

A drop in the bucket: Indexing's share of U.S. trading activity

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- Despite its popularity, indexing plays a relatively small role in the price discovery process. Since most indexing strategies have low turnover and trade at the margins of a large list of securities, their impact on trading activity is minimal. In fact, price discovery is driven by active market participants such as high-frequency traders, hedge funds, and individual investors.
- Market participants quote 5% to 7% as a widely adopted estimate of indexing's trading volume—the amount of notional trading on U.S. exchanges attributable to the portfolio management activity of indexing strategies.¹ In this paper, we use a detailed methodology to improve this estimate.
- Our base case yields a trading volume figure of approximately 1%; under extreme assumptions, our additional estimates are below 5%.

Introduction

Index investing through both traditional open-ended mutual funds and exchange-traded funds (ETFs) offers investors easily accessible, cost-effective ways to achieve their goals. Indexed assets under management have grown from almost zero in the 1980s to about 30% of registered fund assets globally as of 2017. However, despite indexing's benefits, debate continues about its potential negative impact on the capital markets.²

Common arguments assert that growth in indexing assets impairs market pricing dynamics. Either it has too large an influence on prices or it inhibits price discovery because it lowers aggregate market trading volume. We found that total trading volume has actually trended up in recent years, and that indexing strategies account for minimal amounts of that activity. In fact, the overwhelming majority of trading activity can be attributed to market participants engaged in various forms of active management.

In this paper, we explain the methodology we used to quantify what is casually referred to as trading volume due to indexing. More technically, this is measured as the amount of trading volume on U.S. stock exchanges attributable to the portfolio management activity of indexing strategies.³

Reviewing portfolio turnover

The traditional measure of a fund's trading activity is portfolio turnover, which is calculated as the lesser of the fund's gross purchases or sales of securities.⁴ This calculation assumes that the lesser figure has been offset by the larger figure, reflecting the volume of securities replaced (that is, "turned over") during a particular year. However, this is arguably not a good estimate of a fund's trading volume because it does not take into account net-cash-flow-related activity—the difference between purchases and sales. That can potentially lead to underestimating trading volume, especially when indexing is experiencing substantial growth.

¹ See Blackrock (2017) and Rowley, Hirt, and Wang (2018) for further details.

² See Rowley, Hirt, and Wang (2018) for a discussion of indexing's benefits and an exploration of the validity of claims that indexing has an adverse impact on the capital markets.

³ We exclude secondary trading of ETF shares from trading volume due to indexing as it is not part of the ETFs' portfolio management activity. However, such secondary trading is accounted for in overall market trading activity.

⁴ The U.S. Securities and Exchange Commission (SEC) defines turnover rate as the lesser of purchases or sales of portfolio securities for the particular fiscal year divided by the monthly average of the value of the portfolio securities owned during the fiscal year (*Disclosure of Mutual Fund Performance and Portfolio Managers* [Release Nos. 33-6988; IC-19382; S7-1-90]).

Introducing cash-flow-adjusted turnover

For our research, we amended turnover by leveraging a concept from Carhart (1997) that takes a fund’s net-cash-flow-related activity into account. We refer to this as “cash-flow-adjusted turnover.”⁵ We applied the methodology to mutual funds and ETFs to assess index investing’s share of market trading.

A fund’s prospectus and annual report display its gross purchases and sales, but data vendors such as Morningstar typically provide a turnover ratio. Therefore, we converted the turnover ratio back into an aggregate dollar figure. As shown in **Equation 1**, we estimated a fund’s portfolio turnover as the turnover ratio multiplied by its average net assets:

Equation 1

$$\text{Portfolio turnover} = \text{Turnover ratio} \times \text{average net assets}$$

Equation 2 shows that cash-flow-adjusted turnover can be assessed as the sum of (i) portfolio turnover and (ii) one-half the absolute value of annual net cash flow. This is an easy-to-calculate way to estimate the sum of a fund’s “one-way” trading. The result is supported by the assumption that \$0.50 of each \$1 of one-way trading is attributable to the fund; the trading counterparty is responsible for the other \$0.50.

