

Morningstar Global Thematic Funds Landscape 2022

Morningstar Manager Research

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Contents

1	Executive Summary
2	Introduction
4	Defining the Universe of Thematic Funds
8	Global Landscape
14	United States
20	Europe
26	Canada
32	Rest of World
42	Appendix

Jackie Choy, CFA
 Director of ETF Research, Asia
jackie.choy@morningstar.com

Monika Dutt
 Director of ETF Research, Europe
monika.dutt@morningstar.com

Ben Johnson, CFA
 Director of Global ETF Research
ben.johnson@morningstar.com

Andy Jung, CFA
 Director of Manager Research
andy.jung@morningstar.com

Kenneth Lamont, CAIA
 Senior Analyst
kenneth.lamont@morningstar.com

Zunjar Sanzgiri
 Senior Analyst
zunjar.sanzgiri@morningstar.com

Lan Anh Tran
 Analyst
lananh.tran@morningstar.com

Yoki Wu
 Analyst
yoki.wu@morningstar.com

Executive Summary

The thematic fund market has mushroomed in recent years. These funds attempt to harness secular growth themes ranging from artificial intelligence to Generation Z. Some have delivered phenomenal performance. Others have been duds.

Since we published the first installment of this paper in early 2020, asset managers have ramped up the supply of these niche and often gimmicky funds. Investor demand for clarity and guidance has increased commensurately.

In this report, we introduce an updated taxonomy for classifying these funds based on an enhanced global dataset. Using this framework, we analyze key trends in the global thematic fund landscape.

Key Takeaways

- ▶ Investor interest in thematic funds has increased dramatically in recent years, particularly since the beginning of the global coronavirus pandemic. In the trailing two years to the end of 2021, assets under management in these funds have grown nearly threefold to \$806 billion worldwide. This represented 2.7% of all assets invested in equity funds globally, up from 0.8% 10 years ago.
- ▶ The number of thematic funds has multiplied. A record 589 new thematic funds debuted globally in 2021, more than double the previous record of 271 new launches in 2020.
- ▶ We have updated our three-tier taxonomy for classifying thematic funds to help investors make sense of this expansive and diverse universe.
- ▶ Europe is the largest market for thematic funds, accounting for 55% of global thematic fund assets.
- ▶ Actively managed funds account for the majority of assets invested in thematic funds.
- ▶ Funds tracking multiple technology themes, with \$105 billion in combined assets, represent the most popular thematic grouping globally.
- ▶ Thematic funds tend to spring forth from growth narratives. In total, 72% of thematic funds that plot in the Morningstar Equity Style Box exhibit a growth bias, while just 6% have a value tilt.
- ▶ More than a half of the thematic funds in our global universe both survived and outperformed the Morningstar Global Markets Index over the trailing three years to the end of 2021. However, thematic funds' success rate drops to just one in 10 when we look at the trailing 15-year period. More than three fourths of the thematic funds that were available to investors at the onset of that period have since been closed.

- ▶ Thematic funds' lackluster long-term performance can be partly explained by the fact that their fees tend to be higher than those of their nonthematic counterparts.

Introduction

In recent years, the global menu of thematic funds has expanded in number and breadth like never before. These funds attempt to harness secular growth themes ranging from artificial intelligence to Generation Z. The result has been a steady supply of ever more niche and complex investment strategies from asset managers and increased demand from investors for greater clarity with respect to how these funds are built and how they might (or might not) fit within their portfolios.

In this latest edition of our analysis of the thematic fund landscape, we introduce an updated taxonomy for classifying these funds. We then use these classifications to examine key trends in the global thematic fund market.

A Brief History of Thematic Funds: The Early Years

The history of thematic funds can be traced back to the end of World War II. In 1948, Chicago-based Television Shares Management Corp. launched The Television Fund. This fund sought profit from the burgeoning television industry at a time when there were about 1 million television sets in the United States and color television was about to make its debut.

In 1950, that fund became the Television-Electronics Fund, a change that signaled an expanded investment scope. This on-the-fly tweaking of funds' investment strategies as themes evolve has been a hallmark of thematic funds through the decades. Kemper acquired the fund in 1970. Its new owner expanded the fund's remit further, rechristening it Kemper Technology. Thus, the fund was even further from its originally narrow thematic focus, a fate shared by many subsequent thematic funds.

The concept of growth investing gained steam in the 1950s. T. Rowe Price launched its Growth Stock mutual fund in 1950. The late Sir John Templeton founded Growth Companies Inc., ancestor of Templeton Growth, which launched in 1954. An early proponent of growth investing, Phillip Fisher, published the first edition of "Common Stocks and Uncommon Profits," a core text for growth investors, in 1958.

By the mid-1950s, a string of future technology-focused thematic funds had debuted, including the Atomic Development Mutual Fund; the Science and Nuclear Fund; Nucleonics, Chemistry & Electronics Shares; and the Missiles-Rockets-Jets & Automation Fund.

By the 1960s, other futuristic thematic funds like the Steadman Oceanographic Fund, which invested in companies aiming to farm and build communities underwater, became popular too. But much like "The Jetsons," these funds had limited success in the 1960s.

1990s: The Modern Era

One of the earliest thematic funds that survives in its original guise today is Fidelity New Millennium FMILX, which launched in 1992. The fund, which now manages more than \$2.6 billion¹ in assets, aims to outperform by identifying early signs of long-term changes in the marketplace.

In the mid-1990s there was an influx of new funds targeting specific nontechnological themes. For example, Excelsior Aging of America was the first of many thematic funds to specifically target a demographic theme. The fund struggled to raise assets and eventually shuttered in 1997. By the end of the decade, the number of thematic funds listed globally had grown to 95.

The Rise and Fall of Internet-Themed Funds

In 1995, Japanese asset manager Daiwa launched the first internet-themed fund: Daiwa U.S. Internet Open. As the dot-com bubble inflated, the number of internet- and tech-related thematic fund launches also ballooned. By the turn of the millennium, one in three thematic funds globally was tracking a digital economy theme. However, after the bubble burst, the vast majority of these funds closed. Today, just five of the 50 internet-themed funds launched in that period remain open.

The Thematic Menu Expands: 2000-10

Between 2000 and 2010, the number of different themes targeted by thematic funds globally jumped to 25 from 14. Older themes, such as those targeting resource management (for example, water funds), were joined by a host of new technological themes like fintech and robotics. Despite the growing number of thematic funds, asset levels remained low and still represented just a tiny fraction of the global equity fund market.

The Emergence of Thematic ETFs

At the beginning of 2005, there was just one thematic exchange-traded fund globally. By the dawn of 2010, there were more than 50. The emergence of ETFs as a dominant vehicle for indexing over this period helped fuel product development, first in the U.S. and then in Europe.

But ETFs aren't just for indexing. Indeed, the fund that has become the poster child for the category is a fully transparent actively managed ETF. ARK Innovation ETF ARKK is an actively managed thematic fund domiciled in the U.S. launched in 2014. It places high-conviction bets on stocks exposed to specific tech themes. The fund's aggressive approach has led to stellar returns and turned ARK's CEO into a global sensation. The fund's performance attracted piles of money from new investors. At one point in mid-2021, its assets swelled to more than \$25 billion. The tide has since turned. Recent performance has been poor, and the fund's AUM is now² less than halfway below its high-water mark.

¹As of March 15, 2022.

²As of March 23, 2022.

Defining the Universe of Thematic Funds

For the purposes of this report, we have defined the universe of thematic funds as those that select holdings based on their exposure to one or more investment themes. These themes may pertain to macroeconomic or structural trends that transcend the traditional business cycle. Examples include demographic shifts or technological advances.

Our definition includes funds like cannabis ETFs, which hope to capitalize on the legalization and commercialization of cannabis globally. We exclude funds that might be useful for making tactical economic calls but lack a cohesive longer-term narrative, such as those that target Japanese exporters.

Although many active managers select investments based on exposure to a theme as part of their investment process, we have isolated a distinct subset of funds that explicitly target these themes. The purpose of this paper is to identify and analyze these funds to help investors better navigate this landscape.

Building a Framework

Our updated global taxonomy for thematic funds is based on intentionality rather than holdings. Building on the work done in our previous research on this topic, in this paper we present an enhanced global thematic fund dataset. By using natural language-processing technology to crawl Morningstar's comprehensive global fund database, we have been able to construct an even more complete picture of the global thematic fund market than was previously possible.

To identify intentionality, we have relied on a combination of fund names (a strong indicator of intentionality) and information gleaned from prospectuses, marketing materials, index methodologies (in the case of index funds), and data points available within Morningstar Direct, such as investment objective, where possible.

What's In, What's Out?

Our definition of thematic funds is generally inclusive, but there are some important omissions. We have limited our universe to equity funds—both active and passive—mutual funds, and ETFs. We have excluded other asset classes, most notably fixed-income funds. This is because their investment profile is less suited to capturing the growth potential of emerging themes, and consequently the market for these funds is largely nonexistent.

Sustainable funds are included, provided they seek to capture a specific theme. Alternative energy funds, which aim to capitalize on the transition to a low-carbon economy, are included, but most broad environmental, social, and governance funds, which select a diverse group of stocks based on ESG scores, fall out of scope. Funds like Generali IS SRI Ageing Population—which tracks a demographics theme and also applies ESG screens—are included.

Others, like SPDR SSGA Gender Diversity Index ETF SHE, which at first glance appear thematic, are excluded on the grounds that they are designed to reward a broad set of companies with strong gender diversity metrics rather than attempt to track the trend toward a more equitable society.

A fund that uses artificial intelligence or machine learning in its stock-selection process will be included only if it also selects stocks connected with one or more themes. For example, Xtrackers Artificial Intelligence & Big Data UCITS ETF uses artificial intelligence to select stocks that it deems well-positioned to harness its targeted theme.

Sector or Theme?

The line between sectors and themes can be blurry, especially as sectors' definitions have drifted over time. As a rule of thumb, we have excluded funds that either track standard sector, industry, or subindustry indexes or closely resemble mainline sector funds from our definition of thematic funds.

To help separate these groups as cleanly as possible, we have referenced the Industry Classification Benchmark, The Global Industry Classification Standard, and Morningstar's own Global Equity Classification Structure.

Perhaps the most challenging distinction to make is between tech sector funds and those that track one or more tech-related themes. To be included in our taxonomy for thematic funds, broad technology funds must explicitly target one or more tech themes, such as disruptive or next-generation technologies.

Evolving Themes

What is considered a theme can change through time. For example, at its launch in 2009, Pictet Agriculture focused on meeting the expected food needs of a growing global population. Since then, technological advances have helped boost global food production, and global food scarcity has become a less pressing issue. In response, the Pictet fund pivoted toward a broader "nutrition" theme and now targets firms that it deems key to improving nutrition profiles in addition to those improving efficiencies within the food value chain.

Some funds began as thematic before outgrowing the label. For example, American Funds The New Economy Fund ANEFX, which launched in 1983, initially aimed to capitalize on the shift from a manufacturing- dominated economy to one based on services and information companies. The fund has subsequently broadened its remit and now resembles a more-traditional growth fund. As such, it is outside the scope of our framework for classifying thematic funds.

Mapping the Universe

To make sense of the diverse universe of thematic funds offered to investors around the world, we have developed a three-tier taxonomy, visualized in Exhibit 1.

At first glance, it appears that thematic funds tend to resist rigid categorization. However, after assessing the global universe of these funds, we found that themes do cluster into distinct groups. For

example, funds tracking smart car, next-generation automobile, hybrid car, and automated driving themes can all be comfortably collected under the umbrella of future mobility. This in turn can be grouped with other themes under a broader theme—in this case, technology.

Broad Themes

Our framework first arranges the universe into four broad buckets: technology, physical world, social, and broad thematic.

Technology themes, as the name suggests, target the disruptive growth potential of technological change. These include themes like fintech, robotics & automation, and battery technology.

Physical world themes address the management of physical resources. Included in this bucket are funds that facilitate the transition to a low-carbon world, such as alternative energy funds.

Themes in the social bucket deal with structural changes in society. These themes may be politically oriented or focus on demographic changes.

Finally, those funds that track multiple themes belonging to any of the above buckets are grouped under the broad thematic umbrella.

Themes

Collected under each of these broad themes are more-granular theme groupings. For example, the technology broad theme includes the fintech theme, which brings together fintech but also the more-specific financial innovation, blockchain, and digital payments subthemes.

As a further example, the social broad theme includes the political theme, which in turn gathers funds targeting new silk road, structural reform, and even Korea unification.

Definitions

The global thematic fund taxonomy is presented in Exhibit 1. Definitions of broad themes and themes can be found in the Appendix.

Exhibit 1 Thematic Fund Taxonomy

Technology
Artificial Intelligence + Big Data

Artificial Intelligence
Deep Learning
Quant Computing
Machine Learning
Intelligent Machines
Big Data

Battery Technology

Battery Value Chain
Secondary Battery Industry

Cloud Computing

Cloud Computing

Cyber Security

Cyber Security

Digital Economy

Connectivity
Convergence Technology
Data Economy
Digital Economy
Digitalisation
Disruptive Commerce
E-commerce
Information Revolution
Internet
Internet of Things
New Retail
Sharing Economy
Social Media
Web x.0

Digital Media

Advertising + Marketing Tech
Multimedia

Electronics

Innovative Electronics
Integrated circuits

Fintech

Blockchain
Digital Payments
Disruptive Fintech
Financial Innovation
Fintech
Pay Infrastructure

Future Mobility

Automated Driving
Automobile Innovation
Cleaner Transport
Electric Vehicle
Green Car

Hybrid Car

Internet fo Vehicle
New Car Industry
New Energy Vehicles
Next Gen Auto
Smart Mobiiity
Smart Transport

Life Sciences

Alternative Medical Technology
Biotech Clinical Trials
Biotech Innovation
Biothreat
Brand Name Drugs
Cancer
Cardio Devices
Digital Health
Generic Pharma
Genomics
Health Innovation
Ophthalmology
Medical Breakthroughs
Metabolic-Endocrine
mRNA
Neuroscience
Patient Care Services
Treatments Test Advancements

Nano Tech + Smart Materials

Nano Tech
Smart Materials

Next Gen Communications

5G
Advanced Communications
Mobile Internet
Next Generation Communication
Smart Cities
Smart Grid
Telecoms Innovation
Wireless

Robotics + Automation

3D Printing
Automation
Drones
Manufacturing Revolt
Mechatronics
Robotics
Smart Industrial Technology

Space

Space
Space Exploration
Space Innovation

Virtual Reality and Gaming

ESports
Gaming
Online Betting
Virtual Reality

Multiple Technology Themes

4th Industrial Revolution
Disruptive Technology
Early Stage Innovation
Emerging Industry
Exponential Technology
FAANGS
Frontier Tech
Future Economy
IT Revolution
Metaverse
Moonshot Tech
New Economic Engine
Next Generation Technology

Physical World
Energy Transition

Alternative Energy
Carbon Transition
Clean Energy
Clean Tech
Climate Solutions
Decarb Enablers
Green Energy
Hydrogen Economy
New Energy
Nuclear
Renewable Energy
Renewable Infrastructure
Smart Energy
Solar
Wind

Food

AgniTech
Fishing
Food
Food Tech
Nutrition

Logistics + Transportation

E-Commerce Logistics
Jets
Logistics
Ship Building and Transportation
Shipping
Transport

Resource Management

Air
AquaBusiness
Circular Economy
Efficient Resources
Future Resources
New Resources
Rare Resources
Timber
Upstream Natural Resources
Uranium
Waste
Water

Broad Physical World

Multiple Physical World Themes

Social
Cannabis

Cannabis

Consumer

Alcohol
Baby Boomers
Changing Lifestyles
Classic Cars
Consumer Joy
Cosmetics
EM Consumption
Kids
Luxury
Millennials
Organics
Pets
Sports
Subscription Economy

Demographics

Aging Population
Demographics
Future of Humans
Urbanisation

Political

Energy Independence
Infrastructure Spending
Korea New Deal
Korea Unification
New Silk Road
Policy driven
Regional Development
State-Owned Enterprise
Structural Reform
Trade War

Post-Corona

Airlines, Hotels, Cruise Lines
Post Corona
Work From Home
Security
General Security
National Defense
Safety

Security

General Security
National Defense
Safety

Wellness

Alternative Health
Culture
Education
Health + Weight Loss
Healthy Lifestyle
Obesity
Self Development/Fulfillment
Wellbeing

Other

Gig Economy
Holding Companies
Vice

Broad Social

Multiple Social Themes

Broad Thematic
Broad Thematic

Future Life
Future Trends
Global Themes
MegaTrends
New Millenium
Secular Trends
Smart Future
Smart Industries
Transformational Changes

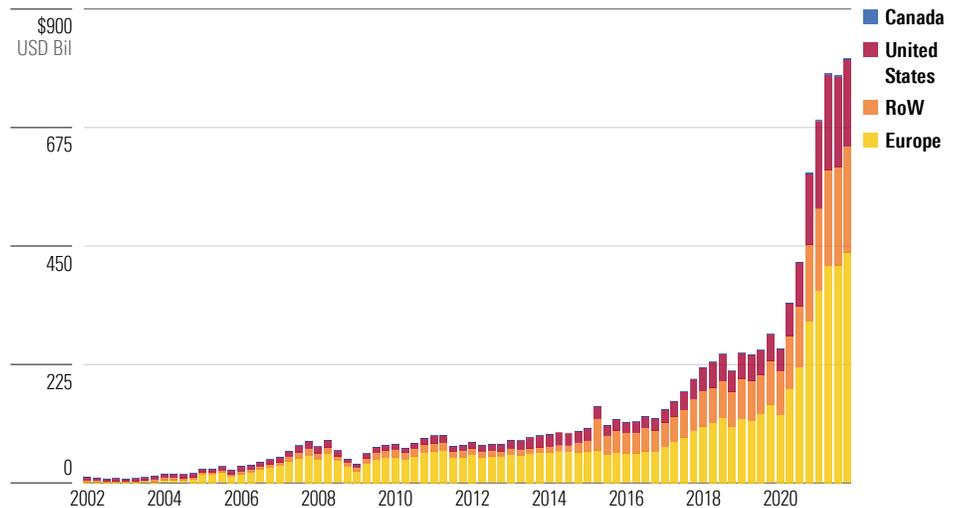
Through this framework, we hope to shine a light on the fast-growing world of thematic investing. By grouping funds in this way, investors can more readily compare them.

