dimensional trade value)[5] was 13.3 bps, which indicates that Dimensional's trades captured most of the spread. In addition, the price advantage tends to be greater in regions and market segments with larger bid-ask spreads. For example, Dimensional's average price advantage for US large cap stocks is 4.3 bps, vs. 24.8 bps for small cap stocks in emerging countries. In fact, more than 80% of Dimensional's trades by value captured the full spread (buy at the bid and sell at the offer) across all regions and market capitalizations.

PRICE ADVANTAGE DURING HIGH-VOLATILITY PERIODS: A CASE STUDY

Spreads tend to widen in periods of higher uncertainty and greater volatility, so demanding immediacy becomes even more costly during such periods, and the price advantage of flexibility becomes more significant. The first half of 2020 offers a great case study: global equity markets were highly volatile, with the VIX index reaching an all-time high in March 2020.[6] **Exhibit 3** shows Dimensional's price advantage over SBBO over time, which increases by as much as 100% during the high-volatility period across regions and market capitalization. For example, the monthly average price advantage for the US large cap stocks was around 5 bps before March 2020 but increased to 10 bps in March 2020. The same pattern was observed in most countries, as shown in **Exhibits 4** and **5**. These results highlight the

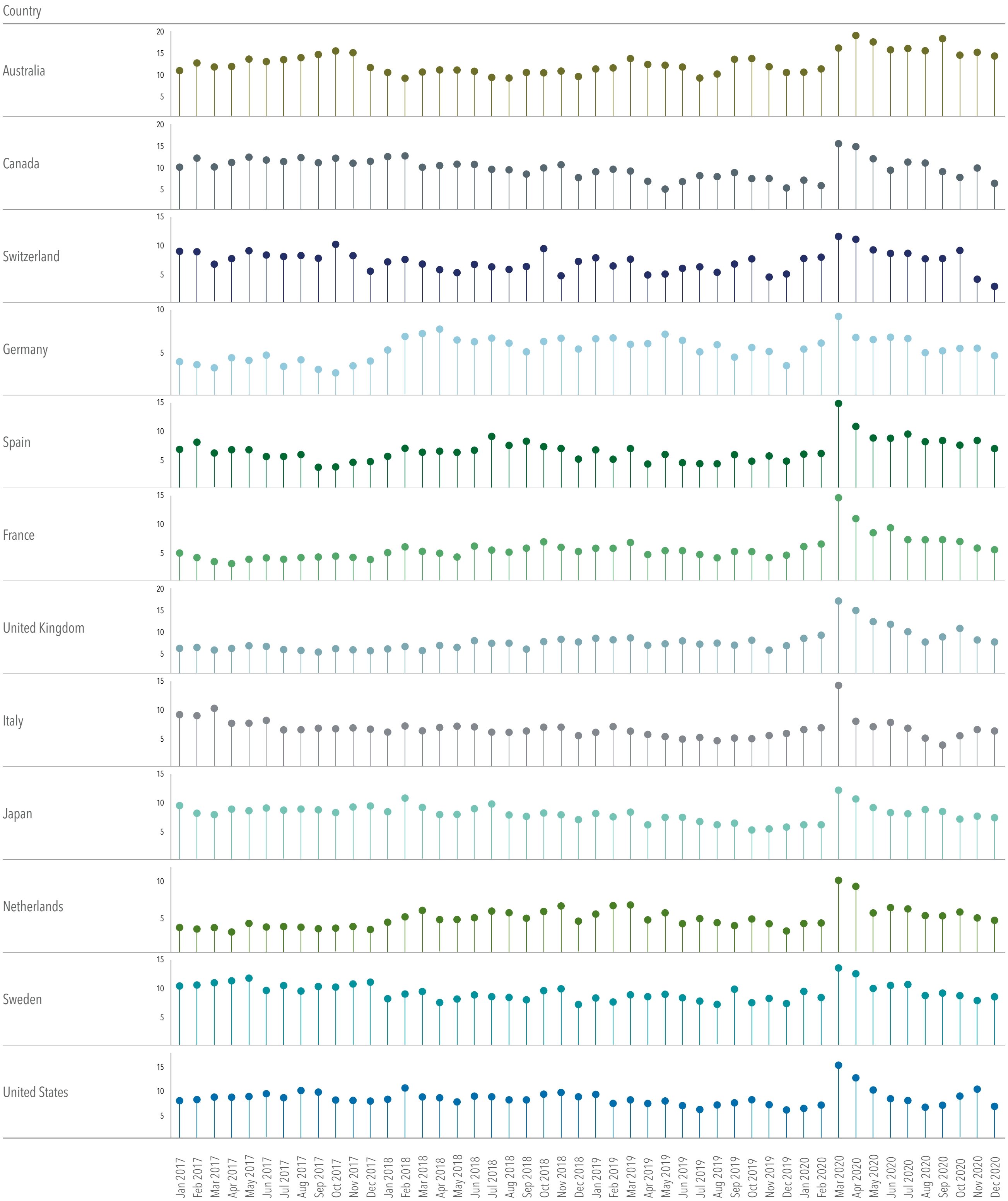
EXHIBIT 3: Dimensional's Price Advantage over SBBO, *2017–2020*



Monthly average price advantages over SBBO in basis points (bps). Source: Dimensional Fund Advisors. Small cap is defined as approximately the bottom 8% of market cap within the US, bottom 12.5% of market cap within each non-US developed market country, and bottom 15% of market cap within each emerging market country. Small cap stocks with the lowest profitability and lowest book-to-market ratios are excluded.