Equation 2

$$\text{Cash-flow-adjusted turnover} = \text{portfolio turnover} + \frac{1}{2} \text{absolute value of net annual cash flow}$$

Illustrating trading volume

Figure 1 displays a hypothetical example demonstrating why we believe cash-flow-adjusted turnover provides a better estimate of a fund’s trading volume.

Suppose Fund A buys \$10 million worth of securities and sells \$2 million over the course of a year, while Fund B buys \$2 million and sells \$2 million:

- The portfolio turnover—the lesser of the fund’s purchases and sales—equals \$2 million for both Funds A and B.
- Assuming the funds’ average net assets for the year are \$25 million, the funds will report a turnover ratio of 8% ($\$2\text{M}/\$25\text{M} = 8\%$).

Figure 1. Hypothetical example illustrating cash-flow-adjusted turnover

	Fund A	Fund B
Purchases	\$10M	\$2M
Sales	\$2M	\$2M
Total purchases and sales	\$12M	\$4M
Portfolio turnover	\$2M	\$2M
Average assets under management	\$25M	\$25M
Turnover ratio	8%	8%
Net cash flow	\$8M	\$0M
Half of absolute value of net cash flow	\$4M	\$0M
Cash-flow-adjusted turnover	\$6M	\$2M
Cash-flow-adjusted turnover ratio	24%	8%

Source: Vanguard.

However, the portfolio turnover underestimates Fund A’s trading activity. As the fund has experienced a net cash inflow, cash-flow-adjusted turnover will take this into account:

- The difference between purchases (\$10 million) and sales (\$2 million) results in net annual cash flow of \$8 million.
- The cash-flow adjustment is one-half of the absolute value of net annual cash flow, or \$4 million.
- Cash-flow-adjusted turnover for the year is \$6 million (the \$2 million portfolio turnover added to the \$4 million cash-flow adjustment), or 24% (based on the average net assets of \$25 million).

Over the year, Fund A engaged in \$12 million worth of trades (\$10 million of purchases plus \$2 million of sales). However, an entity (in this case the fund) can be responsible for only half of each dollar traded (the entity’s counterparty is responsible for the other half). Therefore, the trading activity attributable to the fund is \$6 million.

This example demonstrates that two funds could report the same turnover while their cash-flow-adjusted turnover and therefore their trading volume could differ substantially.

⁵ Carhart (1997) calculates a variable referred to as “Turnover” and “Mturn” in a slightly different manner. We believe our variable is at least conceptually similar and acknowledge the inspiration for it.

Estimating trading volume

We estimated the trading activity on U.S. exchanges attributable to the portfolio management activity of both indexed and actively managed registered funds globally. We considered the following four types of equity funds and ETFs:

- U.S.-domiciled with U.S. mandates
- Non-U.S.-domiciled with U.S. mandates
- U.S.-domiciled with global mandates
- Non-U.S.-domiciled with global mandates

Based on data from Morningstar, we placed funds into each of the four categories. We then obtained those funds' turnover ratios, net assets under management, net cash flow, and U.S. equity exposure. The product of the monthly percentage of U.S. equity exposure and monthly net assets was the dollar amount of U.S. asset exposure. This figure enabled us to estimate the turnover attributable to U.S. equity exposure for both U.S.-domiciled and non-U.S.-domiciled funds. Since turnover ratio is reported on

an annual basis, we calculated each fund's average net assets and average net U.S. asset exposure by taking the average of twelve monthly data points in the relevant fiscal year.⁶

Figure 2 shows that U.S.-domiciled index funds (\$3.7 trillion with U.S. mandates and \$415 billion with global mandates) held far more assets under management (AUM) than did non-U.S.-domiciled index funds (\$308 billion). In addition, Morningstar fund information contained all of the data points needed to study more than 98% of AUM in U.S.-domiciled index funds. It contained the necessary data points for less than 15% of AUM in non-U.S.-domiciled index funds, and these accounted for less than 8% of overall index fund AUM.