The Global Landscape

As of the end of December 2021, there were 1,952 surviving funds in our global database that fit our definition of thematic. In the trailing two years to the end of 2021, AUM has grown nearly threefold to \$806 billion from \$255 billion worldwide. As of the end of 2021, global thematic fund assets represented 2.7% of all assets invested in equity funds globally, up from 0.8% 10 years ago.

Assets have poured into thematic funds, and the menu has broadened. A record 589 new thematic funds debuted globally in 2021, more than double the previous record of 271 funds launched in 2020.

Exhibit 2 Global Thematic AUM Growth by Region (USD Billion)



Source: Morningstar Research. Data as of 31 December 2021.

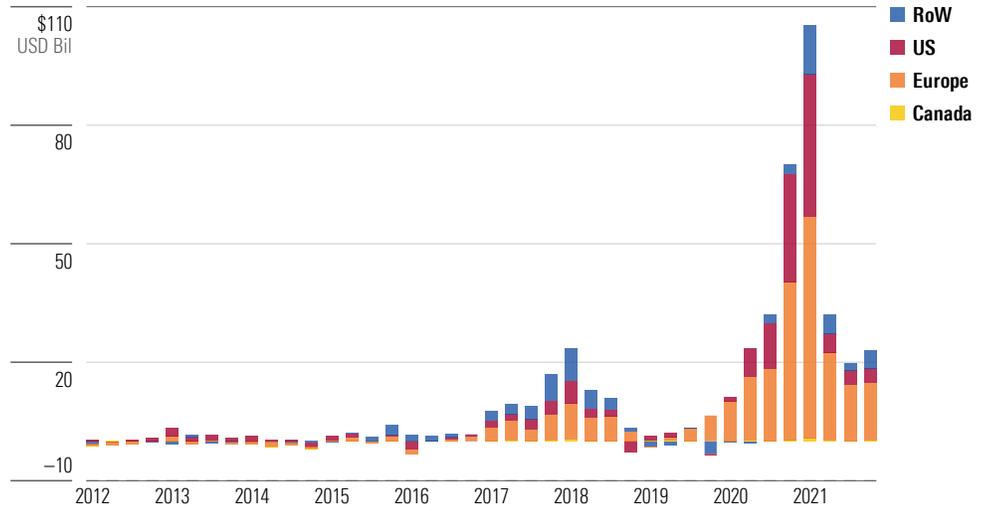
Europe Is the Largest Thematic Fund Market

Thematic funds' growth has been uneven across geographies. Europe-domiciled thematic funds' share of the global pie has expanded to 55% from 15% since 2002. In the U.S., thematic funds' market share shrank to 21% from 51% over the same period.

While all regions have experienced net inflows over the trailing three years through to the end of 2021, Europe and the U.S. have been the main beneficiaries, netting \$200 billion and \$97 billion in new flows over the period, respectively.

Net inflows in 2021 were particularly noteworthy. Over the trailing year to the end of December 2021, global net inflows equaled \$188 billion, a figure that dwarfs the previous year's record inflows of \$139 billion.

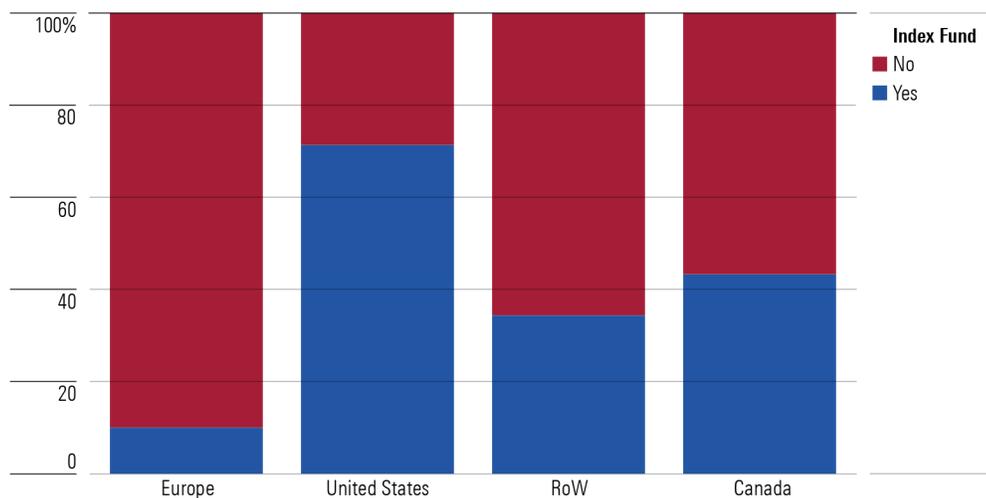
Exhibit 3 Global Net Asset Flows by Region* (USD Billion)



Source: Morningstar Research. Data as of 31 December 2021. *China-domiciled funds are excluded from these calculations.

Almost three fourths of assets invested in thematic funds globally are actively managed; this includes 90% of AUM in Europe. Bucking the trend is the U.S., where 71% of thematic fund assets are passively managed. This reflects the success of thematic ETFs in the region.

Exhibit 4 Active Versus Passive Regional Thematic AUM



Source: Morningstar Research. Data as of 31 December 2021.

No Thematic Asset Manager Is Dominant Globally

Exhibit 5 illustrates the regional nature of the global thematic fund market. No asset manager is dominant in all regions. Most are major players in only a single region.

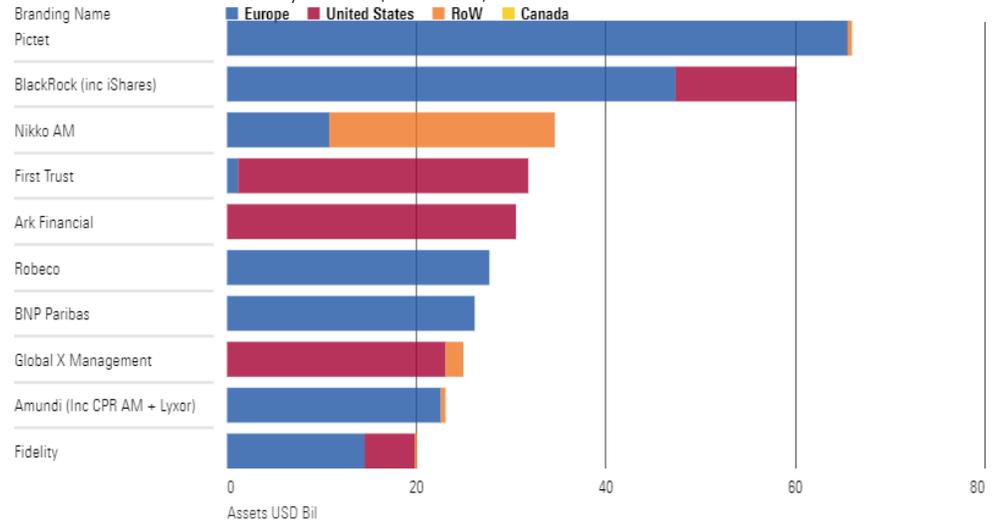
Europe-focused thematic specialist Pictet Asset Management remains the largest thematic fund provider globally, with AUM of \$66 billion. The firm's success has been built over many years and is founded on a measured approach to selecting and tracking long-term themes. In a market where both fund launch and closure rates run high, Pictet has scored reassuringly low on both counts.

With a handful of sizable active thematic funds in Europe and a suite of passive iShares-branded thematic ETFs in both the U.S. and Europe, fund giant BlackRock is the second-largest global thematic fund provider.

The stratospheric success of ARK's compact range of actively managed ETFs has elevated the firm to the top five on the global thematic provider leaderboard. However, it is beaten on the global leaderboard by Japanese Nikko AM, whose largest funds in Europe and Asia repackage ARK's own investment strategies.

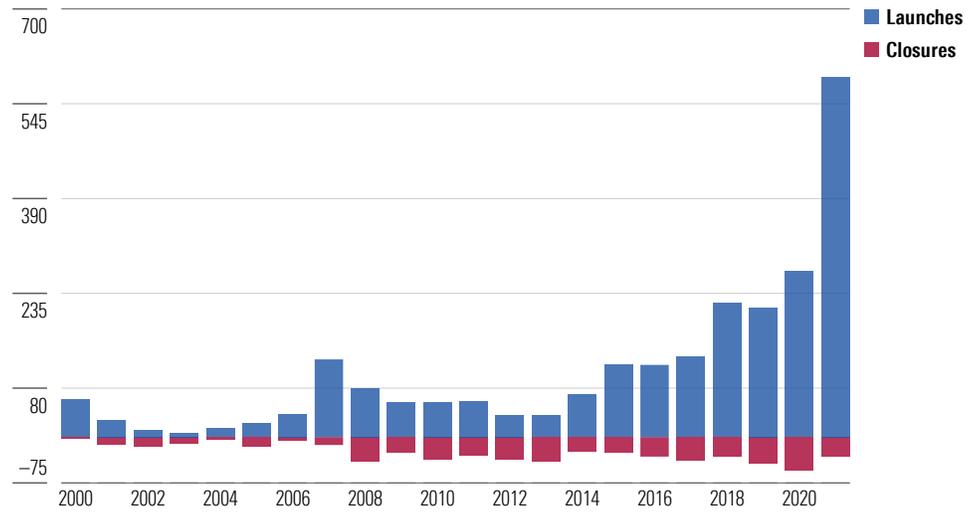
First Trust snatches fourth place globally with its U.S.-focused range of popular thematic ETFs. The suite is dominated by several large ETFs tracking cloud computing, cyber security, and energy transition themes, and crowned by the hefty First Trust Dow Jones Internet Index ETF FDN.

Exhibit 5 Global Thematic AUM by Provider (USD Billion)



Source: Morningstar Research. Data as of 31 December 2021.

Exhibit 6 Global Thematic Launches and Closures by Year



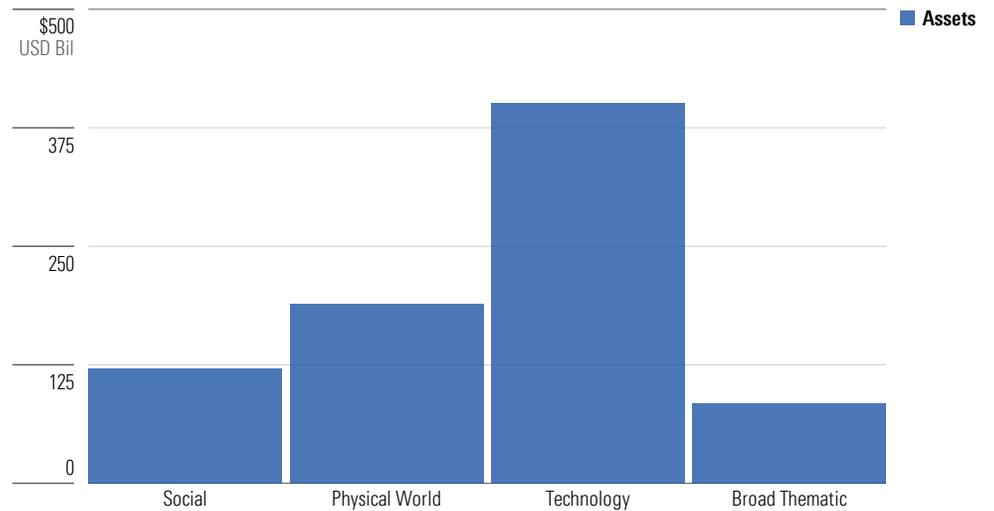
Source: Morningstar Research. Data as of 31 December 2021.

Exhibit 7 Largest Thematic Funds Globally

Fund Name	Domicile	Inception Date	Broad Theme	Theme	Size (USD Bil)
ARK Innovation ETF	United States	10/30/2014	Technology	Multiple Tech Themes	16.2
Pictet-Global Megatrend Select	Luxembourg	10/31/2008	Broad Thematic	Broad Thematic	15.8
Pictet-Water	Luxembourg	1/19/2000	Physical World	Resource Management	11.0
Pictet - Robotics	Luxembourg	10/7/2015	Technology	Robotics + Automation	10.2
Pictet-Security	Luxembourg	10/31/2006	Social	Security	10.2
First Trust Dow Jones Internet ETF	United States	6/19/2006	Technology	Digital Economy	10.0
Allianz Global Artificial Intelligence	Luxembourg	3/31/2017	Technology	Artificial Intelligence + Big Data	9.6
Robeco Global Consumer Trends	Luxembourg	6/3/1998	Social	Consumer	9.1
BGF Sustainable Energy	Luxembourg	4/6/2001	Physical World	Energy Transition	8.3
GS netWIN GS Technology Equity Fund	Japan	11/29/1989	Technology	Digital Economy	7.1

Source: Morningstar Research. Data as of 31 December 2021.

Exhibit 8 Global Thematic AUM by Broad Theme



Source: Morningstar Research. Data as of 31 December 2021.

Tech Funds Capture Investors' Imagination; Energy Transition Remains Popular

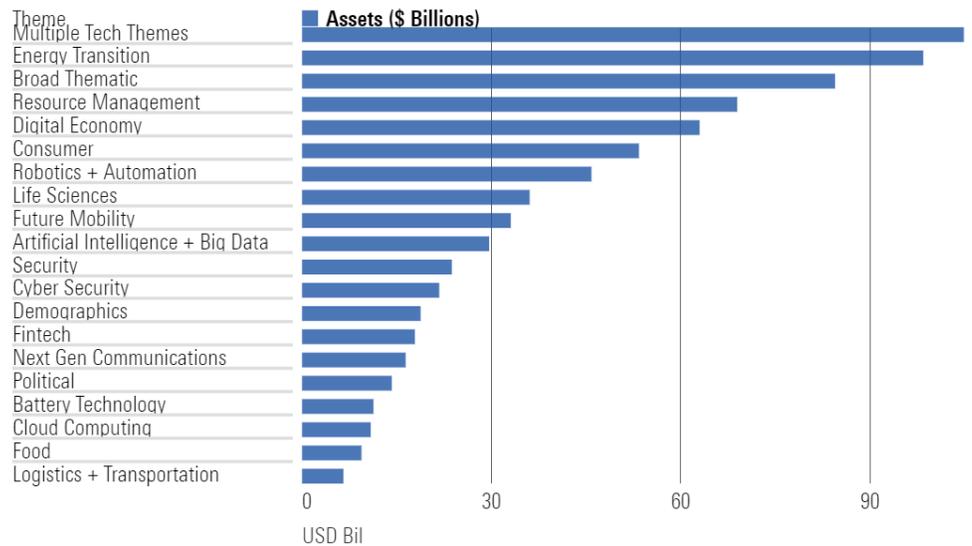
Funds tracking technology themes secured the largest share of flows over 2021, at which point they held half of assets in thematic funds globally.

Funds tracking multiple technology themes, with \$105 billion in assets, represent the most popular thematic grouping globally. Funds in this cohort include the largest thematic fund globally: ARKK. This dazzlingly popular actively managed ETF targets a range of technology themes including genomics, fintech, and next generation internet.