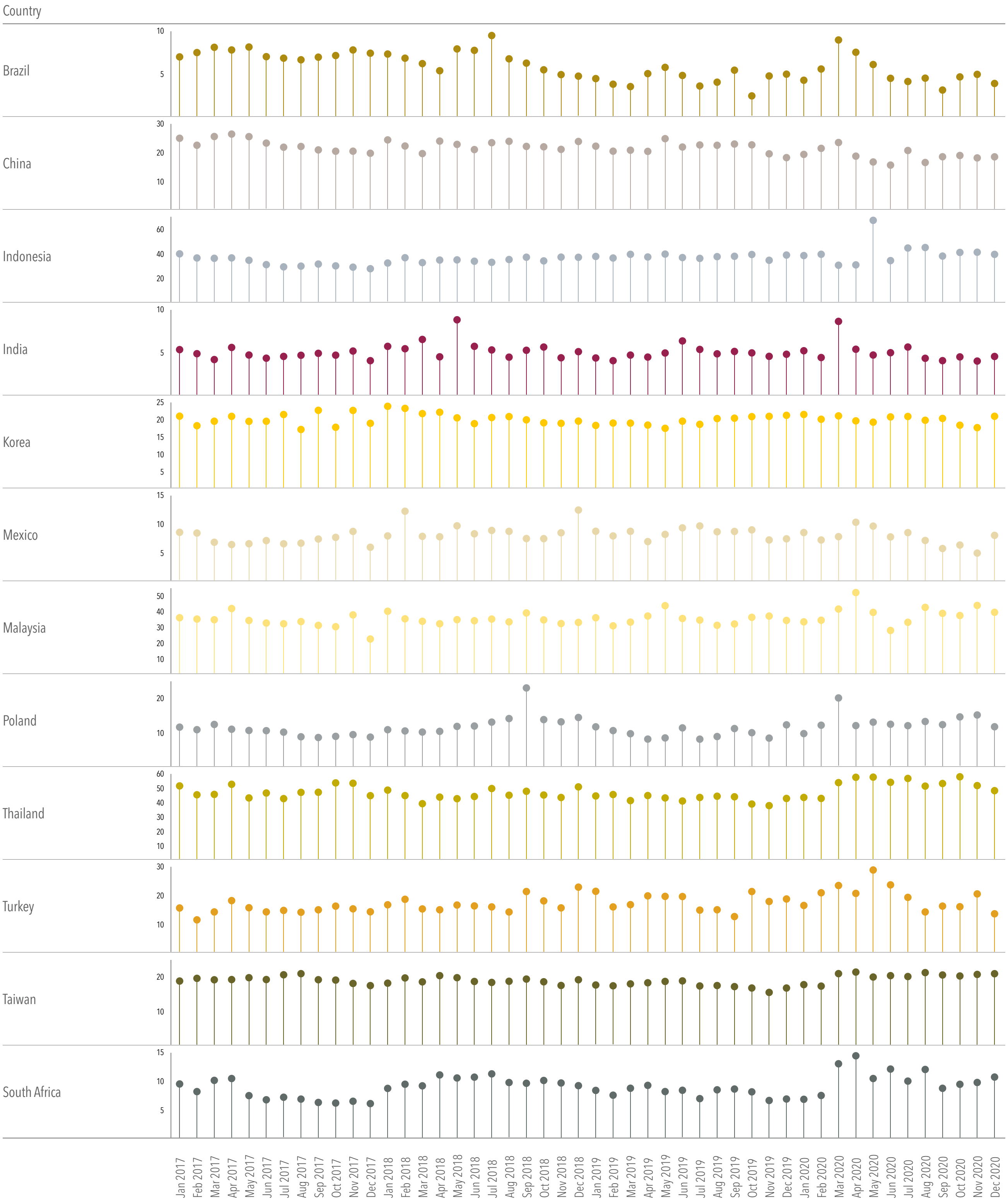
5. For each security on each day, the bid-ask spread is computed as the time-weighted average difference between best bid and offer prices $\frac{(Offer - Bid)}{(Offer + Bid)/2}$ in bps from market open to close. Those daily average spreads are then aggregated using Dimensional-trade-value-weighted average (in line with SBBO computation) across securities and days.
6. "*VIX Historical Price Data*," Cboe, 2021.

EXHIBIT 4: Dimensional's Price Advantage over SBBO in Developed Markets, *2017–2020*



Monthly average price advantages over SBBO in basis points (bps). Source: Dimensional Fund Advisors.