Many of the non-U.S.-domiciled funds report turnover ratios calculated using a different methodology (UCITS), making proper comparisons difficult, if not impossible.⁷ Because of that, and because non-U.S.-domiciled index funds account for a relatively small amount of AUM, we estimated trading volume based on the characteristics

Figure 2. Number of funds and assets under management (AUM) by category, 2017

Category	Totals		Complete data availability		
	Number of funds	AUM (USD, billion)	Number of funds	AUM (USD, billion)	Percentage of total AUM
Indexed U.S.-domiciled with U.S. mandates	2,552	\$3,710	1,261	\$3,682	99.2%
Indexed non-U.S.-domiciled with U.S. mandates	1,850	\$195	39	\$28	14.5%
Indexed U.S.-domiciled with global mandates	1,371	\$415	700	\$409	98.4%
Indexed non-U.S.-domiciled with global mandates	3,183	\$113	132	\$17	14.8%
Indexed open-ended funds and ETFs	8,956	\$4,434	2,132	\$4,136	93.3%
Active U.S.-domiciled with U.S. mandates	22,081	\$4,488	8,207	\$4,339	96.7%
Active non-U.S.-domiciled with U.S. mandates	8,319	\$298	592	\$59	19.9%
Active U.S.-domiciled with global mandates	9,318	\$559	3,981	\$542	96.9%
Active non-U.S.-domiciled with global mandates	28,387	\$451	1,403	\$66	14.7%
Active open-ended funds and ETFs	68,105	\$5,796	14,183	\$5,006	86.4%
Total industry	77,061	\$10,230	16,315	\$9,142	89.4%

Source: Vanguard calculations, using data from Morningstar, Inc.

⁶ All trading volume estimates have been performed on the basis of year-end October 31, the fiscal year-end for many mutual funds and ETFs.

⁷ See Traulsen (2011).

of U.S.-domiciled index funds. **Figure 3** shows that our analysis covers a substantial proportion of both total global fund assets and fund assets for which complete data is available.

After defining our terms, we put them into practice using net assets, percentage of U.S. equity exposure, turnover ratio, and net flow data from Morningstar and total trading volume on U.S. exchanges from ArcaVision (\$68.3 trillion in 2017, including \$15.8 trillion of ETF shares). **Figure 4** summarizes the turnover and cash-flow-adjusted turnover of U.S.-domiciled index funds and index ETFs for the year ended October 31, 2017.

While an ETF's portfolio turnover already captures cash transactions, the net-cash-flow component of our cash-flow-adjusted turnover estimates assumes all transactions in an ETF's underlying securities were in cash. We

believe this is a very generous assumption because in the U.S., ETFs typically issue new shares and redeem existing shares on an in-kind basis through the creation-redemption process. This is generally not considered a trade in the underlying securities. Therefore, on one hand, our estimates significantly overstate trading volume. However, an opposing view might suggest that an authorized participant's purchase or sale of underlying securities to satisfy a creation or redemption still reflects—or is at least attributable to—an ETF's portfolio management activity. From that perspective, our assumption attributes a more conservative (higher) estimate of trading volume to the portfolio management activity of indexing.

Figure 3. Number of funds and AUM for U.S.-domiciled open-ended funds and ETFs, 2017

Category	Totals		Complete data availability	
	Percentage of funds	Percentage of AUM	Percentage of funds	Percentage of AUM
U.S.-domiciled (percentage of total industry)	45.8%	89.7%	18.4%	87.7%
U.S.-domiciled index (percentage of total index funds)	43.8%	93.0%	21.9%	92.3%
U.S.-domiciled active (percentage of total active funds)	46.1%	87.1%	17.9%	84.2%

Source: Vanguard calculations, using data from Morningstar, Inc.

Figure 4. Turnover and cash-flow-adjusted turnover for indexed open-ended funds and ETFs in 2017

Category	Indexed open-ended funds	Indexed ETFs	Indexed open-ended funds and ETFs
Portfolio turnover (USD, billion)	\$133	\$276	\$409
Portfolio turnover (percentage of overall trading volume)	0.19%	0.40%	0.60%
Cash-flow-adjusted turnover (USD, billion)	\$245	\$404	\$649
Cash-flow-adjusted turnover (percentage of overall trading volume)	0.36%	0.59%	0.95%

Source: Vanguard calculations, using data from Morningstar, Inc., and ArcaVision.