With \$98 billion in assets tied to it, energy transition is by a whisker the second-most-popular theme globally. The grouping, largely populated by alternative energy funds, got a huge boost in late 2020 when newly elected U.S. President Joe Biden pledged billions of dollars of government support for green infrastructure.

Broad thematic funds, which invest across many different themes, take the third spot globally. Among this cohort is the second-largest thematic fund globally, Pictet-Global Megatrend Selection, which targets several global megatrends including demographics and consumer themes.

Exhibit 9 Global Thematic AUM by Theme (USD Billion)



Source: Morningstar Research. Data as of 31 December 2021.

Most Thematic Funds Display a Growth Tilt

Exhibit 10 shows where the funds in the thematic universe plot on the Morningstar Equity Style Box. In total, 72% of thematic funds with a style box placement globally exhibit a growth bias. This compares with just 6% that have a value tilt. This shouldn't be a surprise, as most thematic funds are seeking to tap emerging themes with large growth potential, such as technology.

Exhibit 10 Global Thematic Funds Style Box (% of funds)

	Value	Blend	Growth
Large	3	13	47
Mid	2	8	20
Small	1	1	5

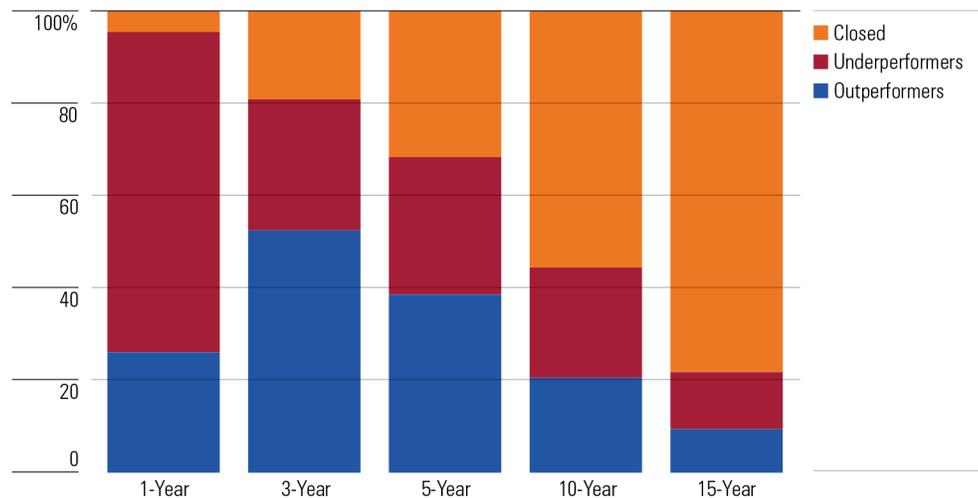
Source: Morningstar Research. Data as of 31 December 2021.

Most Thematic Funds Don't Beat Global Equities Over Longer Periods

Since the beginning of the global pandemic, many thematic funds have chalked up impressive returns. More than a half of thematic funds globally survived and outperformed the Morningstar Global Markets Index during the three years to the end of 2021.

But thematic funds' long-term track record isn't nearly as compelling. When we stretch our observation window out to include the trailing five years, the success rate drops to 39%. Over the past 15 years, more than three fourths of thematic funds globally have shuttered and just one in 10 survived and outperformed.

Exhibit 11 Global Thematic Fund Survival and Success Rate



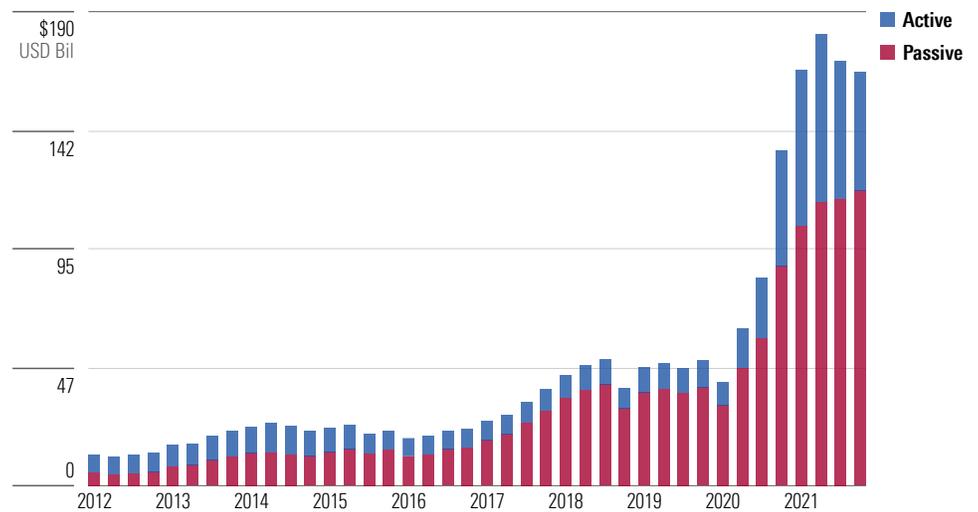
Source: Morningstar Research. Data as of 31 December 2021.

These figures paint a bleak picture for investors. They suggest that the odds of picking a thematic fund that survives and outperforms global equities over longer periods are firmly stacked against them.

United States

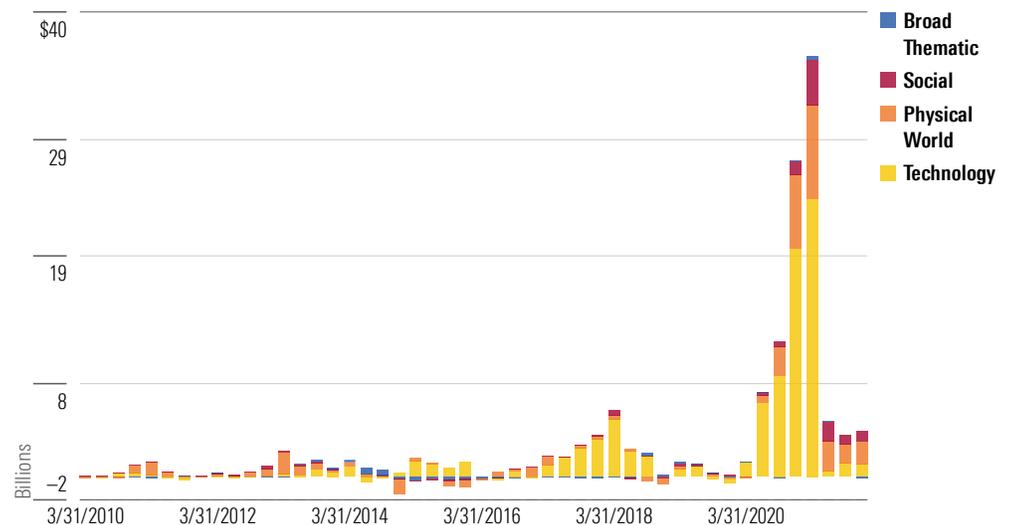
After an explosive 2020, assets in U.S. thematic funds stabilized in 2021 despite a record-breaking number of launches. In mid-2021, total AUM topped out at more than \$180 billion, but inflows had already begun to slow. Assets flowing into U.S. thematic funds increased dramatically throughout 2020 and peaked in the first quarter of 2021 at around \$36 billion. Net inflows were below \$5 billion in each of the remaining three quarters of 2021. At the end of 2021, U.S.-domiciled thematic funds held a combined \$165 billion.

Exhibit 12 U.S. AUM Growth (USD Billion)



Source: Morningstar Research. Data as of 31 December 2021.

Exhibit 13 U.S. Thematic Flows by Broad Theme (USD Billion)

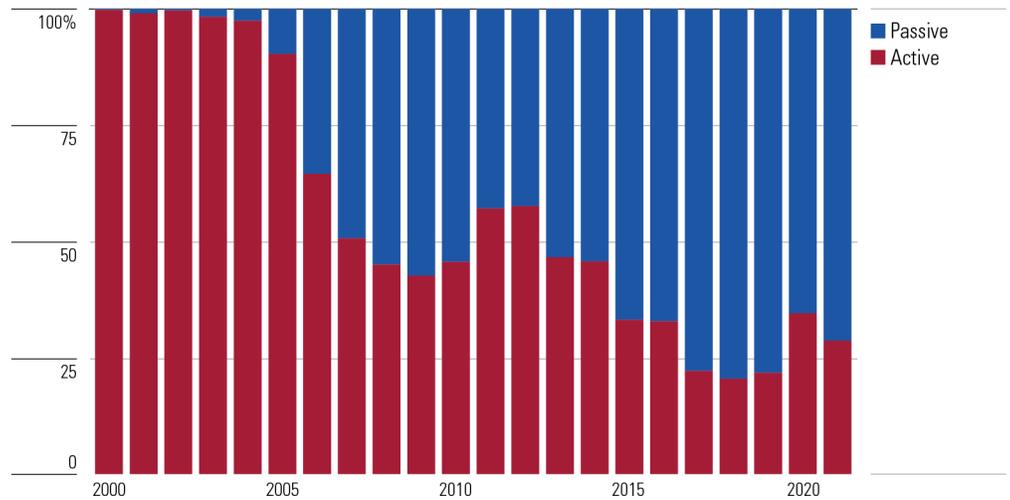


Source: Morningstar Research. Data as of 31 December 2021.

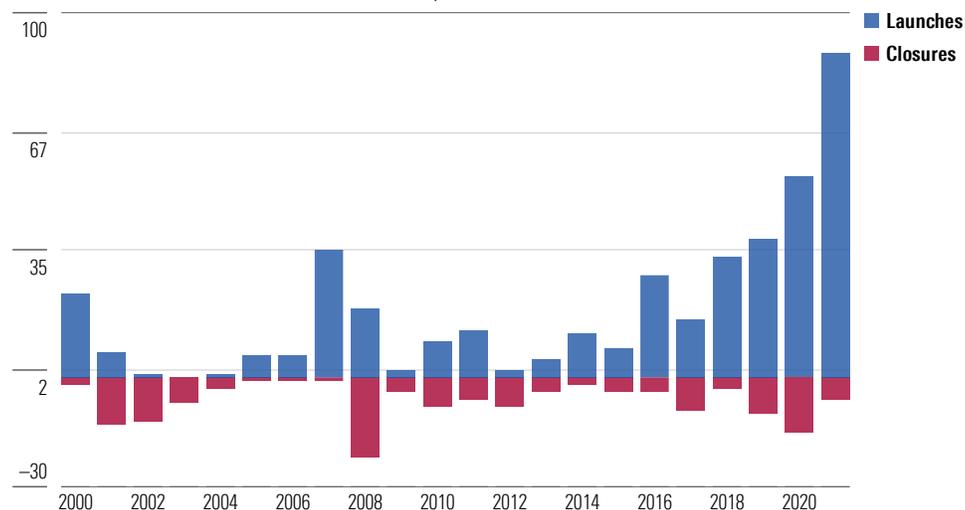
As of December 2021, passive funds controlled around 71% of U.S.-domiciled thematic fund assets. Exhibit 14 shows that the rise to current levels came in one burst in the mid-2000s. Within two years from 2005 to 2007, assets in passively managed thematic funds rose to a staggering \$6 billion from barely \$200 million. This was powered by a series of launches from Invesco that quickly gathered assets, the largest of which were Invesco WilderHill Clean Energy ETF PBW and Invesco Water Resources ETF PHO. This overlapped with a period of outflows from actively managed strategies, notably Fidelity New Millennium following a manager change. While active strategies claimed back some market share between 2010 and 2012, they ultimately couldn't keep pace with the rapidly growing asset base of their indexed counterparts.

In the past few years, actively managed strategies have started to see massive inflows, shifting market share away from passive strategies. Leading the charge were active ETFs from ARK Invest, which amassed more than \$31 billion in net inflows during 2020.

Exhibit 14 Passive Market Share of U.S. Thematic Funds



Source: Morningstar Research. Data as of 31 December 2021.

Exhibit 15 U.S. Thematic Launches and Closures by Year

Source: Morningstar Research. Data as of 31 December 2021.

Historically, thematic fund launches have tended to move in cycles. New strategies are often introduced in periods of strong performance, like the new millennium and the mid-2000s. But they tend to wane during downturns, as Exhibit 15 illustrates. Those trends indicate that investors' appetites for these strategies and the desire for providers to offer them typically move in sync with the broader market.

Thematic fund launches are a bull-market phenomenon. The horde of new thematic funds introduced over the past several years further supports this connection. The second half of 2020 witnessed nearly as many launches as the entirety of 2019, and 2021 was another record year with 90 new launches. Nearly half of these new launches came to market in the fourth quarter of 2021.

Exhibit 16 Largest Thematic Funds in U.S.

Name	Theme	Sub-Theme	Index Fund	Assets (USD Bil)
ARK Innovation ETF	Multiple Tech Themes	Innovative Tech	No	16.2
First Trust Dow Jones Internet ETF	Digital Economy	Internet	Yes	10.0
FlexShares Morningstar Global Upstream Natural Resources ETF	Resource Management	Upstream Natural Resources	Yes	6.6
KraneShares CSI China Internet ETF	Digital Economy	Internet	Yes	6.3
First Trust Cloud Computing ETF	Cloud Computing	Cloud Computing	Yes	6.1
First Trust NASDAQ Cybersecurity ETF	Cyber Security	Cyber Security	Yes	5.8
iShares Global Clean Energy ETF	Energy Transition	Alternative Energy	Yes	5.6
Global X U.S. Infrastructure Development ETF	Political	Infrastructure Spending	Yes	5.6
Global X Lithium & Battery Tech ETF	Battery Technology	Battery Technology	Yes	5.6
ARK Genomic Revolution ETF	Life Sciences	Genomics	No	5.1

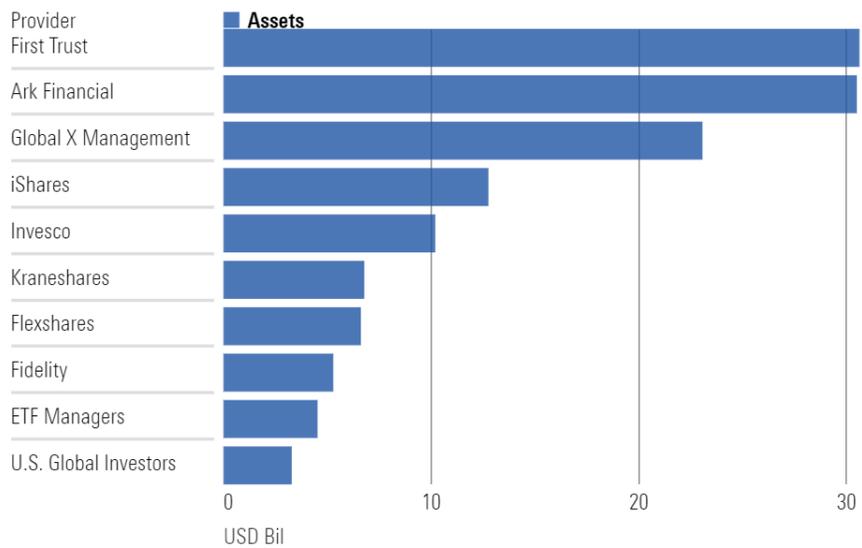
Source: Morningstar Research. Data as of 31 December 2021.

Overall, the U.S. thematic fund landscape is still dominated by a handful of very large funds. The 10 largest, highlighted in Exhibit 16, accounted for nearly 44% of all U.S. thematic fund assets as of Dec. 31, 2021. At the end of 2021, ARKK was still the largest U.S. thematic fund, maintaining a large lead over its next-largest competitor. However, ARKK shrank over the course of 2021, owing to a combination of disappointing performance and investor withdrawals. While the fund experienced net inflows for the

whole year, it suffered significant outflows during the second half of 2021. All three ARK funds that were on the top 10 list in 2020 saw their assets shrivel in 2021.