EXHIBIT 5: Dimensional's Price Advantage over SBBO in Emerging Markets, *2017–2020*



Monthly average price advantages over SBBO in basis points (bps). Source: Dimensional Fund Advisors.

benefit of having a robust daily process to continually monitor portfolios and take advantage of real-time flexibility. Our trading process can react to events in the marketplace as they unfold and opportunistically execute when it is more efficient to do so. In contrast, for portfolios that do not have this flexibility, demanding immediate execution may come at an even higher price in periods of higher volatility.

PRICE ADVANTAGE MEASURED BY ALTERNATIVE BENCHMARKS

In the previous sections, we measure the price advantage by benchmarking to the SBBO. While SBBO serves as a useful benchmark, it is a theoretical price based on prevailing market quotes, not an actual trade price from immediacy demanders. In practice, the cost of demanding immediacy may depend on more than just the spread. The order book is dynamic and quickly reacts to information about expected supply and demand. Spreads, execution prices, and depth (how many shares at each price level) can change throughout the day in response to changes in supply and demand. All these considerations can impact the actual trade prices and the cost of demanding immediacy. Therefore, as a supplementary analysis, we compare our trade price with the prices of the actual trades in the same stock and in the same trading direction from liquidity demanders[7] before and after our trades. In **Exhibit 6**, we can see that the price advantages over the trade before and the trade after are 9.8 bps and 2.9 bps, respectively.[8] The variation in price advantage across regions and market capitalization is similar to that based on the SBBO benchmark. These results indicate that after considering other possible aspects of trading costs—like the natural market movements, the hidden liquidities, and the potential market impacts (of both our trades and market trades)—our flexible trading approach still buys at lower prices and sells at higher prices than other approaches that demand immediacy.

EXHIBIT 6: Dimensional's Trade Price Advantages over Various Benchmarks, *2017–2020*

Region	Size	Side	SBBO (bps)	Previous Trade (bps)	Next Trade (bps)
US	Large	B	4.2	3.4	1.1
		S	4.3	3.2	0.8
	Small	B	13.9	9.9	2.6
		S	13.2	9.4	2.6
Developed ex US	Large	B	5.2	6.2	1.3
		S	5.9	6.9	1.6
	Small	B	15.5	15.7	3.0
		S	15.8	16.5	3.1
Emerging	Large	B	14.6	15.4	6.6
		S	15.0	16.3	6.9
	Small	B	24.8	25.1	8.2
		S	24.8	24.8	6.9
Total			10.5	9.8	2.9

Source: Dimensional Fund Advisors. Stock universe includes all cap securities in the US, developed ex US, and emerging markets. Small cap is defined as approximately the bottom 8% of market cap within the US, bottom 12.5% of market cap within each non-US developed market country, and bottom 15% of market cap within each emerging market country. Small cap stocks with the lowest profitability and lowest book-to-market ratios are excluded.

CONCLUSION

Portfolio design and trading are mutually dependent. Dimensional's approach to portfolio design allows for flexible trading, which our research demonstrates to have provided significant price advantages, both cross-sectionally and over time. The extent of this study—over a period of four years and across almost 50 countries—shows the consistency and robustness of this approach.

7. We use the Lee-Ready trade signing algorithm, a technique for determining whether a trade was initiated on the buy or sell side.
8. One component of the trading cost for liquidity providers is the potential market impact, which is the (temporary or permanent) change in the value of the security following the trade and is reflected in the "next trade" benchmark. As a result, the price advantage tends to be smaller when measured against the "next trade" benchmark.

APPENDIX: DETAILS OF COMPUTATIONS

For each Dimensional trade for security i at time t on side s, the price difference C_{its} relative to the benchmark is:

$$C_{its} = D_{its} \frac{(BM_{its} - P_{its})}{BM_{its}}$$

where P_{its} is Dimensional's transaction price for security i at time t on side s, D_{its} is an indicator variable that is $+1$ for buys and -1 for sells, and BM_{its} is the corresponding benchmark price. Those price differences are then aggregated by security i, date d, and side s into $\overline{C}_{i,d,s}$ using trade-value-weighted average, with total traded value $V_{i,d,s}$. Finally, we take trade-value-weighted average over $\overline{C}_{i,d,s}$ across a collection of combinations of security, date, and side. In this study, we define these collections based on the side of trade and two characteristics of the underlying securities: country of exposure and market capitalization (size).

We use three benchmark prices for BM_{its}:

- **SBBO:** Consolidated quoted best bid price for sells and best offer price for buys at time t. For many countries, a stock could be traded at multiple venues, including primary-listing exchanges, other exchanges, MTFs (multilateral trading facilities), ECNs (electronic communication networks), dark pools, etc. We consolidate quote prices from all eligible venues to generate consolidated bid and offer prices.
- **Previous/Next Trade:** Trades from all eligible venues are selected. Due to lack of trading direction disclosure in market data, we use Lee-Ready algorithm and consolidated bid and offer prices to determine side of each trade. We then pick the last trade before t and the first trade after t among trades in the same trading direction.

REFERENCES

Lee, Charles M.C., and Mark J. Ready. 1991. "Inferring Trade Direction from Intraday Data." *Journal of Finance* 46, no. 2: 733–746.

JAPAN

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