Figure 5 shows that the aggregate level of market trading volume has actually trended up since 2006 (2007 appears to be an anomalous upward spike). The cash-flow-adjusted turnover estimates suggest that the trading volume attributable to the portfolio management activity of index funds and index ETFs has been very low. Perhaps surprisingly, the figures also appear low for U.S. open-ended active funds and active ETFs.

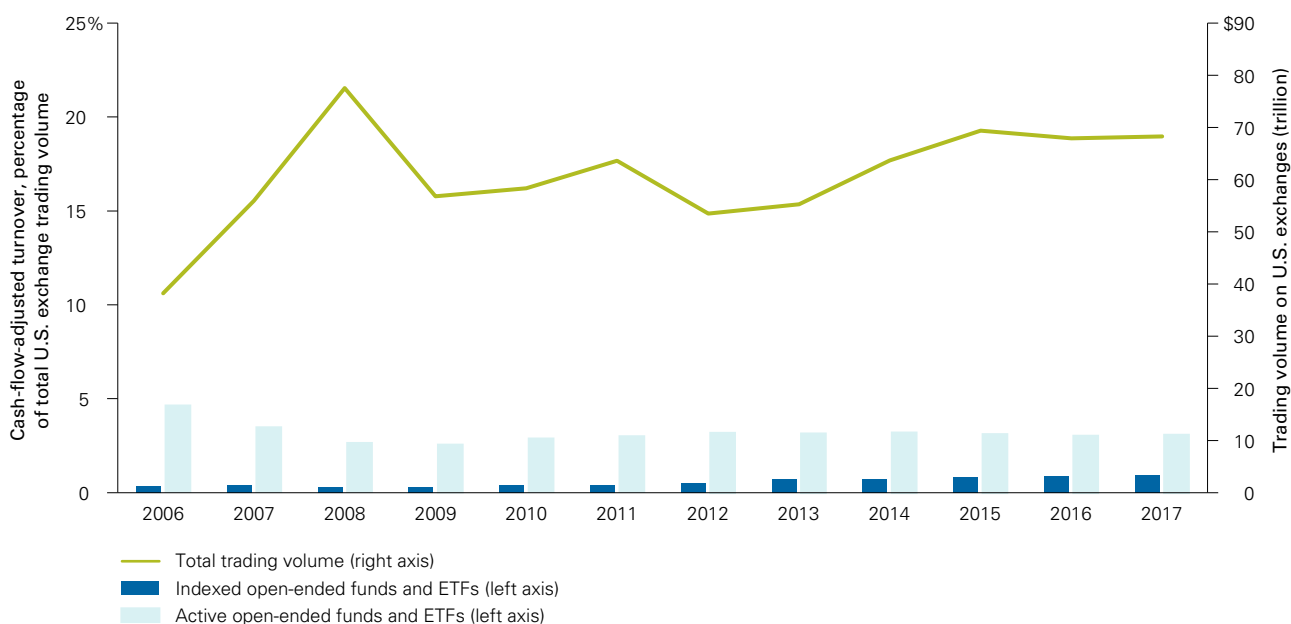
These estimates relate only to traditional open-ended mutual funds and ETFs; they don't take into account other forms of indexing and active management. We estimate the impact of "non-fund" indexing strategies (such as pension funds and separately managed accounts) in the analysis below. But a detailed discussion

of the trading activity of the various forms of non-fund active management (such as individual investors, hedge funds, corporates, insurance companies, and pension funds) that constitute the majority of trading on the U.S. exchanges is outside the scope of this paper.

Impacts of high-frequency trading and non-fund indexing strategies

High-frequency trading (HFT) is a significant trend that has been on the rise since the mid-2000s. HFT has pushed trading volumes higher across the globe, especially on U.S. stock exchanges. Avramovich, Lin, and Krishnan (2017) estimate that about 50% of recent stock trading volume in the U.S. is driven by HFT.

Figure 5. Index fund trading volume is low while aggregate trading volume is steady



Source: Vanguard calculations, using data from Morningstar, Inc., and ArcaVision.

Many academics and market participants argue that HFT activity has improved liquidity. But others complain that it is not “real” activity but rather “unnecessary trading” (shuffling shares back and forth with no intention of taking a position or, worse, manufactured activity designed to take advantage of slower investors on the other side).