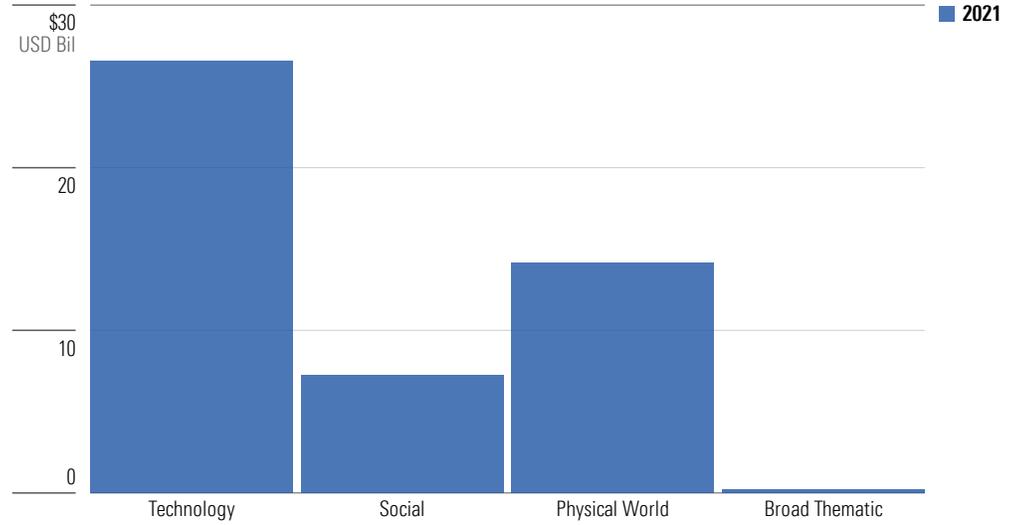
The ranks of the largest U.S.-domiciled thematic funds welcomed three new entrants in 2021, coming from Global X and First Trust. Most notably, Global X U.S. Infrastructure Development ETF *PAVE* pulled in \$4 billion in net inflows in 2021. First Trust NASDAQ Cybersecurity ETF *CIBR* also climbed the leader board. First Trust overtook ARK as the largest provider of thematic funds in the U.S. in 2021. Its thematic assets grew to \$31 billion by year-end, up from \$26 billion in 2020. Meanwhile, ARK's thematic assets dropped to \$30 billion at the end of 2021 from \$47 billion in 2020.

Exhibit 17 U.S. Thematic AUM by Provider (USD Billion)



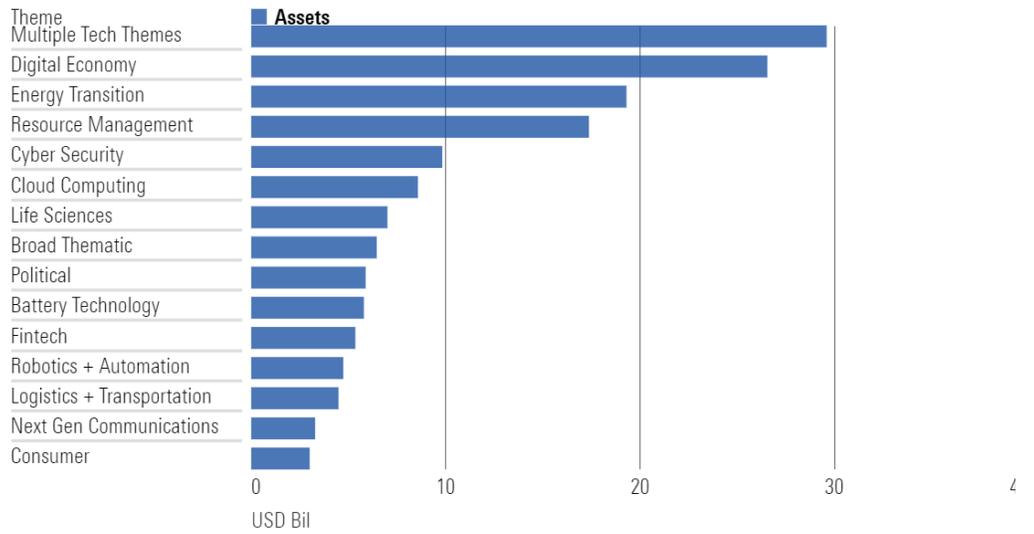
Source: Morningstar Research. Data as of 31 December 2021.

Exhibit 18 U.S. Thematic Net Flows by Broad Theme 2021 (USD Billion)



Source: Morningstar Research. Data as of 31 December 2021.

Exhibit 19 U.S. Thematic AUM by Theme (USD Billion)



Source: Morningstar Research. Data as of 31 December 2021.

Tech-oriented thematic funds remain the largest U.S. cohort by a wide margin despite the fact that their assets declined in 2021. At year-end, these funds accounted for around 64% of U.S. thematic assets. Assets in other broad themes grew in 2021. For example, the physical world bucket added more than \$6 billion in assets in 2021, the majority of which came from resource management funds.

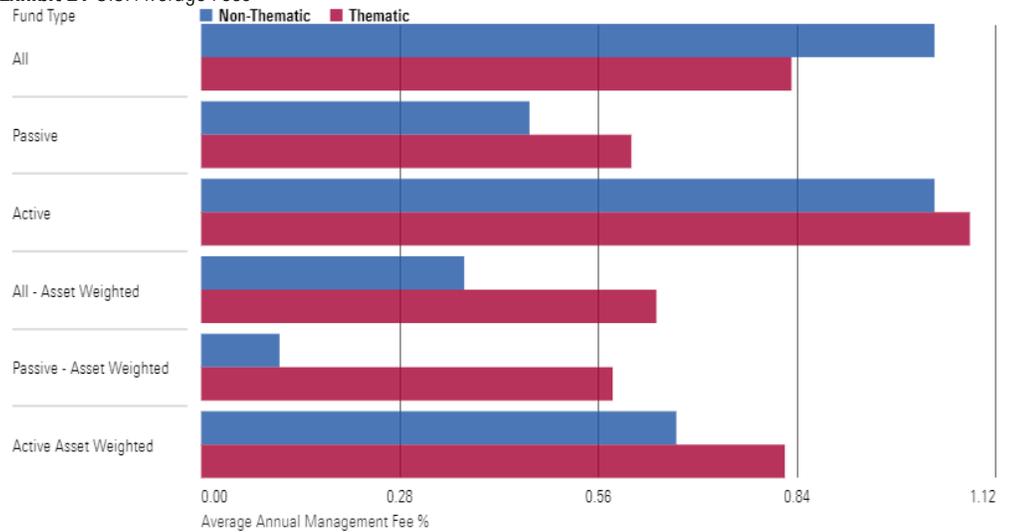
Still, funds with multiple technology themes, like ARKK, claim the most assets. These funds' fondness for disruptive tech firms influences where they land in the style box. At the end of 2021, 70% of U.S. thematic funds landed on the growth side of the equity style box, while just 7% fit on the value side. This growth/value gap grew versus 2020 as more than half of the new launches in 2021 were classified in one of the three growth categories. There has also been a size shift to small from large, as more niche funds emphasizing purer plays on their targeted themes pull these funds' portfolios toward smaller stocks.

Exhibit 20 U.S. Thematic Funds Style Box

	Value	Blend	Growth
Large	2	8	30
Mid	5	13	27
Small	1	2	13

Source: Morningstar Research. Data as of 31 December 2021.

Exhibit 21 U.S. Average Fees



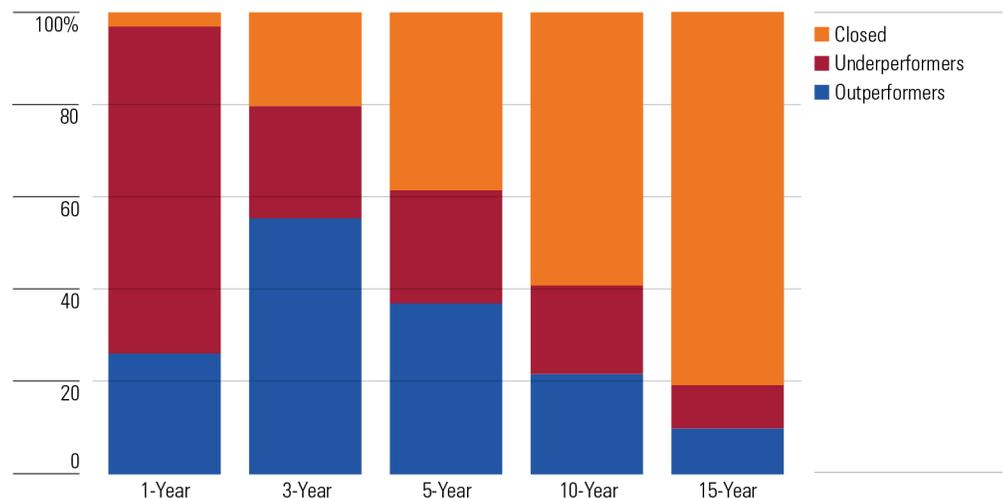
Source: Morningstar Research. Data as of 31 December 2021.

On average, both active and passive U.S. thematic funds levy higher average management fees than their nonthematic counterparts. The difference is particularly striking when we look at asset-weighted fees, especially as the most popular thematic funds charge fees many multiples higher than those of the most popular nonthematic funds.

In 2021, more than two thirds of thematic funds underperformed the Morningstar Global Markets Index. This is a sharp reversal from their stellar showing in 2020, highlighting the volatility that goes hand-in-hand with thematic investing.

Over longer periods, these funds' high fees contribute to their relatively poor performance versus broad market indexes. A supportive market for growth strategies has seen thematic funds generally perform well over the trailing three years, but their success rate tumbles as we go further back in time. Over the 10 years through the end of 2021, nearly 60% of U.S. thematic funds shuttered, and just 22% both survived and outperformed the Morningstar Global Markets Index. Exhibit 22 details the dismal odds facing investors in selecting a thematic fund that will succeed.

Exhibit 22 U.S. Thematic Fund Survival and Success Rates



Source: Morningstar Research. Data as of 31 December 2021.

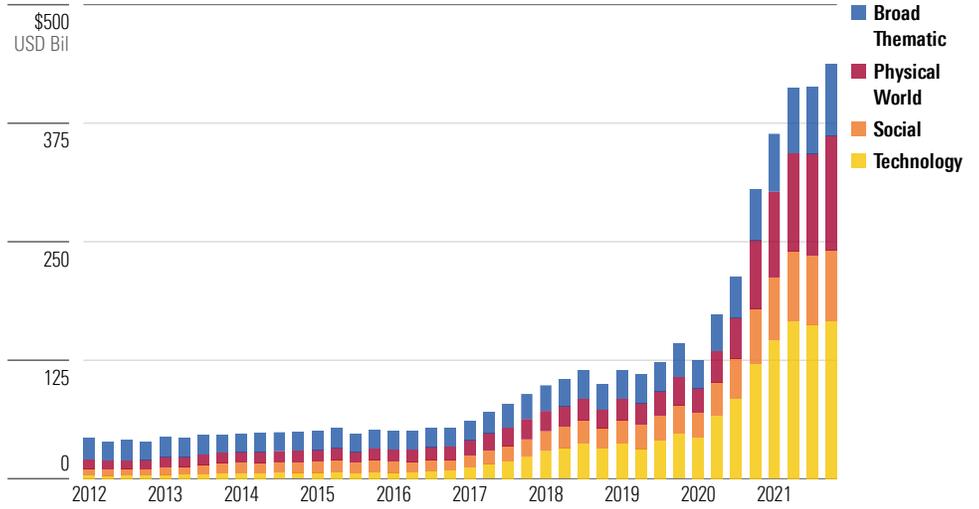
Europe

Europe is home to the largest market for thematic funds. As of Dec. 31, 2021, there were 653 thematic funds domiciled in the region, accounting for more than half (55%) of all assets in thematic funds globally.

Assets invested in thematic funds domiciled in the region have more than quadrupled over the trailing three years to \$437 billion. This has been supported by a nearly unbroken streak of positive quarterly net inflows, which amounted to \$149 billion over the period.

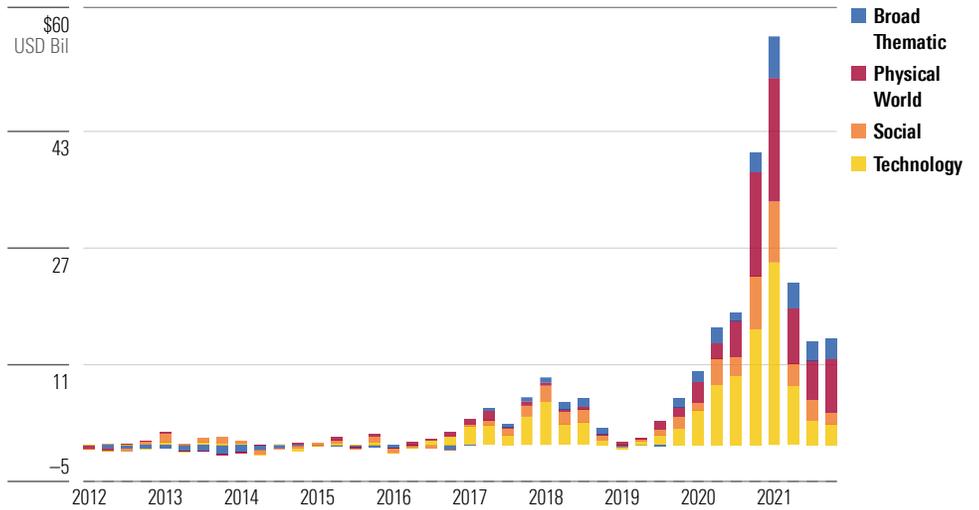
Most thematic funds in Europe are actively managed. Passive funds hold just 10% of total thematic assets in the region. In the first quarter of 2021 alone, thematic funds attracted a record \$56 billion in net flows.

Exhibit 23 Europe AUM Growth (USD Billion)



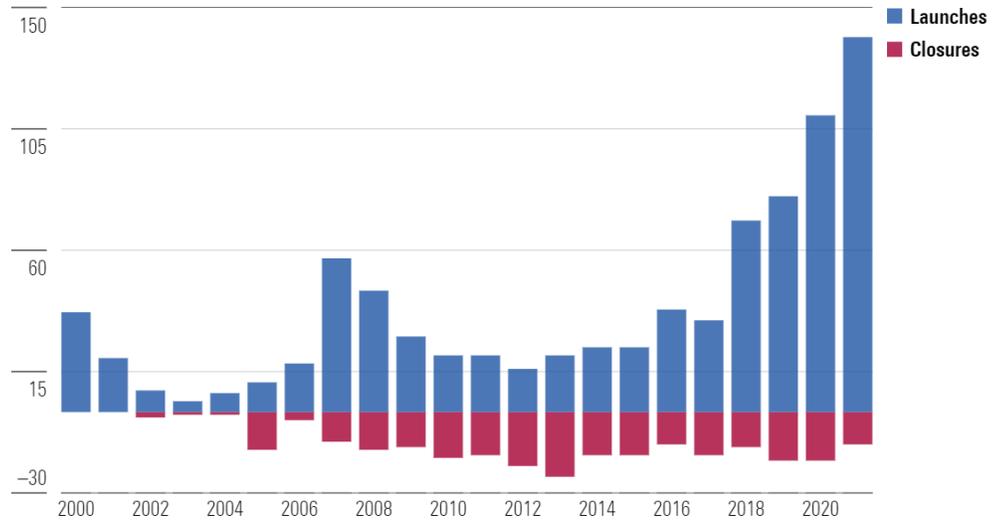
Source: Morningstar Research. Data as of 31 December 2021.

Exhibit 24 Europe Net Asset Flows by Broad Theme (USD Billion)



Source: Morningstar Research. Data as of 31 December 2021.

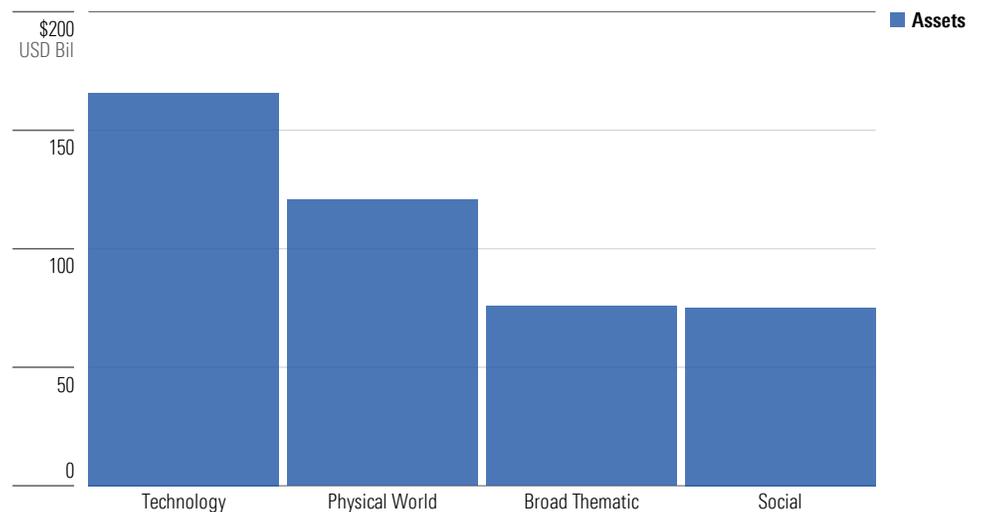
Exhibit 25 European Thematic Launches by Year



Source: Morningstar Research. Data as of 31 December 2021.

In Europe, 2021 was a record year for thematic fund launches, with 139 new entrants. Historically, the number of thematic fund launches has been positively correlated with the performance of the broader equity markets. The number of new thematic launches rose in the runup to, and peaked immediately prior to, both the dot-com bubble and the global financial crisis before trailing off in the years that followed.

Exhibit 26 European Thematic AUM by Broad Theme (USD Billion)



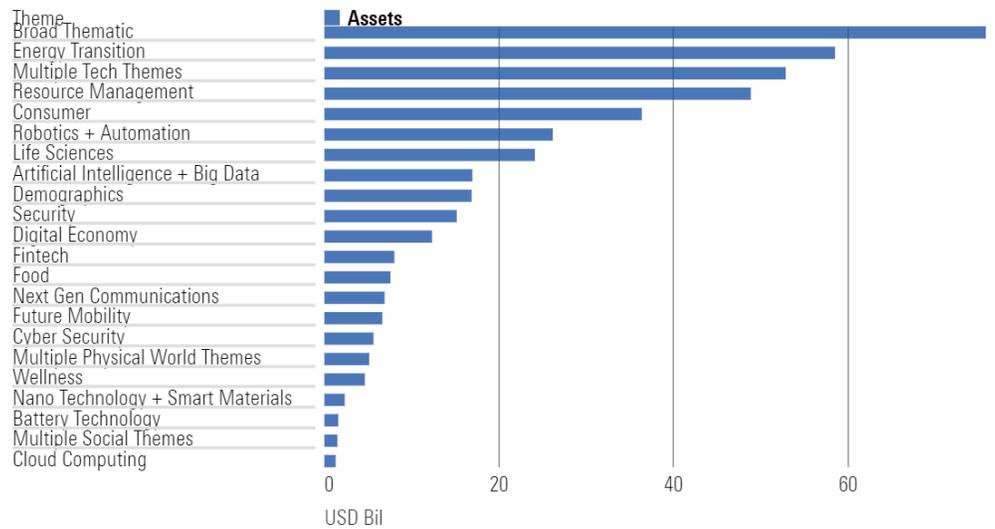
Source: Morningstar Research. Data as of 31 December 2021.

Broad thematic funds make up the most popular theme grouping by assets in Europe. The largest thematic fund in the region is included in there: Pictet Global Megatrend Selection.

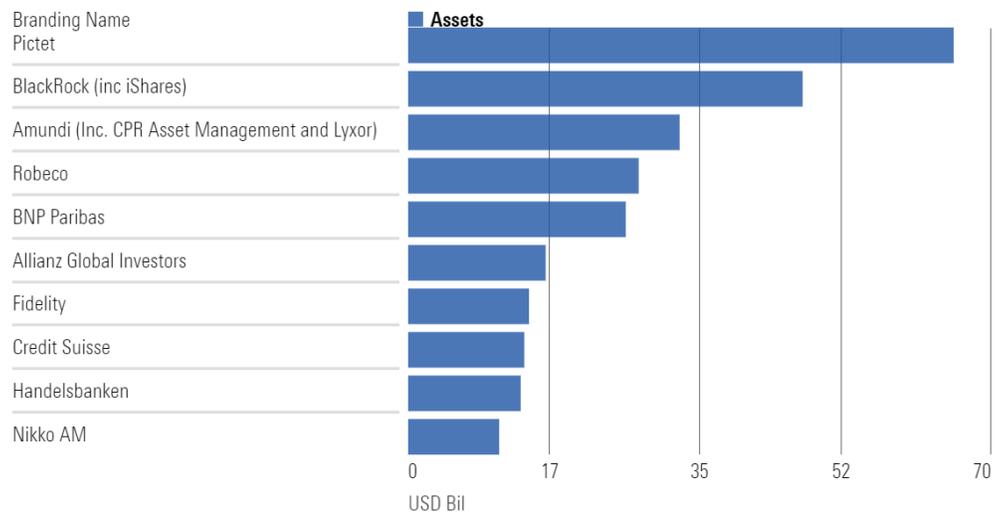
The booming popularity of ESG funds in Europe has spilled over into the world of thematic investing. In late 2020, the promise of huge government spending plans announced by the incoming Biden administration in the U.S. prompted massive inflows into funds with an energy transition theme. Despite a subsequent drop in net flows, funds seeking to profit from the transition away from hydrocarbon-based energy sources, such as alternative energy funds, have risen to become the second-most popular theme grouping in the region.

Funds tracking multiple technology themes take third place, buoyed by success of ARK Disruptive Innovation, which is sold under the Nikko Asset Management brand in Europe. Total assets across all funds fitting this theme reached a record \$53 billion by the end of 2021.

Exhibit 27 European Thematic AUM by Theme (USD Billion)



Source: Morningstar Research. Data as of 31 December 2021.

Exhibit 28 European Thematic AUM by Provider (USD Billion)

Source: Morningstar Research. Data as of 31 December 2021.

Pictet Asset Management is the largest thematic fund provider in Europe. Pictet has a range of 12 actively managed thematic funds, four of which sit atop the table of the 10 largest thematic funds in Europe. The firm's success has been built over many years and is founded on a measured approach to selecting and tracking long-term themes. In a market where fund launch and closure rates run high, Pictet has scored reassuringly low on both counts.

BlackRock takes second place in the European thematic provider league table. Its small stable of actively managed funds, which includes the sizable BlackRock Sustainable Energy and BlackRock Next Generation Technology funds, is complemented by the range of thematic ETFs marketed under its iShares brand.

French asset manager Amundi takes the third position. Much of Amundi's thematic range is managed under its CPR Asset Management sub-brand, which specializes in sustainable thematic exposures. A small suite of indexed thematic funds was bolstered by Amundi's recent acquisition of Lyxor Asset Management, an ETF specialist.

Exhibit 29 Largest Thematic Funds in Europe

Fund Name	Inception Date	Broad Theme	Theme	Sub-Theme	Size (USD Bil)
Pictet-Global Megatrend Selection	10/31/2008	Broad Thematic	Broad Thematic	Broad Thematic	15.8
Pictet-Water	1/19/2000	Physical World	Resource Management	Water	11.0
Pictet-Robotics	10/7/2015	Technology	Robotics + Automation	Robotics	10.2
Pictet-Security	10/31/2006	Social	Security	Broad Security	10.2
Allianz Global Investors Fund - Allianz Global Artificial Intelligence	3/31/2017	Technology	Artificial Intelligence + Big Data	Artificial Intelligence	9.6
Robeco Global Consumer Trends	6/3/1998	Social	Consumer	Consumer	9.1
BlackRock Global Funds - Sustainable Energy Fund	4/6/2001	Physical World	Energy Transition	Alternative Energy	8.3
Nikko AM ARK Disruptive Innovation Fund	8/29/2018	Technology	Multiple Tech Themes	Disruptive Tech	7.0
ACS Climate Transition World Equity TO	5/15/2020	Physical World	Energy Transition	Climate Transition	6.6
CPR Invest Global Disruptive Opps	12/22/2016	Technology	Multiple Tech Themes	Disruptive Opportunities	6.4

Source: Morningstar Research. Data as of 31 December 2021.

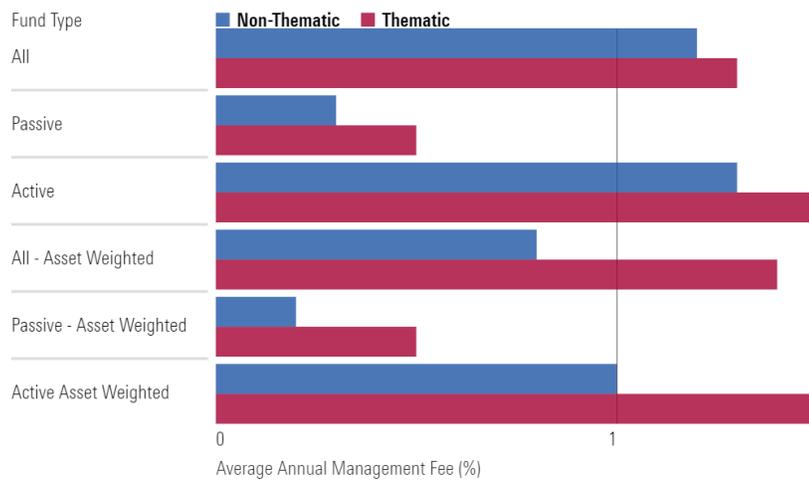
The style and size breakdowns of European thematic funds resemble those of their global counterparts. Two thirds of funds with an equity style box placement have a growth tilt, and just 6% have a value bias.

Exhibit 30 European Thematic Funds Style Box

	Value	Blend	Growth
Large	3	17	41
Mid	2	10	23
Small	1	1	3

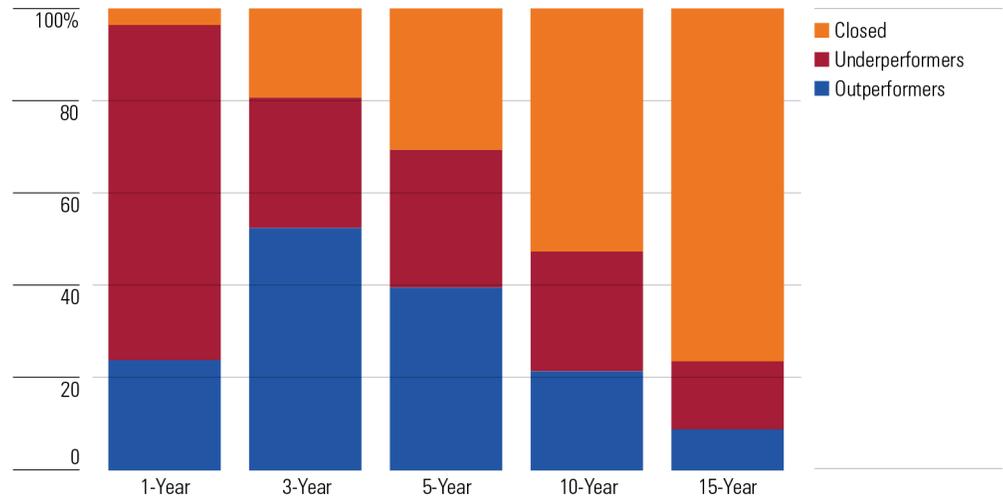
Source: Morningstar Research. Data as of 31 December 2021.

Exhibit 31 European Average Fees



Source: Morningstar Research. Data as of 31 December 2021.

Both active and passive European thematic equity funds charge higher management fees than their nonthematic counterparts, on average.

Exhibit 32 European Thematic Fund Survival and Success Rate

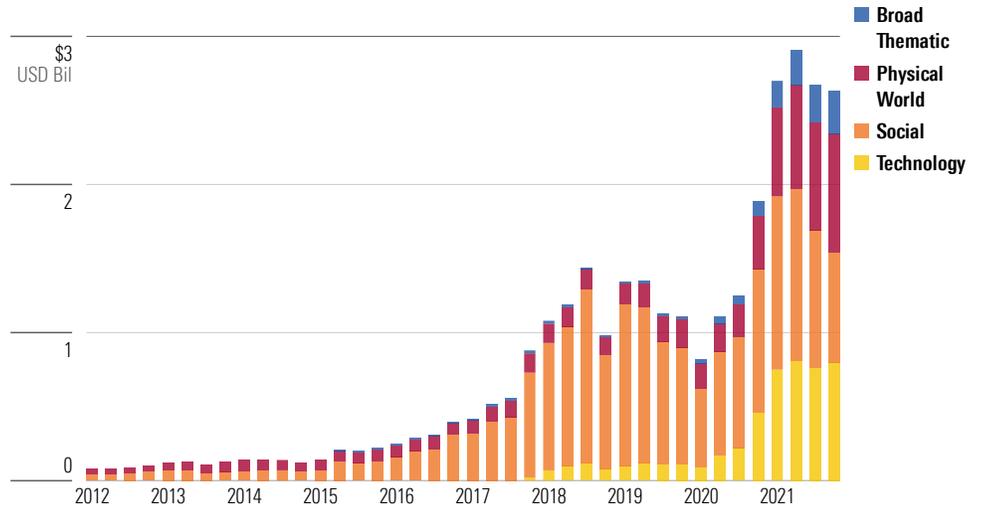
Source: Morningstar Research. Data as of 31 December 2021.

Exhibit 32 lays bare the challenge faced by investors in thematic funds. Over short periods—for example, 2020—many of these funds survived and outperformed global equities, but over longer periods the number that survive and outperform tumbles. Over the trailing five-year period, less than half of these funds survived and outperformed the index. That figure plunges to just 9% over the trailing 15 years.

Canada

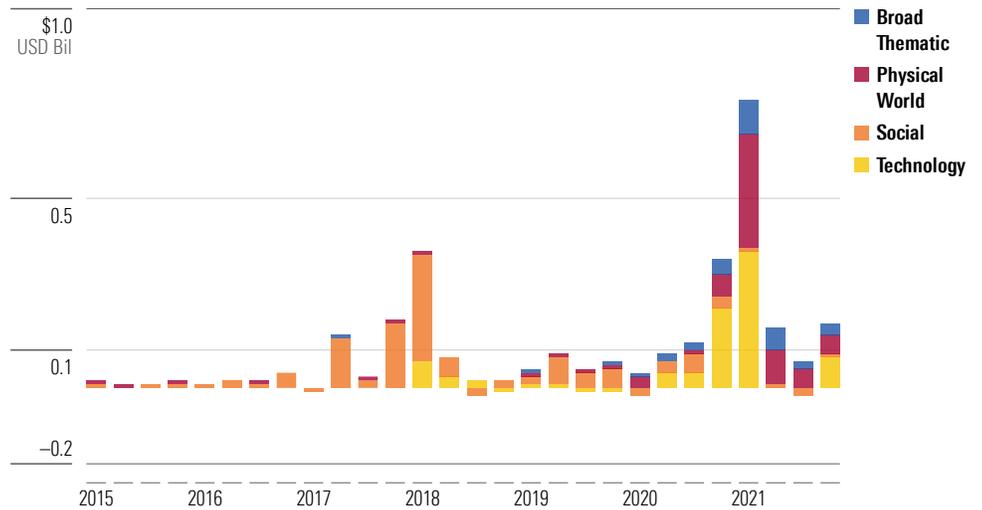
Canadian thematic funds represent a tiny but growing segment of the Canadian fund universe. As of December 2021, the cohort held a little more than \$2.6 billion of investors' money, up from just \$405 million in December 2016. As seen in other regions, inflows started off strong in 2021, but they cooled down as performance went from being a tailwind to a headwind. Canadian thematic funds pulled in \$755 million in the first quarter before quickly dropping to less than \$200 million for each of the remaining three quarters of the year. Funds from the technology and physical world broad themes were among the most popular with investors in 2021, as measured by inflows. Overall, investors put a little more than \$1.1 billion of new money into Canadian thematic funds over the course of 2021, more than twice the amount they invested in 2020.

Exhibit 33 Canada Thematic Fund AUM Growth (USD Billion)



Source: Morningstar Research. Data as of 31 December 2021.

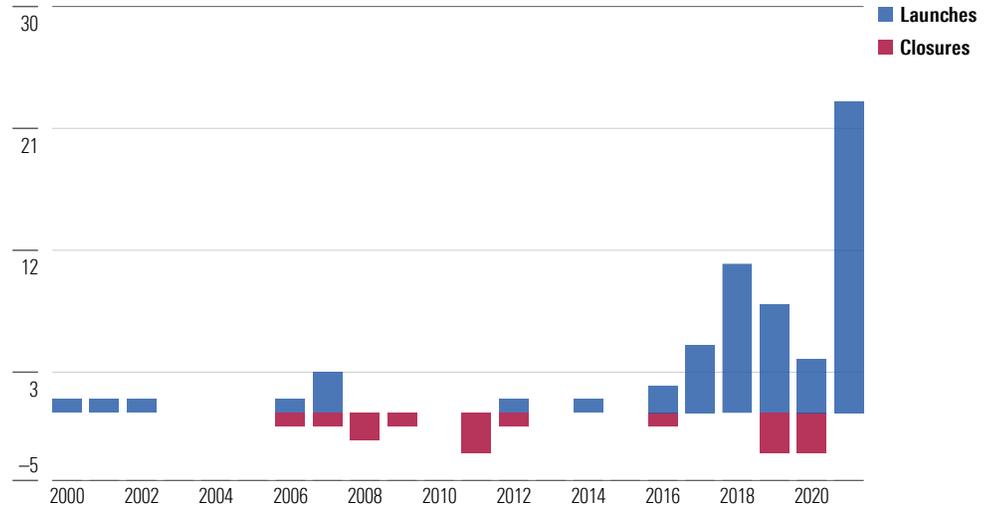
Exhibit 34 Canada Thematic Fund Net Asset Flows by Broad Theme (USD Billion)



Source: Morningstar Research. Data as of 31 December 2021.