We conducted a scenario analysis to consider the impact of applying a market trading volume “discount.” This would eliminate the impact of so-called unnecessary trading due to HFT (which decreases the denominator) and allow for trading volume due to indexing strategies outside of registered funds (which increases the numerator).

Estimating the AUM of indexing strategies such as pension funds and separately managed accounts is beyond the scope of our research. However, in order to estimate trading volume attributable to indexing in general and not just index funds, we attempted to account for them.

Figure 6 displays scenarios considering both impacts. It allows non-fund indexing strategies to have a bigger market impact and applies a market trading volume discount to eliminate the effect of HFT.

We begin with the 2017 cash-flow-adjusted turnover ratio for indexed open-ended funds and ETFs of 0.95% (as estimated in Figure 4). We then progressively

increase the trading volume by 1.2x, 1.4x, 1.6x, 1.8x, and 2.0x to reflect trading by non-fund indexing strategies (not captured by our sample). The most extreme scenario, the 2.0x increase (which would imply that non-fund strategies are as big as open-ended funds and ETFs put together), lifts the indexing trading volume to 1.90%.

Another set of scenarios takes HFT into account by reducing overall trading volume. We begin with the \$68.3 trillion trading volume for 2017 as reported by ArcaVision; the next scenario reduces total trading volume by 50%, to \$34.1 trillion. In conjunction with the 2.0x increase in indexing trading volume, this scenario lifts the estimate to 3.8%.

Adjusting for trading of ETF shares

The \$68.3 trillion overall trading volume includes \$15.8 trillion of ETF shares. Trading of ETF shares provides a venue for observing intraday price discovery and helps make the markets more liquid. However, some believe it leads to overstated trading volume estimates since it largely reflects secondary-market transactions.⁸

Figure 7 shows the results after we eliminate the impact of potentially overstated trading volume due to trading of ETF shares. Our estimate of 1.24% is the result of the 2017 cash-flow-adjusted turnover for indexed open-ended funds and ETFs as a proportion of overall trading volume less the \$15.8 trillion trading volume of ETF shares.

Figure 6. The impact of HFT and non-fund strategies on cash-flow-adjusted turnover

		Increase in indexing strategy trading to account for non-funds (multiple of registered fund trading)					
		1.0x	1.2x	1.4x	1.6x	1.8x	2.0x
Market trading volume discount to account for HFT	0%	0.95%	1.14%	1.33%	1.52%	1.71%	1.90%
	50%	1.90%	2.28%	2.66%	3.04%	3.42%	3.80%

Source: Vanguard calculations, using data from Morningstar, Inc., and ArcaVision.

⁸ Investment Company Institute (2018) and Vanguard (2019) note that the trading volume of ETF shares largely consists of secondary-market transactions—the trading of ETF shares between two market participants.

Figure 7. The impact of HFT and non-fund strategies on cash-flow-adjusted turnover adjusted for secondary-market ETF trading

		Increase in indexing strategy trading to account for non-funds (multiple of registered fund trading)					
		1.0x	1.2x	1.4x	1.6x	1.8x	2.0x
Market trading volume discount to account for HFT	0%	1.24%	1.48%	1.73%	1.98%	2.22%	2.47%
	50%	2.47%	2.97%	3.46%	3.95%	4.45%	4.94%

Source: Vanguard calculations, using data from Morningstar, Inc., and ArcaVision.

Applying only the assumption of the 2.0x increase yields an estimate of 2.47%. Applying the 2.0x increase with the HFT discount yields an estimate of 4.94%.

The analysis demonstrates that even after we apply multiple assumptions that, taken together, might be considered extreme, indexing still appears to account for less than 5% of overall trading volume on U.S. exchanges.

Conclusion

This paper has presented a methodology for estimating the trading volume on U.S. exchanges attributable to the portfolio management activity of index funds, index ETFs, and other indexing strategies.

Our base case estimates that index funds and index ETFs account for approximately 1% of overall trading volume on U.S. exchanges, well below the more widely quoted 5% to 7%. Even after accounting for indexed portfolio management activity outside of registered funds and removing trading volume due to HFT and shares of ETFs, we estimate that indexing represents less than 5% of overall U.S. trading volume.

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