Along with assets and inflows, new fund launches started growing in 2016. Canadian fund providers introduced 30 new thematic funds between 2016 and 2020. The number of new launches exploded in 2021, as 23 new thematic funds opened their doors.

Exhibit 35 Canadian Thematic Launches by Year

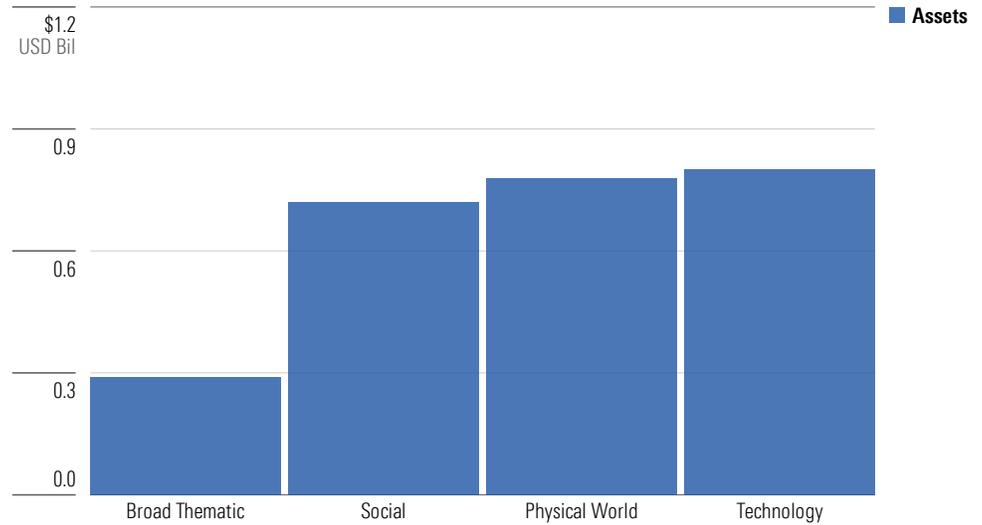


Source: Morningstar Research. Data as of 31 December 2021.

Running Canadian thematic funds through our taxonomy shows roughly equal representation across funds from the social, physical world, and technology broad themes. Each of those broad themes represented about \$1 billion of thematic fund assets at the end of 2021.

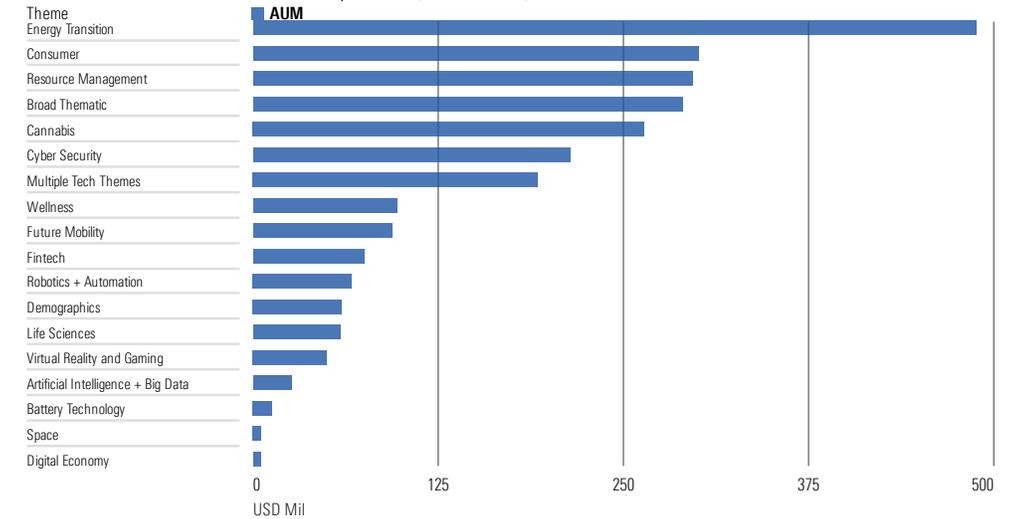
The popularity of cannabis-, consumer-, and wellness-related themes underpinned the success of funds with a social broad theme. Funds tapping the energy transition (largely alternative energy funds) and resource management (mostly water funds) themes accounted for most of those in the physical world group. Technology funds were spread across a wide range of themes, including cyber security, fintech, future mobility, and robotics + automation, among others.

Exhibit 36 Canadian Thematic AUM by Broad Theme (USD Billion)



Source: Morningstar Research. Data as of 31 December 2021.

Exhibit 37 Canadian Thematic AUM by Theme (USD Million)



Source: Morningstar Research. Data as of 31 December 2021.

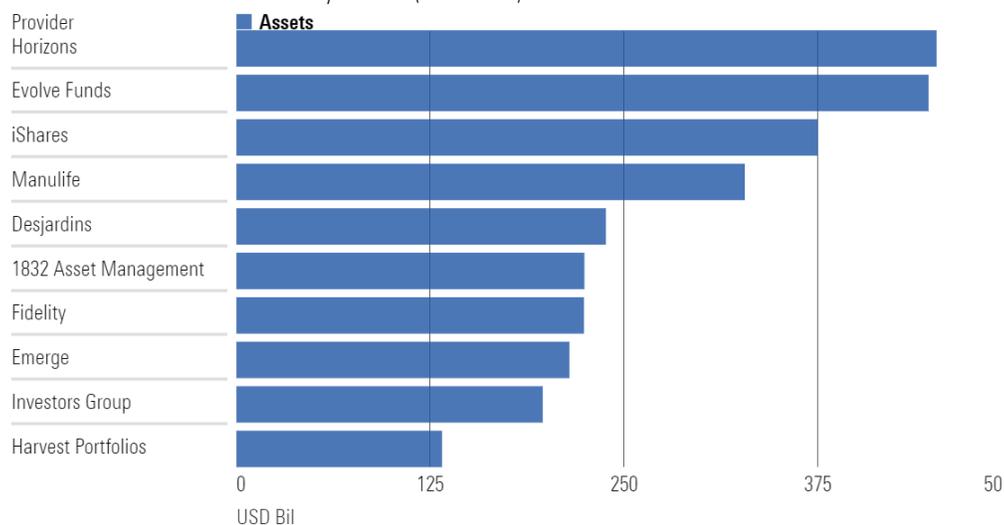
The largest funds in Canada target a diverse array of themes. With almost \$375 million in AUM at the end of 2021, iShares Global Water Index ETF was by far the largest thematic fund in the market, representing 14% of all Canadian thematic fund assets. Only five other funds had more than \$200 million in assets.

Exhibit 38 Largest Thematic Funds in Canada

Name	Inception Date	Broad Theme	Theme	Sub Theme	Size (USD Mil)
iShares Global Water ETF Comm	6/4/2007	Physical World	Resource Management	Water	374.9
Horizons Marijuana Life Sciences ETF	4/4/2017	Social	Cannabis	Cannabis	283.0
Evolve Cyber Security ETF Hdq	9/15/2017	Technology	Cyber Security	Cyber Security	268.3
Desjardins SocieTerra Cleantech F	6/14/2016	Physical World	Energy Transition	Clean Tech	238.3
Dynamic Energy Evolution F	10/29/2020	Physical World	Energy Transition	Energy Transition	224.4
Manulife Global Thematic Opps F	10/11/2018	Broad Thematic	Broad Thematic	Broad Thematic	205.0
IG Mackenzie Global Cnsmr Coms CL A	10/24/2002	Social	Consumer	Consumer	197.6
Fidelity Global Consumer Ind Sr B	6/5/1997	Social	Consumer	Consumer	153.9
Emerge ARK Global Disruptive Innovt ETF	7/29/2019	Technology	Multiple Tech Themes	Disruptive Tech	143.7
Manulife Global Thematic Opps Cl F	10/12/2018	Broad Thematic	Broad Thematic	Broad Thematic	122.9

Source: Morningstar Research. Data as of 31 December 2021.

The largest funds shown in Exhibit 38 closely map to the largest fund providers. Horizons and Evolve were the biggest in Canada because they each managed one of the biggest funds. They also have the largest thematic lineups and therefore have the most opportunity to attract investors interested in thematic strategies.

Exhibit 39 Canadian Thematic AUM by Provider (USD Billion)

Source: Morningstar Research. Data as of 31 December 2021.

Outside of the largest funds, most have small asset bases. As of December 2021, the median thematic fund in Canada had about \$20 million in assets, while only 11 had more than \$100 million in assets. Funds with smaller asset bases (those with less than \$100 million) indicate that a strategy or theme has not gained (and may not ever gain) traction. Caution is warranted with these smaller funds as they could potentially liquidate because of a lack of interest.

Many of these funds are hoping to profit from emerging trends that are expected to grow rapidly in the near future. As such, about 87% of Canadian thematic funds were classified as growth strategies within

the confines of the equity style box, compared with only 2% for value. Exhibit 40 further details how Canadian thematic assets map to the style box.

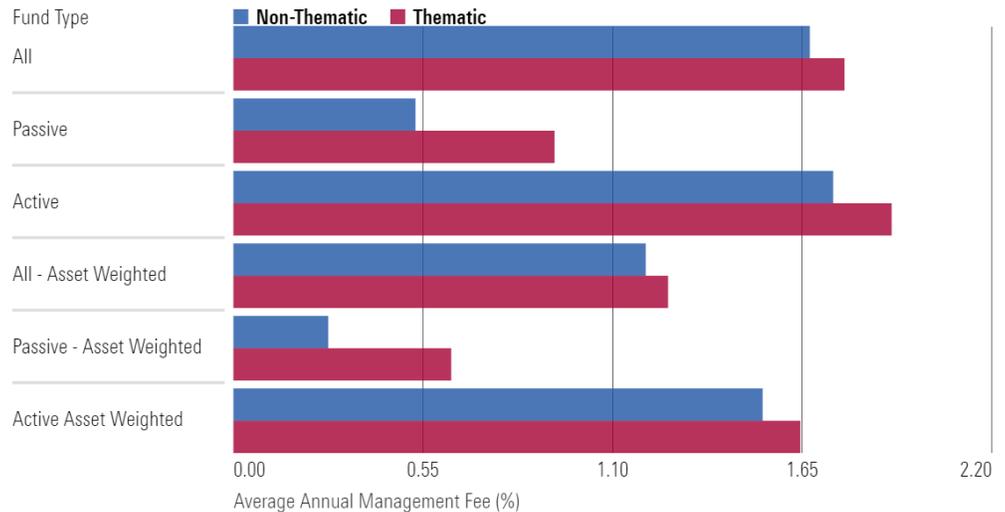
Exhibit 40 Canadian Thematic Funds Style Box (% of Funds)

	Value	Blend	Growth
Large	0	6	40
Mid	2	4	36
Small	0	0	11

Source: Morningstar Research. Data as of 31 December 2021.

Fees are an important consideration for any investment strategy as they directly affect performance. Exhibit 41 shows that Canadian thematic funds charge higher fees than their nonthematic counterparts.

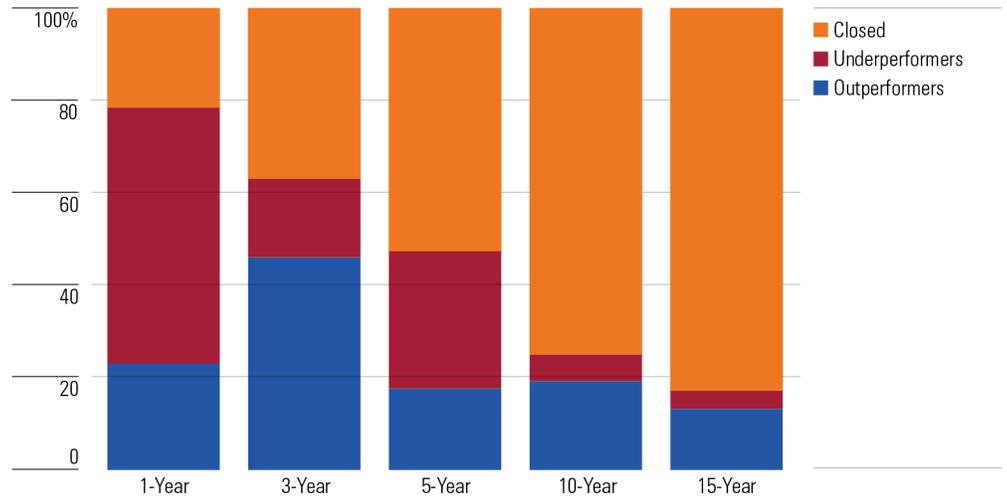
Exhibit 41 Canadian Average Fees



Source: Morningstar Research. Data as of 31 December 2021.

Higher fees charged by thematic funds have contributed to their relatively poor performance over longer periods, and their ability to outperform the global stock market tends to decline as strategies age. For example, about half of Canadian thematic funds survived and outperformed the Morningstar Global Markets Index over the trailing three years through December 2021. Their success rate drops to less than 20% over the prior five years. Exhibit 42 details the formidable challenges facing investors in selecting a thematic fund that will survive and outperform global equities over longer periods.

Exhibit 42 Canadian Thematic Fund Survival and Success Rate

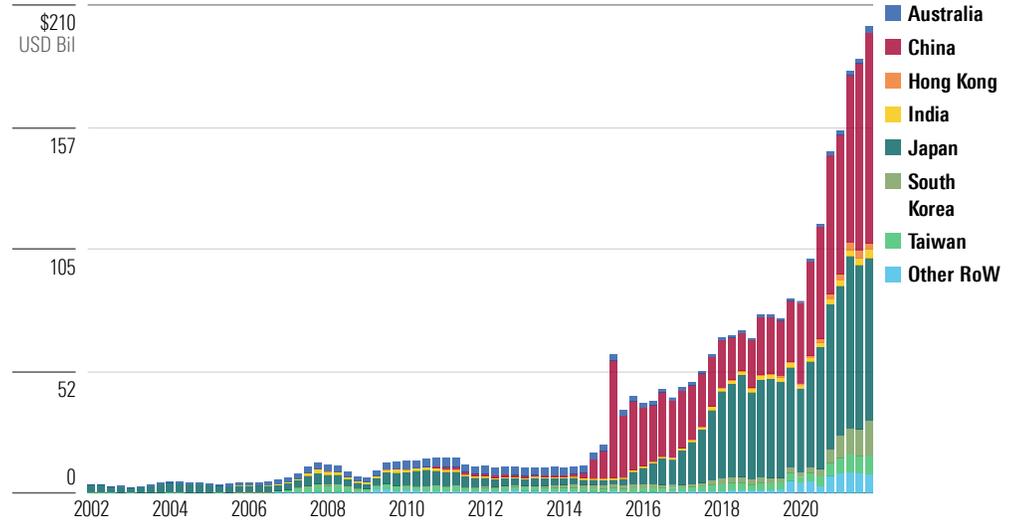


Source: Morningstar Research. Data as of 31 December 2021.

Rest of World

Assets in thematic funds outside of North America and Europe recorded 37% growth in absolute terms from a year ago to \$201 billion as of the end of 2021. Thematic funds in China made a major contribution to this growth. Assets in China-domiciled thematic funds increased 51% in 2021, making China the largest thematic fund market outside of Europe and the U.S., with 11% global market share. The thematic fund markets in Japan and Korea rank well behind China, with AUM totaling \$70 billion and \$15 billion, respectively, as of the end of 2021. Thematic funds domiciled in Taiwan, India, Hong Kong, and Australia made up a small portion of the thematic fund market at the end of 2021, with AUM ranging from \$3 billion to \$8 billion.

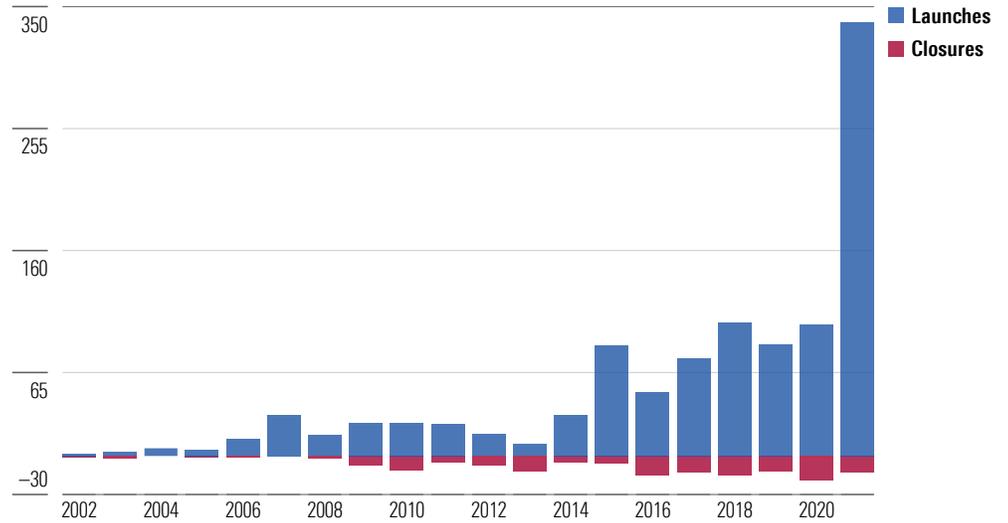
Exhibit 43 Rest of World AUM Growth by Region (USD Billion)



Source: Morningstar Research. Data as of 31 December 2021.

New launches were a key driver of growth in the thematic market in what we have termed Rest of World for purposes of this analysis. In 2021, asset managers launched over 300 new thematic funds in these markets, easily exceeding the number of new entrants in any previous year. Half of these new launches came from China, and more than 60% of them belong to the technology broad theme.

Exhibit 44 Rest of World Thematic Launches by Year



Source: Morningstar Research. Data as of 31 December 2021. Data based on available data on inception date and obsolete date.

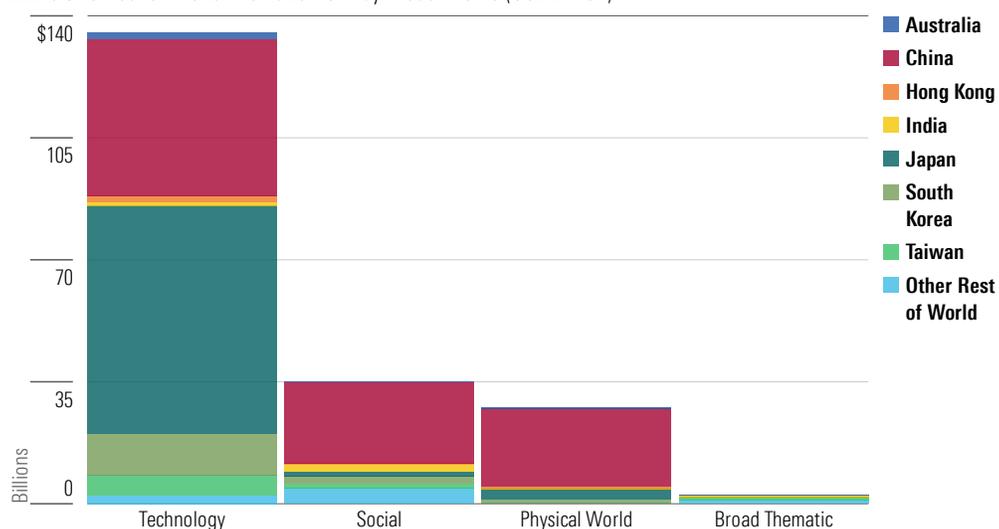
Exhibit 45 Rest of World Largest Thematic Funds

Name	Theme	Sub-Theme	Domicile	Passive Fund	Assets (USD Bil)
GS netWIN GS Technology Equity Fund	Digital Economy	Internet	Japan	No	7.1
Nikko Global Prospective Fund	Multiple Tech Themes	Disruptive Tech	Japan	No	6.2
SMTAM NextGen CommRel WldEq Strat Fd	Connectivity	Next Generation Communication	Japan	No	5.3
E Fund CSI China Ovsea Net 50 QDII-ETF	Digital Economy	Internet	China	Yes	5.1
Nikko Global Robotics Equity Fund	Robotics + Automation	Robotics	Japan	No	3.9
Nikko Global Exponential Innovation Fund	Multiple Tech Themes	Exponential Tech	Japan	No	3.8
ChinaAMC Energy Innovation Equity	Energy Transition	Energy Tech	China	No	3.7
SMDS Global AI Fund	Artificial Intelligence + Big Data	Artificial Intelligence	Japan	No	3.7
MUKAM Cyber Security Equity Open	Cyber Security	Cyber Security	Japan	No	3.6
Nikko Global Robotics Equity Fund	Robotics + Automation	Robotics	Japan	No	3.3

Source: Morningstar Research. Data as of 31 December 2021.

Similar to the trend observed in the U.S. and Europe, Technology is the most popular broad theme, accounting for 67% of thematic fund assets in the Rest of World. This trend also applied across most of the individual markets. For example, in Japan, more than 90% of thematic fund assets resided under technology as of the end of 2021. The social and physical world broad themes received contributions from China-domiciled thematic funds, mainly those belonging to the consumer and energy transition themes. Most of the funds fitting this description were ETFs that were launched within the past year.

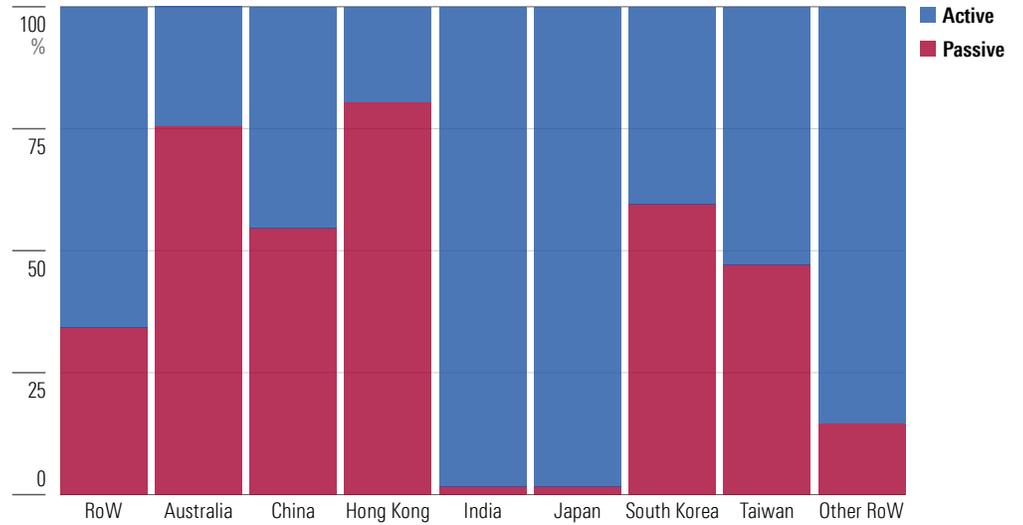
Exhibit 46 Rest of World Thematic AUM by Broad Theme (USD Billion)



Source: Morningstar Research. Data as of 31 December 2021.

Actively managed funds accounted for around two thirds of assets invested in thematic funds in the combined Rest of World markets as of end-2021. However, the active/passive split was very different across markets. Actively managed thematic funds dominate the market in Japan and India, accounting for about 98% of assets in both cases. Meanwhile, in Australia, China, Hong Kong, and South Korea, passively managed thematic funds accounted for 55%-80% of assets, mainly invested in ETFs. In China, many of these indexed thematic offerings were new additions to the local menu in 2021.

Exhibit 47 Rest of World Active Versus Passive Thematic AUM

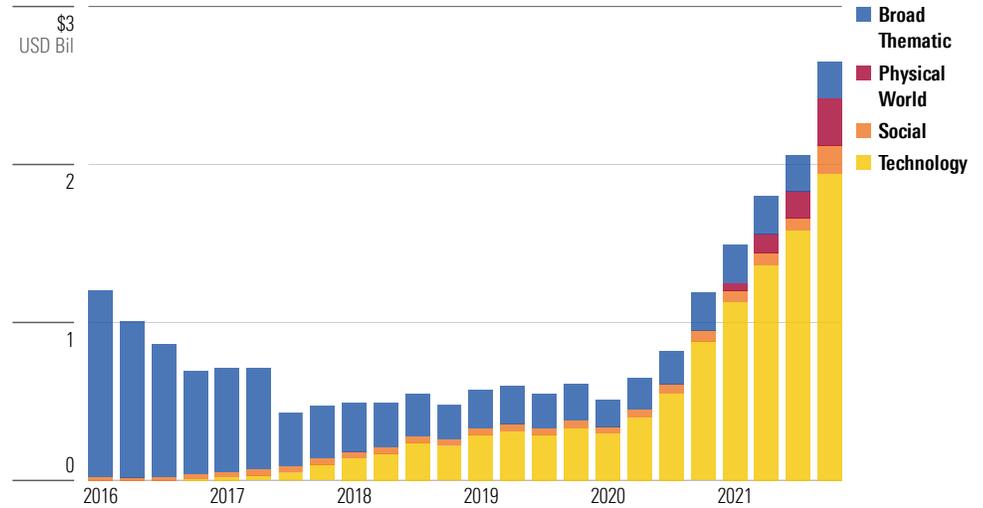


Source: Morningstar Research. Data as of 31 December 2021.

Australia

The Australian thematic fund market accounted for \$2.6 billion of global thematic fund assets at the end of 2021. From 2016 to 2019, there was a lull in demand for thematic funds. AUM stagnated in this period. Inflows into thematic funds have surged since 2020, as ETF providers have been launching unique products, some of which have seen strong uptake from investors. Technology funds managed to secure most of the inflows. Most notable new launches have fallen under the broad theme of technology, including VanEck Vectors Video Gaming and eSports ETF, BetaShares Cloud Computing ETF, and BetaShares Crypto Innovators ETF. Other trendy newer funds follow sustainability, energy transition, and climate innovation themes.

Exhibit 48 Australia Thematic Fund AUM Growth by Broad Theme (USD Million)



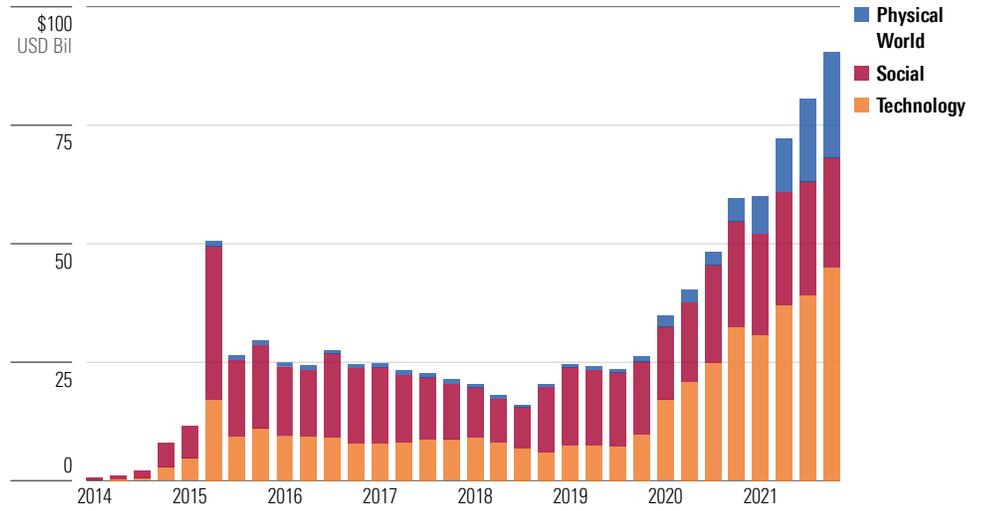
Source: Morningstar Research. Data as of 31 December 2021.

China

Over the past decade, China has risen from nothing to become the largest thematic fund market outside of the U.S. and Europe. As of December 2021, the number of thematic funds domiciled in China had risen to 373. These funds held a combined \$90 billion. Relative to the other markets, the Chinese thematic fund market has followed a somewhat peculiar path. In the second quarter of 2015, thematic fund assets in China surged to \$50 billion from \$11 billion. This growth spurt was stimulated by strong stock market performance, inflows, and new launches. After the stock market crashed in mid-June 2015, assets in Chinese thematic funds plummeted and the development of the local thematic fund market stagnated.

More recently, AUM in China-domiciled thematic funds have more than tripled over the past two years. Most new assets have flowed into technology-oriented thematic funds and those fitting our physical world description. Meanwhile, the market share for funds falling under the social broad theme shrank to 26% as of the end of 2021, down from 59% two years ago.

Exhibit 49 China AUM Growth (USD Billion)

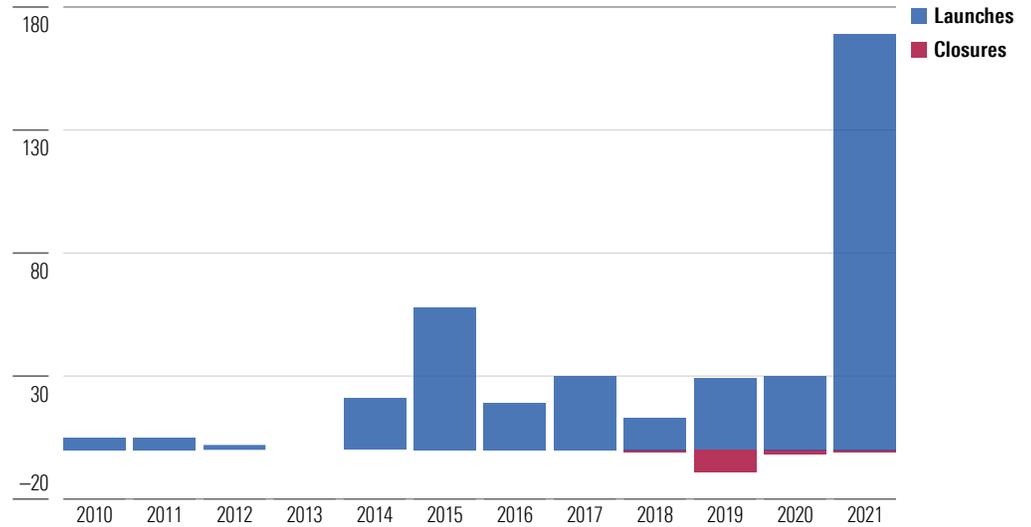


Source: Morningstar Research. Data as of 31 December 2021.

The active/passive split among thematic funds in China has been roughly equal throughout history. While the number of passive thematic funds has increased significantly in recent years and now is nearly twice the number of active thematic funds, active funds still accounted for 45% of total thematic fund assets at the end of 2021.

A record 169 new thematic funds were launched in China in 2021, pushing the total number of thematic funds to 373. Trends in thematic fund launches in China tend to align with the popularity of the themes they try to harness. Though 2021 was a tough year for the Chinese equity market, several themes performed well, such as energy transition, digital economy, and future mobility. Asset managers were enthusiastic about launching thematic funds to satisfy increasing demand from investors to capitalize on these themes. In 2021, fund launches in energy transition, digital economy, and future mobility themes accounted for 40% of all new launches.

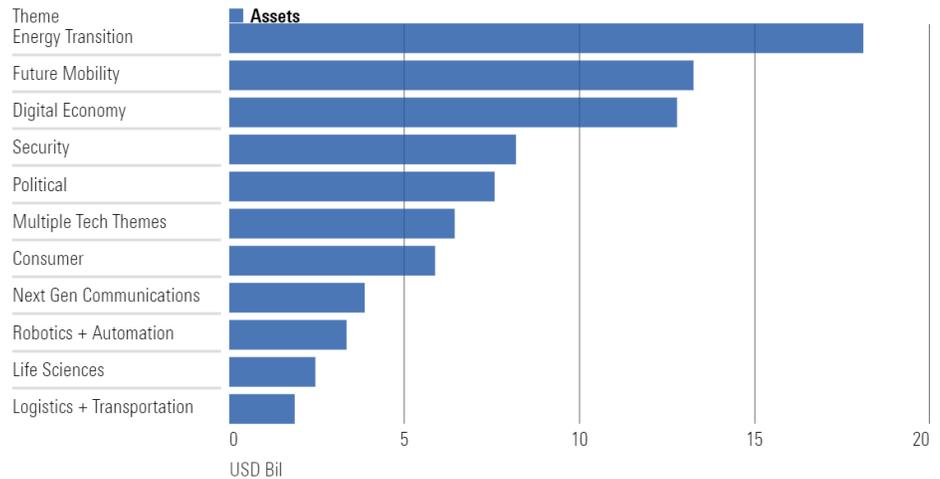
Exhibit 50 China Thematic Launches by Year



Source: Morningstar Research. Data as of 31 December 2021.

Energy transition is the most popular theme among Chinese investors. There were 34 funds in this group as of December 2021, accounting for 20% of total Chinese thematic assets. Funds within this group mainly invest in companies engaged in generation and distribution of alternative energy, such as solar and other forms of clean energy. Future mobility represented the second-most-popular theme in China. This group counted 34 funds as members. The funds tend to focus on alternatives to internal combustion engine vehicles and claimed a 15% share of Chinese thematic fund assets as of the end of 2021. Digital economy, a theme largely populated by internet and e-commerce funds, ranked third with 14% market share. The largest thematic fund in China is in this group: CSI China Ovsea Net 50 QDII-ETF.

Exhibit 51 China Thematic AUM by Theme (USD Billion)



Source: Morningstar Research. Data as of 31 December 2021.

The popularity of specific themes has been influenced by the Chinese government's commitment to pursue economic transformation. In recent years, the transition to a low-carbon and innovation-based economy has become a key focus for the government. The government's carbon neutrality plan, announced in September 2020, spurred the development of alternative energy and electric vehicle funds. Also, the U.S.-China trade war pushed the government to seek technological independence, spurring the growth of tech-oriented thematic funds.

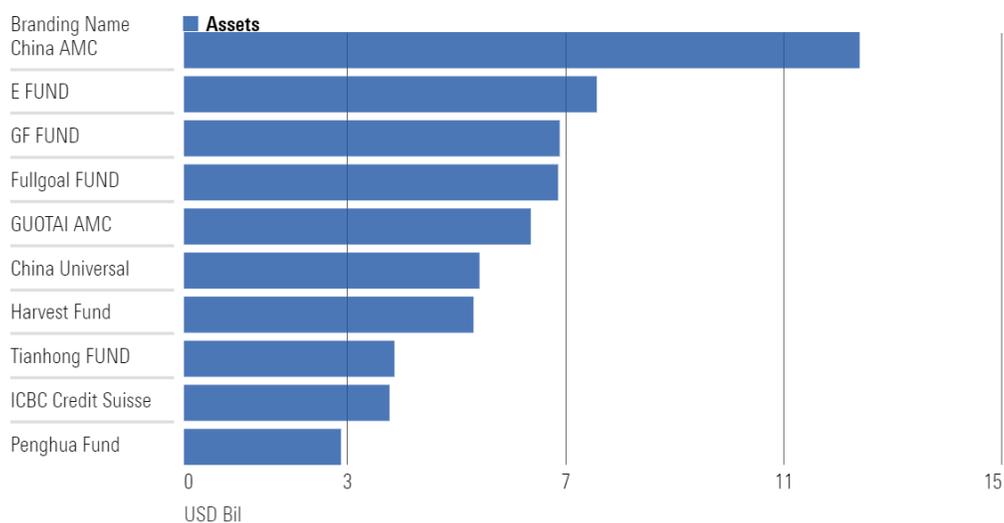
Exhibit 52 Largest Thematic Funds in China

Fund Name	Inception Date	Broad Theme	Theme	Sub-Theme	Size (USD Bil)
E Fund CSI China Ovsea Net 50 QDII-ETF	2017-01-04	Technology	Digital Economy	Internet	5.1
ChinaAMC Energy Innovation Eq	2017-06-07	Physical World	Energy Transition	Energy Tech	3.7
ChinaAMC Hang Seng Int&InfoTech ETF QDII	2021-01-26	Technology	Digital Economy	Internet	3.0
GF High-End Manufacturing Eq	2017-09-01	Technology	Robotics + Automation	Hi-Tech Manufacturing	2.9
China Universal New Eng Clnd Index LOF A	2018-05-23	Technology	Future Mobility	New Energy Vehicles	2.8
First State Cinda New Energy Ind Stk Fd	2015-07-31	Physical World	Energy Transition	Alternative Energy	2.7
Huatai-PB CSI Photovoltaic Industry ETF	2020-12-07	Physical World	Energy Transition	Solar	2.2
TianHong CSI Photovoltaic Industry Idx A	2021-01-28	Physical World	Energy Transition	Solar	2.1
BOCOM Schroders CSI Ovs idx QDII-LOF	2015-05-27	Technology	Digital Economy	Internet	1.9
Guotai CSI National Defense Ind ETF	2016-07-26	Social	Security	National Defense	1.9

Source: Morningstar Research Data as of 31 December 2021.

As of December 2021, thematic ETF specialist China AMC was the largest thematic fund provider in China, with AUM of \$12.4 billion. China AMC has launched 25 thematic funds, 20 of them passively managed. The firm's roster of thematic funds includes the third-largest thematic fund in the China market, ChinaAMC Hang Seng Int&InfoTech ETF QDII. E Fund management company has 15 passively managed thematic funds and two actively managed thematic funds. The sizable asset base of E Fund CSI China Ovsea Net 50 QDII-ETF makes E Fund the second-largest thematic fund provider in China. GF and Fullgoal Fund management company had similar asset bases of around \$7 billion at the end of 201, ranking them in third and fourth place, respectively.

Exhibit 53 China Thematic AUM by Provider (USD Billion)



Source: Morningstar Research. Data as of 31 December 2021.

Japan

Japan's thematic fund market is the second largest outside of North America and Europe, after China, with total assets of \$70 billion³ as of Dec. 31, 2021, up 12% from a year ago. Recent growth was largely driven by inflows into new products. Of the \$10.3 billion of net inflows into thematic funds observed in 2021, \$7.0 billion came from funds launched during the year. Actively managed funds accounted for the majority of the local thematic fund market, accounting for 98% of AUM.

Technology funds held the lion's share of the local market, soaking up 94% of thematic funds' total assets. They also contributed most of the inflows in 2021, raking in 92% of net new money. Included in this group was Goldman Sachs netWIN Technology Equity, which targets the digital economy; Nikko Global Prospective; and SMTAM Next Generation Telecom-Related World Equity Strategy. The trio tops the list of largest funds in the Rest of World shown in Exhibit 45.

Nikko AM is the largest thematic fund provider in Japan with a 33% market share. The majority of its thematic funds are tech-focused. Four of Nikko's offerings sit among the 10 largest thematic funds in Rest of World.

India

Assets in India-domiciled thematic funds grew 78% from a year ago to \$3.7 billion as of the end of 2021. Social and technology broad themes accounted for 51% and 30% of assets, respectively. Funds falling under the consumer theme contributed the majority of the assets (81%) in the social broad theme. Actively managed funds accounted for nearly all (98%) of the AUM in the local thematic fund market.

Hong Kong

Assets in thematic funds domiciled in Hong Kong grew 27% from a year ago to \$2.7 billion as of the end of 2021. More than one third of those assets were invested in products launched in 2020 and 2021. Most of the locally domiciled thematic funds are ETFs, which accounted for 87% of total assets in the thematic fund market. While the local menu is small, many investors in Hong Kong can choose from the list of Europe-domiciled thematic funds available for sale in the market.

South Korea

As of the end of 2021, assets in Korea-domiciled thematic funds totaled \$15 billion. Of the 128 local thematic funds, 80 were launched between 2020 (23) and 2021 (57). These newer entrants accounted for 52.5% of thematic fund assets at the end of 2021. Many of the new launches in 2020 either explicitly or implicitly sought to benefit from the Korean New Deal announced by the Korean president in the summer of 2020. The deal involved large government investment in the domestic green energy and digital sectors.

Existing domestically focused battery technology and future mobility themed funds are among the largest in the market and have also benefited from flows. Among the funds launched in 2021, the main

³ Although the issue of double-counting cannot be eliminated, we include Japan-domiciled funds of funds and feeder funds in this review to better reflect the actual flow situation in the Japanese fund market, as many Japanese funds of funds are invested in European funds.

themes fell under the physical world and technology broad groups. In March 2021, the Korean government announced plans to be carbon neutral by 2050. This led to the launch of energy transition-related funds.

Taiwan

In 2021, assets in thematic funds in Taiwan grew 43% to \$8.0 billion. Growth was driven mainly by inflows into new products. Seven out of the nine thematic funds launched in 2021 were passively managed ETFs. Inflows into these products contributed the majority of asset growth in the local thematic fund market in 2021.

Funds matching the next gen communications and future mobility themes accounted for more than 40% of total assets in the local thematic fund market. Cathay Taiwan 5G Plus ETF, listed on the Taiwan Stock Exchange in December 2020, has since become the largest thematic fund in Taiwan. This ETF's AUM stood at \$1.2 billion as of Dec. 31, 2021, accounting for 16% of total assets in the Taiwan thematic fund market. As of the end of 2021, almost three fourths of the thematic funds in Taiwan were actively managed. These funds accounted for just over half of total AUM in thematic funds. ■■

(Note: A previously published version of this paper stated that "In the trailing three years (corrected to 'two years') to the end of 2021, these funds' assets under management grew nearly threefold to \$806 billion from \$255 billion worldwide." Exhibits 5, 21, 36, 37, and 41 have been revised.)

Appendix

Definitions of Broad Themes

Technology	Funds that target the disruptive growth potential of technological change. The technology broad theme includes the following themes: artificial intelligence + big data, battery technology, cloud computing, cyber security, digital economy, digital media, electronics, fintech, future mobility, life sciences, nano tech + smart materials, next gen communications, robotics + automation, space, virtuality reality and gaming, multiple technology.
Artificial Intelligence + Big Data	Invests in companies whose business is related to the evolution of artificial intelligence and/or big data analytics. This may include companies that are positioned to gain from the implementation of artificial intelligence or big data technologies in their own businesses and also those engaged in the production of artificial intelligence products and services, which enable third parties to more efficiently deliver their own products and services. Funds that use artificial intelligence or big data analytics in the stock-selection process but do not select stocks on their exposure to these technologies are excluded from this taxonomy.
Battery Technology	Invests in companies that are exposed to the development of battery and energy storage technologies. Targeted holdings can range from firms that design and build batteries for electric vehicles to mining companies that extract raw materials like lithium used to manufacture batteries. Companies engaged in the development of future energy storage solutions may also be included.
Cyber Security	Invests in companies that are set to benefit from the growing need for security in an increasingly digital world. This includes businesses that provide products and services to help protect systems and networks from information disclosure; theft of or damage to their hardware, software, or electronic data; and the disruption of the services they provide.
Future Mobility	Invests in companies whose products and services are connected with the field of future-oriented mobility systems. These can include those involved in the

design and production of the cleaner, safer, and more efficient mass transit solutions, including but not limited to the electrification, connectivity, and automation of vehicles. Target holdings may include automobile manufacturers, automotive component suppliers, and technology providers, as well as firms that provide new energy solutions.

Cloud Computing

Invests in companies whose products and services are connected with cloud computing. Cloud computing refers to the provision of computing services (software, databases, and so on) over a network rather than on localized devices, allowing users remote access. Eligible are companies facilitating software as a service, platform as a service, and infrastructure as a service. Companies providing managed server storage space and/or other computing infrastructure and hardware may also be included.

Digital Economy

Invests in companies exposed to developments in the digital economy. These firms may directly profit from the rise of the internet and increased digital connectivity in almost every aspect of life. Target companies may engage directly in e-commerce or provide products and services to those that do. They may also participate in the data economy by collecting, buying, and/or selling digital information. Companies that facilitate the move to a more digitalized world may also be included.

Fintech

Invests in companies facilitating or exposed to technological developments in banking and financial services. They may leverage emerging technologies such as blockchain to gain efficiencies and provide new solutions to financial problems. They may also combine technological innovation with disruptive business models such as neobanks, peer-to-peer lending, and costless trading platforms. Funds that invest directly in cryptocurrencies or associated futures contracts are not included in this taxonomy.

Life Sciences

Invests in companies facilitating or exposed to technological developments in the biological and medical sciences. These firms may target specific advancements in biotech or medical sciences such as geonomics or oncology and/or may be exposed to other technological changes such as the transition to digital health solutions like telemedicine. Strategies that do not differentiate themselves from biotechnology and healthcare sector funds are not included in this taxonomy.

Nano Technology + Smart Materials

Invests in companies whose business is related to the development and commercialization of nanotechnology and/or smart materials, as well as those predicted to benefit most from advancements in these technologies. The emerging science of nanotechnology involves the manipulation of matter at an atomic scale and is likely to have transformative commercial applications in many areas including medicine, energy, consumer goods, and in the creation of new materials (some of which fall under the smart materials label).

Robotics + Automation

Invests in companies whose businesses are involved with the development and/or implementation of robotics technologies or those that are predicted to benefit most from a transition to a more automated world. This may include companies involved in providing industrial robotics solutions, as well as other commercial applications. Those firms that design, build, and/or operate robotic technology, including those focused on specific automotive technologies such as drones or 3D printing, may also be included.

Space

Invests in companies that design, build, operate, or directly benefit from products and/or services that require operations that occur beyond the earth's atmosphere. These include firms that directly provide or enable space travel and exploration, satellite telecommunications, mapping, or intelligence services, or are a key component in the connected supply chain.

Next Gen Communications

Invests in companies developing and implementing the next generation of communications infrastructure. Target businesses may be connected to technological developments in mobile or wireless networks such as 5G. Companies exposed to the development of smart city technology, which collects real-time data from across a city to help monitor and improve city operations, may also be included.

Virtual Reality and Gaming

Invests in companies exposed to video gaming and the development of virtual reality technology. Companies active in the computer gaming industry, including mobile gaming and e-sports, may be included. Providers of online casino and sports betting services may also be included, as well as any firms pioneering virtual reality technology.

Multiple Technology Themes	This theme collects funds that are permitted to invest in more than one of the other technology themes outlined in this taxonomy.
Other	This theme covers funds that track targeted technology themes that do not meet the definitions of the other technology themes identified in this taxonomy.
Physical World	Funds that address the management of physical resources. Included in this bucket are funds that facilitate the transition to a low-carbon world, such as alternative energy funds. The physical world theme includes the following themes: energy transition, food, logistics + transportation, resource management, or broad physical world.
Energy Transition	Invests in companies that are expected to benefit from the global transition away from hydrocarbon-based energy sources. This includes firms that design, supply, build, and/or operate wind, solar, and hydrogen-based energy solutions. Companies that provide other technical solutions such as carbon capture, which will help meet current or future carbon-related goals, may also be included.
Food	This theme collects together subthemes focused on the global production and supply of food. Companies involved in specific segments of the food value chain such as fishing may be included, as may those engaged in agritech or foodtech.
Broad Physical World	This theme collects funds that are permitted to invest in more than one of the other physical world themes outlined in this taxonomy.
Resource Management	Invests in companies that profit from the management of natural resources. These include companies engaged in the management of water, forestry, rare earth metals, and other resources of the future. Those firms involved in building a low-waste or circular economy may also be included. Companies that primarily extract and manage widely traded commodities such as gold are excluded from this taxonomy.

Logistics + Transportation	Invests in companies that participate in the business of transporting physical goods across the globe. These may include businesses involved in the building of transportation vessels such as ships and aircraft, as well as global shipping and logistics solutions providers.
Other	This theme covers funds that track targeted physical world themes that do not meet the definitions of the other physical world themes identified in this taxonomy.
Social	Funds that look to capitalize on structural changes in society. The social broad theme includes the following themes: cannabis, consumer, demographics, political, post-corona, security, wellness, other, or broad social.
Cannabis	Invests in companies operating within the global cannabis ecosystem. These companies may facilitate or be directly involved in the production and/or sale of cannabis or its derivatives for medical and/or recreational use.
Political	Invests in companies that are expected to benefit from specific political policies. These could be related to international policy, such as trade wars or global infrastructure projects like the new silk road, or domestic policy such as structural reform or the Korean New Deal.
Wellness	Invests in companies that operate within the wellness industry. Target businesses may offer products and services that promote the wellbeing of individuals and society. These include companies providing education solutions and those seeking to profit from a global trend toward healthier lifestyles.
Consumer	Invests in companies exposed to particular trends in consumer behavior. Target holdings may be connected with specific product segments (for example, sports or luxury goods), but also with changes to consumer behavior (for example, subscription economy). They may also focus more broadly on consumer trends at a geographic level, such as those in emerging markets.

Demographics	Invests in companies that are poised to benefit from demographic shifts. These businesses may be positioned to profit from global megatrends such as aging populations and/or increased urbanization.
Post-Corona	Invests in companies that are predicted to thrive in a post-coronavirus world. These include firms positively exposed to industries hit hardest by the global pandemic, such as airlines, tourism, and restaurants, as well as those profiting from the rise in remote work.
Security	Invests in companies whose businesses are connected with the need for security globally. Target firms may operate to support national security efforts, but also included are those that provide private security services to corporations and individuals. Companies providing safety services and/or products may also be included.
Other	This theme covers funds that track targeted social themes that do not meet the definitions of the other social themes identified in this taxonomy.
Broad Social	This theme collects together funds that are permitted to invest in more than one of the other social themes outlined in this taxonomy.
Broad Thematic	Broad thematic funds are permitted to invest in themes that fall under more than one of the other three broad themes outlined in this taxonomy.

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For More Information

North America

Connor Furlan

Connor.Furlan@morningstar.com

Europe/UK

Jonathan Miller

Jonathan.Miller@morningstar.com

APAC

Tim Murphy

Tim.Murphy@morningstar.com



22 West Washington Street

Chicago, IL 60602 USA

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